Manhattan Review®

6th Edition

GMAT® Quantitative Question Bank

Joern Meissner

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The Turbocharge Your GMAT Series is carefully designed to be clear, comprehensive, and content-driven. Long regarded as the gold standard in GMAT prep worldwide, Manhattan Review's GMAT prep books offer professional GMAT instruction for dramatic score improvement. Now in its updated 6th edition, the full series is designed to provide GMAT test-takers with complete guidance for highly successful outcomes. As many students have discovered, Manhattan Review's GMAT books break down the different test sections in a coherent, concise, and accessible manner. We delve deeply into the content of every single testing area and zero in on exactly what you need to know to raise your score. The full series is comprised of 16 guides that cover concepts in mathematics and grammar from the most basic through the most advanced levels, making them a great study resource for all stages of GMAT preparation. Students who work through all of our books benefit from a substantial boost to their GMAT knowledge and develop a thorough and strategic approach to taking the GMAT.

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About the Company

Manhattan Review's origin can be traced directly back to an Ivy League MBA classroom in 1999. While teaching advanced quantitative subjects to MBAs at Columbia Business School in New York City, Professor Dr. Joern Meissner developed a reputation for explaining complicated concepts in an understandable way. Remembering their own less-than-optimal experiences preparing for the GMAT, Prof. Meissner's students challenged him to assist their friends, who were frustrated with conventional GMAT preparation options. In response, Prof. Meissner created original lectures that focused on presenting GMAT content in a simplified and intelligible manner, a method vastly different from the voluminous memorization and so-called tricks commonly offered by others. The new approach immediately proved highly popular with GMAT students, inspiring the birth of Manhattan Review.

Since its founding, Manhattan Review has grown into a multi-national educational services firm, focusing on GMAT preparation, MBA admissions consulting, and application advisory services, with thousands of highly satisfied students all over the world. The original lectures have been continuously expanded and updated by the Manhattan Review team, an enthusiastic group of master GMAT professionals and senior academics. Our team ensures that Manhattan Review offers the most time-efficient and cost-effective preparation available for the GMAT. Please visit www.ManhattanReview.com for further details.

About the Founder

Professor Dr. Joern Meissner has more than 25 years of teaching experience at the graduate and undergraduate levels. He is the founder of Manhattan Review, a worldwide leader in test prep services, and he created the original lectures for its first GMAT preparation class. Prof. Meissner is a graduate of Columbia Business School in New York City, where he received a PhD in Management Science. He has since served on the faculties of prestigious business schools in the United Kingdom and Germany. He is a recognized authority in the areas of supply chain management, logistics, and pricing strategy. Prof. Meissner thoroughly enjoys his research, but he believes that grasping an idea is only half of the fun. Conveying knowledge to others is even more fulfilling. This philosophy was crucial to the establishment of Manhattan Review, and remains its most cherished principle.

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Chapter 1

Welcome

Dear Students,

Here at Manhattan Review, we constantly strive to provide you the best educational content for standardized test preparation. We make a tremendous effort to keep making things better and better for you. This is especially important with respect to an examination such as the GMAT. A typical GMAT aspirant is confused with so many test-prep options available. Your challenge is to choose a book or a tutor that prepares you for attaining your goal. We cannot say that we are one of the best, it is you who has to be the judge.

There are umpteen books on Quantitative Ability for GMAT preparation. What is so different about this book? The answer lies in its approach to deal with the questions. Solution of each question is dealt with in detail. There are over hundred questions that have been solved through alternate approaches. You will also find a couple of questions that have been solved through as many as four approaches. The objective is to understand questions from multiple aspects. Few seemingly scary questions have been solved through Logical Deduction or through Intuitive approach.

The has a great collection of 500 GMAT-like questions: 250 PS and 250 DS.

Apart from books on 'Word Problem,' 'Algebra,' 'Arithmetic,' 'Geometry,' 'Permutation and Combination,' and 'Sets and Statistics' which are solely dedicated on GMAT-QA-PS & DS, the book on 'Fundamentals of GMAT math' is solely dedicated to develop your math fundamentals. We recommend that you go through it before attempting questions from 'GMAT Quantitative Ability Question Bank.'

The Manhattan Review's 'GMAT Quantitative Ability Question Bank' book is holistic and comprehensive in all respects. Should you have any queries, please feel free to write to me at info@manhattanreview.com.

Happy Learning!

Professor Dr. Joern Meissner
& The Manhattan Review Team

Chapter 2

Problem Solving Question Bank

2.1 Number properties

1. $99996^2 - 4^2 =$

- **(A)** $10^{10} - 8$
- **(B)** $(10^5 - 8)^2$
- **(C)** $10^4(10^5 - 8)$
- **(D)** $10^5(10^4 - 8)$
- **(E)** $10^5(10^5 - 8)$

2. If 5^a is a factor of $n!$, and the greatest integer value of a is 6, what is the largest possible value of b such that 7^b is a factor of $n!$?

- **(A)** 2
- **(B)** 3
- **(C)** 4
- **(D)** 5
- **(E)** 6

3. If $a = 0.999$, $b = (0.999)^2$ and $c = \sqrt{0.999}$, which of the following is the correct order of a, b and c?

- **(A)** $a < b < c$
- **(B)** $a < c < b$
- **(C)** $b < c < a$
- **(D)** $b < a < c$
- **(E)** $c < a < b$

4. If p is the product of the reciprocals of integers from 150 to 250, inclusive, and q is the product of the reciprocals of integers from 150 to 251, inclusive, what is the value of $(p^{-1} + q^{-1})$ in terms of p?

- **(A)** $\frac{p}{(251)^2}$
- **(B)** $251 \times 252 \times p$
- **(C)** $252p$
- **(D)** $\frac{252}{p}$
- **(E)** $251 \times 252 \times p^2$

5. If x is the sum of all integers from 51 to 100, inclusive, what is the value of x?

- **(A)** 3,624
- **(B)** 3,625
- **(C)** 3,675
- **(D)** 3,725
- **(E)** 3,775

6. If x is the sum of the reciprocals of the consecutive integers from 51 to 60, inclusive and y is the sum of the reciprocals of the consecutive integers from 61 to 70, inclusive, which of the following is correct?

I. $\frac{1}{x} > 6$

II. $\frac{1}{y} > 7$

III. $\frac{1}{y} > \frac{1}{x}$

(A) Only I

(B) Only II

(C) Only III

(D) Only II and III

(E) I, II and III

7. A number $4p25q$ is divisible by 4 and 9; where p and q are the thousands and units digits, respectively. What is the minimum value of $\frac{p}{q}$?

(A) $\frac{1}{8}$

(B) $\frac{1}{7}$

(C) $\frac{1}{6}$

(D) $\frac{2}{5}$

(E) $\frac{5}{2}$

8. If a and b are real numbers such that a percent of $(a - 2b)$ when added to b percent of b, the value obtained is 0, then which of the following statements must be true?

I. $a = b$

II. $a + b = 0$

III. $a - b = 1$

(A) Only I

(B) Only II

(C) Only III

(D) Only I and III

(E) Only II and III

9. A set is such that if m is in the set, $(m^2 + 3)$ is also in the set. If -1 is in the set, which of the following is also in the set?

I. -2

II. 4

III. 19

(A) Only I

(B) Only II

(C) Only I and II

(D) Only II and III

(E) I, II and III

10. A sequence $t_1, t_2, t_3, \ldots t_n$ is such that $t_2 = 5$ and $t_{n+1} = 2t_n - 1$ for $n \geq 1$, then what is the value of $t_{10} - t_9$?

(A) 2^9

(B) $2^{10} + 1$

(C) 1

(D) 2

(E) 4

11. If m, n, p and q are distinct positive integers, greater than 1 such that $mnpq = 660$, how many possible combination of values exist for m, n, p and q?

(A) Two

(B) Three

(C) Four

(D) Five

(E) Seven

12. If $x = 216$ and $y = 125$, what is the value of $\left(\sqrt{x^{2/3} + y^{2/3} + 2(xy)^{1/3}} + \sqrt{x^{2/3} + y^{2/3} - 2(xy)^{1/3}}\right)$?

(A) 0

(B) 1

(C) 4

(D) 5

(E) 10

13. If $m \geq 0.9$, which of the following is a possible value of $\left(\frac{1}{\sqrt{m}}\right)$?

(A) 1.01

(B) 1.12

(C) 1.13

(D) 1.35

(E) 1.50

14. Given a and b are positive integers and $a = \dfrac{b^3}{90}$, which of the following must be an integer?

I. $\dfrac{a}{45}$

II. $\dfrac{a}{90}$

III. $\dfrac{a}{300}$

(A) Only I
(B) Only II
(C) Only III
(D) Only I and II
(E) I, II and III

15. The following addition operation shows the sum of the two-digit positive integers XY and YX. If X, Y, and Z are different digits, what is the value of the integer Z?

$$\begin{array}{ccc} & X & Y \\ + & Y & X \\ \hline X & X & Z \\ \hline \end{array}$$

(A) 8
(B) 7
(C) 2
(D) 1
(E) 0

16. Suzy saves $20 per month. In each of the next 30 months, she saved $20 more than he saved in the previous month. What is the total amount she saved during the 30-month period?

(A) $3,600
(B) $4,800
(C) $6,000
(D) $9,300
(E) $12,000

17. If a sequence of numbers $t_1, t_2, \ldots t_n$ is such that $t_1 = 0$, $t_2 = 2$ and $t_n = t_{(n+1)} + 2t_{(n-1)}$ for $n \geq 1$, what is the value of t_4?

(A) -2
(B) 0
(C) 4
(D) 6
(E) 8

18. If n is an integer such that $n > 9$, which of the following could be the remainder when $(2 + 2^2 + 2^3 + 2^4 + ... + 2^n)$ is divided by 3?

I. 0
II. 1
III. 2

(A) Only I

(B) Only II

(C) Only III

(D) Only I and III

(E) I, II and III

2.2 Percents

19. A machine can be repaired for $1,200 and will last for one year, while the new machine would cost for $2,800 and will last for two years. The average cost per year of the new machine is what percent greater than the cost of repairing the current machine ?

(A) 7%

(B) 10%

(C) 16.67%

(D) 18.83%

(E) 20%

20. An item is levied a sales tax of 10 percent on the part of the price that is greater than $200. If a customer paid a sales tax of $10 on the item, what was the price of the item?

(A) $200

(B) $250

(C) $300

(D) $360

(E) $400

21. Item A attracts sales tax rate of $0.54 per $25. What is the sales tax rate, as a percent, for item B that attracts four times as much as the rate for item A?

(A) 216%

(B) 86.4%

(C) 8.64%

(D) 2.16%

(E) 0.135%

22. Cyclist P increases his speed from 10 miles per hour to 25 miles per hour in the last lap, while another Cyclist Q increases his speed from 8 miles per hour to 24 miles per hour in the last lap. By what percent is the percent increase in speed of Cyclist Q more than that of Cyclist P?

(A) 33.33%

(B) 50%

(C) 66.67%

(D) 75%

(E) 100%

23. In a certain year, Carrier X traveled 101,098 kilometers and consumed 9,890 lites of diesel fuel, while in the same year, Carrier Y traveled 203,000 kilometers and consumed 24,896 lites of diesel fuel. The fuel mileage is defined as kilometers per liter of fuel. The mileage of Carrier X is approximately what percent greater or lesser than that of Carrier Y?

(A) 20%

(B) 25%

(C) 33.33%

(D) 37.50%
(E) 40%

24. The price of a bicycle was \$456. The trader first decreased the price by 25 percent and then increased by 25 percent. Which of the following represents the final percent change in the price of the bicycle?

(A) 0%
(B) 50%
(C) 66.67%
(D) 93.75%
(E) 100%

25. To make a certain color, a paint dealer mixes 3.4 liters of red color to a base that is 68 liters. The paint manufacturer recommends mixing 0.7 liters per 10 liters of base to make that color. By what percent should the mixing be increased to bring it to the recommendation?

(A) 10%
(B) 33.33%
(C) 40%
(D) 66.66%
(E) 72%

26. A Business Processing Outsourcing unit recruits 200 employees. Each of them is paid \$7.50 per hour for the first 44 hours worked during a week and $1\frac{1}{3}$ times that rate for hours worked in excess of 44 hours. What was the total remuneration of the employees for a week in which 30 percent of them worked 30 hours, 40 percent worked 44 hours, and the rest worked 50 hours?

(A) \$25,000
(B) \$40,500
(C) \$63,300
(D) \$70,000
(E) \$73,400

27. A retail company earned \$5 million as commission on the first \$35 million in sales and then \$11 million as commission on the next \$121 million in sales. By what percent did the ratio of commissions to sales decrease from the first \$35 million in sales to the next \$121 million in sales?

(A) 11.11%
(B) 22.22%
(C) 36.36%
(D) 44.44%
(E) 50%

28. A sales representative earned 8 percent commission on the amount of total sales up to \$20,000, inclusive, and x percent commission on the amount of total sales above \$20,000. If the sales representative earned a total commission of \$2,000 on total sales of \$24,000, what was the value of x?

(A) 4
(B) 6
(C) 8
(D) 10
(E) 12

29. A trader buys a batch of 120,000 computer chips for \$3,600,000. He sells $\frac{2}{5}$ of the computer chips, each at 25 percent above the cost per computer chip. Later, he sells the remaining computer chips at a price per computer chip equal to 25 percent less than the cost per computer chip. What was the percent profit or loss on the batch of computer chips?

(A) Loss of 1%
(B) Loss of 5%
(C) Loss of 7.50%
(D) Profit of 10%
(E) Profit of 22.22%

30. With the increase of 20% in price of milk, a housewife can buy 5 liters less quantity for \$60 than she was buying before the increase. What was the initial price per liter of milk?

(A) \$2.00
(B) \$2.50
(C) \$2.75
(D) \$3.00
(E) \$3.50

31. A company was approved to spend a certain sum of money for a year. It spent $\left(\frac{1}{4}\right)^{th}$ of the sum during the first quarter, and $\left(\frac{1}{6}\right)^{th}$ of the remainder during the second quarter. By what percent is the sum of money that was left at the beginning of the third quarter more than the sum spent in the two quarters?

(A) 10%
(B) 22.22%
(C) 33.33%
(D) 66.66%
(E) 133.33%

32. David and Suzy each spent \$450 in 2013. In 2014, David spent 10 percent more than he did in 2013, and together he and Suzy spent a total of \$600. Approximately by what percent less did Suzy spend in 2014 than she did in 2013?

(A) 23%
(B) 66%
(C) 77%
(D) 80%
(E) 83%

33. On day 1, a shopkeeper increases the price of an item by $k\%$, and on day 2, he decreases the increased price by $k\%$. By the end of the day 2, the price of the item drops by \$1. On day 3, he again increases the decreased price by $k\%$, and on day 4, he again decreases the increased price by $k\%$. If, at the end of day 4, the price of the item comes to \$398, what was the approximate initial price of the item?

(A) \$325

(B) \$350

(C) \$375

(D) \$400

(E) \$450

34. As per the previous year data, $\$y$ can buy x number of items. If the average cost of each item increased by 20 percent this year, then the number of items can be bought with $\$3y$ equals

(A) x

(B) $1.50x$

(C) $2.50x$

(D) $3x$

(E) $3.50x$

35. A solution consists of 30 percent of water by weight. After boiling the solution for 15 minutes, 70 percent water, by weight, was evaporated. There is no weight loss for the other part of the solution. What percent of the solution's total remaining weight consists of the remaining water?

(A) $\frac{500}{69}\%$

(B) $\frac{600}{69}\%$

(C) $\frac{700}{79}\%$

(D) $\frac{900}{79}\%$

(E) $\frac{100}{69}\%$

36. A mixed juice contains, by volume, 25 percent banana pulp and 75 percent papaya pulp. If this mixed juice costs 20 percent more than an equal quantity of only banana pulp, by what percent are papaya pulp more expensive than banana pulp?

(A) 22.22%

(B) 26.67%

(C) 28%

(D) 30%

(E) 33.33%

37. At a lab, bacteria P multiplies itself in every 18 days, while bacteria Q multiplies itself in every 15 days. Approximately by what percent is the number of times bacteria Q multiplies itself is more than the number of times bacteria P multiplies itself in a 3-year period?

(A) 12%

(B) 16%
(C) 20%
(D) 22%
(E) 33%

38. Jack purchased a phone for $1,500 and paid tax at the rate of 5 percent, while Tom purchased a phone for $1,200 and paid tax at the rate of 15 percent. The total amount Tom paid was what percent less than the total amount Jack paid?

(A) 5%
(B) 7%
(C) 9%
(D) 12%
(E) 15%

39. In a class, 65 percent of the boys and 78 percent of the girls play basketball. If 72 percent of all the students play basketball, what is the ratio of number of girls to number of boys?

(A) $\frac{4}{3}$
(B) $\frac{7}{6}$
(C) $\frac{8}{7}$
(D) $\frac{9}{8}$
(E) $\frac{13}{11}$

40. In a stadium, Royal Challengers team had a support of 24,500 spectators from natives and 10 percent of spectators from other than natives. If S is the total number of spectators in the stadium and 40 percent belonged to natives, which of the following represents the number of supporters for Royal Challengers team?

(A) $0.6S + 12,250$
(B) $0.28S + 12,250$
(C) $0.28S + 24,500$
(D) $0.06S + 24,500$
(E) $0.6S + 24,500$

41. In a school, 40 percent of the students study Science and 60 percent of them go to special classes after the school. If 30 percent of the students of the school go to special classes, what percent of the students who do not study Science go to special classes after the school?

(A) 6%
(B) 12%
(C) 15%
(D) 24%
(E) 27%

42. In a class of a school, there were 40 percent boys. If some of the students were transferred to a new section and 30 percent of the transferred students were boys, what was the ratio of the transfer rate for the boys to the transfer rate for the girls?

(A) 1 : 4
(B) 2 : 7
(C) 4 : 9
(D) 9 : 14
(E) 9 : 16

43. At the beginning of a year, a car was valued $\left(\frac{5}{7}\right)^{\text{th}}$ of the original price, and in the end of the year, it was value $\left(\frac{3}{5}\right)^{\text{th}}$ of the original price. By what percent did the value of the car decrease during the year?

(A) 11.11%
(B) 16%
(C) 17.50%
(D) 19%
(E) 22.22%

44. A salesman is offered either a 5 percent commission on his monthly sales, in dollar, and a monthly bonus of $500 or a 7 percent commission on his monthly sales with no bonus. At what sales both the offers will give him the same remuneration?

(A) $22,500
(B) $25,000
(C) $32,500
(D) $35,000
(E) $40,000

45. In the beginning of the year, 35 percent of company X's 120 customers were retailers, and after the 24-month period, 25 percent of its 240 customers were retailers. What was the simple annual percent growth rate in the number of retailers?

(A) 14.28%
(B) 21.43%
(C) 24.0%
(D) 30.0%
(E) 37.25%

46. Which of the following gives the highest overall percent increase, if in each case, the second percent increase is applied on the value obtained after application of the first percent Increase?

(A) 10 percent increase followed by 50 percent increase
(B) 25 percent increase followed by 35 percent increase
(C) 30 percent increase followed by 30 percent increase
(D) 40 percent increase followed by 20 percent increase

(E) 45 percent increase followed by 15 percent increase

47. In a school, 70 percent students are boys and the rest are girls. In a prefect election, 30 percent of boys and 70 percent of girls voted for a John. What percent of the total students voted for John?

(A) 37%
(B) 42%
(C) 50%
(D) 58%
(E) 66%

48. According to the table given below, a state has a total of 23,000 number of companies from seven regions. By what percent of the total number of companies in the region, the number of companies of Region S is more than the number of companies of Region R?

Region-wise distribution of companies in the state	
Region P	2,345
Region Q	3,456
Region R	3,421
Region S	5,721
Region T	3,445
Region U	80
Region V	4,532

(A) 5%
(B) 10%
(C) 17.5%
(D) 22.5%
(E) 33.33%

2.3 Profit & Loss

49. A shopkeeper could sell only $\left(\frac{4}{5}\right)^{\text{th}}$ of the stock at the rate of \$3 per item. If 100 itms were unsold, what was the total amount he received from the sale?

(A) \$240

(B) \$1,200

(C) \$1,250

(D) \$1,300

(E) \$1,500

50. A trader bought 900 cartons of a certain ice-cream brand at a cost of \$20 per carton. If he sold $\left(\frac{2}{3}\right)^{\text{rd}}$ of the cartons for one and quarter times their cost price and sold the remaining cartons at a loss of 20 percent of their cost price, what was the trader's gross profit on the total sale?

(A) \$1,800

(B) \$2,400

(C) \$2,700

(D) \$3,000

(E) \$3,200

51. A dealer sells only two brands of bicycles, brand A and brand B. The selling price of a brand A bicycle is \$150, which is 60 percent of the selling price of a brand B bicycle. If the dealer sells 100 pieces of bicycles, and $\left(\frac{3}{5}\right)^{\text{th}}$ of which are brand B, what is dealer's total sales, in dollar, from the sale of bicycles?

(A) \$15,000

(B) \$16,000

(C) \$18,000

(D) \$21,000

(E) \$22,000

52. A trader bought a consignment at a purchase price of \$800 and sold it for 20% less than the marked price. If the trader made a profit equivalent to 30% of the purchase price, what is the marked price of the consignment?

(A) \$1,000

(B) \$1,200

(C) \$1,300

(D) \$1,350

(E) \$1,500

53. A small textile company buys few machines to stitch garments, costing a total of \$10,000. The per unit cost of each garment is \$2.50 and is sold for \$4.50. How many units of the garments must be sold to achieve break-even (A phenomenon when all the investment and production costs are recovered by the sales revenue)?

(A) 2,000
(B) 3,500
(C) 4,500
(D) 5,000
(E) 6,000

54. A broker sold a house with a gross margin of 20 percent on the cost of the house. If the selling price of the house were increased by $10,000, it would yield a gross margin of 30 percent of the cost of the house. What was the original selling price of the house?

(A) $90,000
(B) $100,000
(C) $120,000
(D) $140,000
(E) $150,000

55. A television assembler pays its contractors $20 each for the first 100 assembled sets and $15 for each additional set. If 600 television sets were assembled and the assembler invoiced the manufacture $25.00 for each set, what was the assembler's gross profit, in dollar?

(A) $3,750
(B) $4,500
(C) $5,500
(D) $6,000
(E) $7,000

56. A merchant's gross profit on item A was 10 percent of its cost. If the merchant increased its selling price from $99 to $117, keeping its cost same, the merchant's profit on item A after the price increase was what percent of the cost of item A?

(A) 20%
(B) 21%
(C) 24%
(D) 27%
(E) 30%

57. A merchant bought 2,400 fans for $30 each. He sold 60 percent of the fans for $40 each and the rest for $35 each. What was the merchant's average profit per fan?

(A) $6
(B) $8
(C) $9
(D) $10
(E) $12

58. A man sold an article at k percent profit after offering k percent discount on the listed price. Had he sold the article at $(k + 15)$ percent discount on the listed price, his profit would have been $(k - 20)$ percent. What would have been his percent profit had he sold the article without offering any discount?

- **(A)** 5.0%
- **(B)** 10.0%
- **(C)** 25.0%
- **(D)** 33.3%
- **(E)** 38.0%

59. A merchant sold 800 units of bedsheets for $8 each and 900 units of bedsheets for $5 each. If the merchant's cost of producing each unit of bedsheet was $6, what was the merchant's profit or loss on the sale of 1,700 bedsheets?

- **(A)** Loss of $700
- **(B)** Loss of $300
- **(C)** No profit or loss
- **(D)** Profit of $300
- **(E)** Profit of $700

60. The sales revenue from book sales in 2015 was 10% less than that in 2014 and the sales revenue from stationary sales in 2015 was 6% more than that in 2014. If total sales revenues from book sales and stationary sales in 2015 were 2% more than that in 2014, what is the ratio of sales revenue from book sales in 2014 to sales revenue from stationary sales in 2014?

- **(A)** 1 : 3
- **(B)** 2 : 3
- **(C)** 3 : 4
- **(D)** 4 : 5
- **(E)** 5 : 6

61. A trader's profit in 2002 was 20 percent greater than its profit in 2001, and its profit in 2003 was 25 percent greater than its profit in 2002. The company's profit in 2003 was what percent greater than its profit in 2001?

- **(A)** 5%
- **(B)** 45%
- **(C)** 46%
- **(D)** 48%
- **(E)** 50%

2.4 Averages

62. Milton school has a student-to-teacher ratio of 25 to 2. The average (arithmetic mean) annual salary for teachers is \$42,000. If the school pays a total of \$3,780,000 in annual salaries to its teachers, how many students does the school have?

(A) 900
(B) 1,000
(C) 1,125
(D) 1,230
(E) 1,500

63. The average (arithmetic mean) annual salary of the employees of a company was \$70,000. If the male employees' annual salary average was \$65,000 and that of female employees' annual salary was \$80,000, what could be the number of male employees and female employees, respectively, in the company?

(A) 6; 7
(B) 7; 15
(C) 7; 14
(D) 14; 7
(E) 15; 7

64. A class comprises 40 students and is divided into two sections. In section A, the average score in a test was 85. In section B, the average score in the test was 80. If the average score of the class in the test was 82, how many students are in section A?

(A) 12
(B) 14
(C) 16
(D) 20
(E) 22

65. A juice manufacturer has 1,200 liters of mango pulp in stock, 25 percent of which is water. If the manufacturer adds another 400 liters of mango pulp of which 20 percent is water, what percent, by volume, of the manufacturer's mango pulp contains water?

(A) 21.50%
(B) 23.75%
(C) 33.33%
(D) 35.00%
(E) 37.50%

66. A class has four sections P, Q, R and S and the average weights of the students in the sections are 45 lb, 50 lb, 55 lb and 65 lb, respectively. What is the maximum possible number of students in section R if there are 40 students in all sections combined and the average weight of the all students across the four sections is 55 lb? It is known that each section has at least one student.

(A) 18
(B) 20
(C) 25
(D) 35
(E) 37

67. If set N consists of odd numbers of consecutive integers, starting with 1, what is the difference of the average of the odd integers and the average of the even integers in set N?

(A) -1
(B) 0
(C) $\frac{1}{2}$
(D) 1
(E) 2

68. The average of nine numbers is 25. The average of the first five numbers is 20 and that of the last five is 32. What is the value of the fifth number?

(A) 30
(B) 32
(C) 35
(D) 36
(E) 38

69. Box X and Box Y each contain many yellow balls and green balls. All of the green balls have the same radius. The radius of each green ball is 4 inches less than the average radius of the balls in Box X and 2 inches greater than the average radius of the balls in Box Y. What is the difference between average (arithmetic mean) radius, in inches, of the balls in Box X and of the balls in Box Y?

(A) 4
(B) 6
(C) 7
(D) 8
(E) 10

70. A certain company has 60 employees. The average (arithmetic mean) salary of 10 of the employees is \$35,000, the average salary of 35 other employees is \$30,000, and the average salary of the remaining 15 employees is \$60,000. What is the average salary of the 60 employees at the company?

(A) \$32,500
(B) \$38,333
(C) \$39,500
(D) \$40,000
(E) \$42,222

71. At a certain stationery shop, the price of a pencil is 20 cents and the price of an eraser is 30 cents. A boy buys a total of 20 pencils and erasers from the shop, and the average (arithmetic mean) price of the 20 pieces comes to 28 cents. How many erasers must the boy return so that the average price of the pieces that he buys is 26 cents?

(A) 2
(B) 4
(C) 6
(D) 8
(E) 10

72. A student's average (arithmetic mean) test score on four tests is 78. If each test is scored out of 100, which of the following can be the student's score on the fifth test so that the student's average score on five tests increases by an integer value?

(A) 82
(B) 87
(C) 89
(D) 93
(E) 95

73. An instructor gave the same test to three groups: P, Q, and R. The average (arithmetic mean) scores for the three groups were 64, 84, and 72, respectively. The ratio of the numbers of candidates in P, Q, and R groups was 3 : 5 : 4, respectively. What was the average score for the three groups combined?

(A) 72
(B) 75
(C) 77
(D) 78
(E) 80

74. A fitness club has 50 male and 20 female members. The average (arithmetic mean) age of all of the members is 23 years. If the average age of the male members was 20 years, which of the following is the average age, in years, of the female members?

(A) 30.50
(B) 31.50
(C) 32.50
(D) 33.00
(E) 34.50

75. Following is a modified question of the above.

A fitness club has 50 male and 20 female members. The average (arithmetic mean) age of all of the members is 23.89 years. If the average age of the male members was 20.89 years, which of the following is the average age, in years, of the female members?

(A) 32.75

(B) 33.50

(C) 34.39

(D) 36.00

(E) 37.50

2.5 Ratio & Proportion

76. The total cost of manufacturing metal bearings incurs a fixed cost of $25,000 and a variable expense, which depends on the number of bearings manufactured. If for 50,000 bearings the total cost is $100,000, what is the total cost for 100,000 bearings?

(A) $125,000
(B) $150,000
(C) $175,000
(D) $200,000
(E) $275,000

77. A beaker was filled with a mixture of 40 liters of water and a liquid chemical in the ratio of $3 : 5$, respectively. If each day, for a 10-day period, 2 percent of the initial quantity of water and 5 percent of the initial quantity of liquid chemical evaporated, what percent of the original amount of mixture evaporated during this period?

(A) 22.22%
(B) 33.33%
(C) 38.75%
(D) 44.44%
(E) 58.33%

78. In Ghazal's doll collection, $\left(\frac{3}{5}\right)^{\text{th}}$ of the dolls are Barbie dolls, and $\left(\frac{4}{7}\right)^{\text{th}}$ of the Barbies were purchased before the age of 10. If 90 dolls in Ghazal's collection are Barbies that were purchased at the age of 10 or later, how many dolls in her collection are non-Barbie dolls?

(A) 70
(B) 90
(C) 140
(D) 154
(E) 192

79. The ratio of the ages of John and Suzy is $5 : 6$. Which of the following can be the ratio of their ages after 10 years?

(A) 2 : 3
(B) 13 : 20
(C) 11 : 15
(D) 4 : 5
(E) 9 : 10

80. A company assembles two kinds of phones: feature and smartphone. Of the phones produced by the company last year, $\left(\frac{2}{5}\right)^{\text{th}}$ were feature phones and the rest were smartphones. If it takes $\left(\frac{8}{5}\right)^{\text{th}}$ as many hours to produce a smartphone as it does to produce a feature phone, then the number of hours it took to produce the smartphones last year was what fraction of the total number of hours it took to produce all the phones?

(A) $\frac{8}{31}$

(B) $\frac{11}{31}$

(C) $\frac{12}{17}$

(D) $\frac{13}{34}$

(E) $\frac{15}{34}$

81. At a certain garment shop, the ratio of the number of shirts to the number of trousers is 4 to 5, and the ratio of the number of jackets to the number of shirts is 3 to 8. If the ratio of the number of sweaters to the number of trousers is 6 to 5, what is the ratio of the number of jackets to the number of sweaters?

(A) 9 to 25

(B) 1 to 3

(C) 1 to 4

(D) 3 to 5

(E) 6 to 5

82. At a church prayer, $\left(\frac{3}{5}\right)^{\text{th}}$ of the members were males. $\left(\frac{3}{5}\right)^{\text{th}}$ of the male members and $\left(\frac{7}{10}\right)^{\text{th}}$ of the female members attended the prayer. Of the members who did not attend the prayer, what fraction are male members who did not attend the prayer?

(A) $\frac{1}{4}$

(B) $\frac{3}{7}$

(C) $\frac{2}{3}$

(D) $\frac{9}{10}$

(E) $\frac{6}{19}$

83. John, Suzy, and David together donated a total of $100 for a charity. If John paid $\left(\frac{5}{3}\right)^{\text{th}}$ of what David donated, Suzy donated $20 and David donated the rest, what fraction of the total amount did David donate?

(A) $\frac{1}{5}$

(B) $\frac{1}{6}$

(C) $\frac{2}{7}$

(D) $\frac{3}{10}$

(E) $\frac{4}{11}$

84. A merchant sold a total of X shirts and trousers. If the number of trousers is $\left(\frac{1}{5}\right)^{\text{th}}$ the number of shirts, and $\left(\frac{1}{5}\right)^{\text{th}}$ of the shirts are cotton shirts, how many cotton shirts, in terms of X, were sold by the merchant?

- **(A)** $\frac{2X}{7}$
- **(B)** $\frac{X}{4}$
- **(C)** $\frac{4X}{15}$
- **(D)** $\frac{6X}{25}$
- **(E)** $\frac{X}{6}$

85. A rod that weighs 20 pounds is cut into two pieces so that one of the pieces weighs 16 pounds and is 36 feet long. If the weight of each piece is directly proportional to the square of its length, how many feet long is the other piece of rod?

- **(A)** 9
- **(B)** 12
- **(C)** 18
- **(D)** 24
- **(E)** 27

86. The ratio of John's coins to Suzy's coins is 3 : 4. If John's coins exceeds $\frac{2}{7}$ of the total coins by 25, how many coins Suzy has?

- **(A)** 50
- **(B)** 100
- **(C)** 120
- **(D)** 150
- **(E)** 180

87. Total cost of an item is formed out of four costs: Material cost, Labour cost, Factory overhead cost, and Office overhead cost. If Material cost and Labour cost constitute $\frac{3}{7}$ part of the total cost, Labour cost and Factory overhead cost constitute $\frac{1}{2}$ part of the total cost, Factory overhead cost and Office overhead cost constitute $\frac{4}{7}$ part of the total cost, and Material cost and Office overhead cost constitute $\frac{1}{2}$ part of the total cost, which of the four costs is the highest among all?

- **(A)** Material cost
- **(B)** Labour cost
- **(C)** Factory overhead cost
- **(D)** Office overhead cost
- **(E)** Factory overhead cost or Office overhead cost

88. An entrance test consists of 20 questions. Each question after the first is worth 2 points more than the preceding question. If the total questions are worth a total of 400 points, how many points is the fourth question worth?

(A) 5
(B) 7
(C) 11
(D) 19
(E) 38

89. In a science college, 80 more than $\left(\frac{1}{3}\right)^{\text{rd}}$ of all the students took a science course and $\left(\frac{1}{3}\right)^{\text{th}}$ of those who took the science course took chemistry. If $\left(\frac{1}{6}\right)^{\text{th}}$ of all the students in the school took chemistry, how many students are in the school?

(A) 200
(B) 240
(C) 480
(D) 600
(E) 720

90. In an office having 50 employees, $\left(\frac{1}{4}\right)^{\text{th}}$ of the males and $\left(\frac{1}{5}\right)^{\text{th}}$ of the females eat company breakfast. What is the greatest possible number of employees in the office eat company breakfast?

(A) 6
(B) 8
(C) 10
(D) 12
(E) 25

91. In a cookery class, $\left(\frac{1}{8}\right)^{\text{th}}$ of the number of females is equal to $\left(\frac{1}{12}\right)^{\text{th}}$ of the total number of students. What is the ratio of the number of males to the number of females in the class?

(A) 1 : 5
(B) 1 : 4
(C) 1 : 2
(D) 3 : 4
(E) 2 : 1

92. In a class, there are 40 students. In a test, the average (arithmetic mean) score of the girls is 30, that of boys is 40, and that of the class is 32. If the score of a boy was incorrectly computed 30 for 40, what is the correct average (arithmetic mean) score of the class?

(A) 31
(B) 31.50
(C) 32.25
(D) 41

(E) 42

93. How many liters of Chemical A must be added to a 120-liter solution that is 25 percent Chemical A in order to produce a solution that is 40 percent Chemical A?

(A) 12
(B) 15
(C) 20
(D) 24
(E) 30

94.

Month	**Number of chickens**
1	144
2	c
3	256

Information about the number of chickens hatched in a poultry farm is given in the table above. If the number of chickens in the poultry farm in any month increased by the same fraction during each of the two periods of the successive months, how many chickens were there in the second month?

(A) 192
(B) 200
(C) 210
(D) 220
(E) 240

2.6 Speed, Time & Distance

95. A trip of 900 miles would have taken 1 hour less if the average speed for the trip had been greater by 10 miles per hour. What was the average speed for the trip?

(A) 40 miles per hour
(B) 45 miles per hour
(C) 60 miles per hour
(D) 75 miles per hour
(E) 90 miles per hour

96. A truck traveled 336 miles per full tank of diesel on the national highway and 224 miles per full tank of diesel on the state highway. If the truck traveled 4 fewer miles per gallon on the state highway than on the national highway, how many miles per gallon did the truck travel on the state highway?

(A) 6
(B) 8
(C) 10
(D) 12
(E) 15

97. A bike traveling at a certain constant speed takes 5 minutes longer to travel 10 miles than it would take at 60 miles per hour. At what speed, in miles per hour, is the bike traveling?

(A) 36
(B) 40
(C) 42
(D) 48
(E) 50

98. A biker increased his average speed by 10 miles per hour in each successive 10-minute interval after the first interval. If in the first 10-minute interval, his average speed was 30 miles per hour, how many miles did he travel in the fourth 10-minute interval?

(A) 4
(B) 5
(C) 8
(D) 10
(E) 15

99. An aircraft flew 600 miles to a town at an average speed of 500 miles per hour with the wind and made the trip back following the same route at an average speed of 400 miles per hour against the wind. Which of the following is aircraft's approximate average speed, in miles per hour, for the trip?

(A) 420
(B) 444

(C) 450
(D) 467
(E) 483

100. A truck completed half of a 800-mile trip at an average speed of 40 miles per hour. At what approximate average speed, in miles per hour, should the truck complete the remaining miles to achieve an average speed of 50 miles per hour for the entire 800-mile trip? Assume that he truck completed its 800-mile trip without stoppage.

(A) 52
(B) 55
(C) 60
(D) 67
(E) 70

101. A marathoner ran for two days. On the second day he ran at an average speed of 3 mile per hour faster than the average speed of the first day. If during the two days he ran a total of 36 miles and did a total of 8 hours running, which of the following could be his average speed, in miles per hour, on the first day?

(A) 0.25
(B) 0.50
(C) 1.00
(D) 1.50
(E) 2.00

102. Two trains traveling toward each other on parallel tracks at constant rates of 50 miles per hour and 60 miles per hour are 285 miles apart. How far apart will they be 2 hours before their engine meet?

(A) 110
(B) 120
(C) 150
(D) 200
(E) 220

103. If the speed limit along an 10-mile section of rail track is reduced from 50 miles per hour to 40 miles per hour. Approximately how many minutes more will it take a rail to travel along this section with the new speed limit than it would have taken at the old speed limit?

(A) 3
(B) 5
(C) 8
(D) 10
(E) 12

104. Trains A and B traveled the same 100-mile route. If Train A took 4 hours and Train B traveled at an average speed 25 percent more than the average speed of Train A, how many hours did it take Train B to travel the route?

(A) $1\frac{2}{3}$

(B) 2

(C) $3\frac{1}{5}$

(D) $3\frac{3}{5}$

(E) 4

105. Jeff drives three times farther in 36 minutes than what Amy drives in 30 minutes. If Jeff drives at a speed of 40 miles per hour, at what speed, in miles per hour, does Amy drive?

(A) 6

(B) 9

(C) 16

(D) 24

(E) 32

106. A bus left a bus depot A at 7 am and reached another bus depot B at 12 pm. Another bus left bus depot B at 8 am and reached bus depot A at 11 am. At what time did the two buses pass one another?

(A) 9:00 am

(B) 9:15 am

(C) 9:30 am

(D) 9:40 am

(E) 10:00 am

2.7 Time & Work

107. A photocopier machine makes 1,500 copies per hour. Working 12 hours each day, another photocopier machine, twice as efficient, how many copies will it make in 20 days?

(A) 400,000
(B) 500,000
(C) 540,000
(D) 660,000
(E) 720,000

108. A water pump began filling an empty swimming pool with water and ran at a constant rate til the swimming pool was full. At sometime, the pool was $\frac{1}{2}$ full, and $2\frac{1}{3}$ hours later, it was $\frac{5}{6}$ full. How many hours would it take the pump to fill the empty pool completely?

(A) 4
(B) $5\frac{1}{3}$
(C) 7
(D) $7\frac{1}{5}$
(E) $8\frac{1}{3}$

109. Two pumps, each working alone, can fill an empty pool in 10 hours and 15 hours, respectively. The first pump initially started alone for h hours; after which the second pump was also started. If it took a total of 7 hours for the pool to be filled completely by the both the pumps, what is the value of h?

(A) 2.00
(B) 2.50
(C) 3.00
(D) 3.30
(E) 4.00

110. An empty swimming pool with a capacity of 5,760 gallons is being filled by a pipe at the rate of 12 gallons per minute. An empty pipe that has the capacity to empty $\left(\frac{3}{4}\right)^{\text{th}}$ of the pool in 9 hours is also in operation. If the pool is already half-filled, and if both the pipes are in operation, how many hours would it take to fill the pool to its full capacity?

(A) 6
(B) 12
(C) 24
(D) 36
(E) 72

111. Lathe machine A manufactures metal parts thrice as fast as lathe machine B. Lathe machine B manufactures 300 X-type bearings in 60 days. If each machine manufactures bearings at a constant rate, how many Y-type bearings does lathe machine A manufacturer in 10 days, if each Y-type bearing takes 2.5 times of the time taken to manufacturer each X-type bearing?

(A) 40
(B) 50
(C) 54
(D) 60
(E) 64

112. Photocopier A, working alone at its constant rate, makes 1,200 copies in 3 hours. Photocopier B, working alone at its constant rate, makes 1,200 numbers of copies in 2 hours. Photocopier C, working alone at its constant rate, makes 1,200 numbers of copies in 6 hours. How many hours will it take photocopiers A, B, and C, working together at their respective constant rates, to make 3,600 numbers of copies?

(A) 2.00
(B) 2.25
(C) 2.50
(D) 3.00
(E) 3.50

113. Five men can consume food costing \$150 on a 4-day expedition trip. If a woman consumes three-fourth the amount of food consumed by a man, what would be the cost of food consumed by 4 men and 2 women during a 8-day expedition trip?

(A) \$300
(B) \$330
(C) \$360
(D) \$390
(E) \$400

114. Mark and Kate individually take 12 hours more and 27 hours more, respectively, to complete a certain project than what they would have taken to complete the same project working together. How many hours do Mark and Kate take to complete the project, working together?

(A) 12
(B) 16
(C) 18
(D) 24
(E) 39

2.8 Computational

115. A chemical evaporates out of a beaker at the rate of x liters for every y minutes. If the chemical costs 25 dollars per liter, what is the cost, in dollars, of the amount of the chemical that will evaporate in z minutes?

(A) $\frac{25x}{yz}$

(B) $\frac{xz}{25q}$

(C) $\frac{25y}{xz}$

(D) $\frac{25xz}{y}$

(E) $\frac{25yz}{x}$

116. In company X, the total cost of producing pens is governed by a linear function. If the total cost of producing 25,000 pens is \$37,500 and the total cost of producing 35,000 pens is \$47,500, what is the the total cost of producing 50,000 pens?

(A) \$57,500

(B) \$60,000

(C) \$62,500

(D) \$67,857

(E) \$75,900

117. If Suzy had thrice the amount of money that she has, she would have exactly the money needed to purchase four pencils, each costing \$1.35 per piece and two erasers, each costing \$0.30 per piece. How much money does Suzy have?

(A) \$1.50

(B) \$2.00

(C) \$2.25

(D) \$2.50

(E) \$2.75

118. The population of a certain country increases at the rate of 30,000 people every month. The population of the country in 2012 was 360 million. In which year would the population of the country be 378 million?

(A) 2060

(B) 2061

(C) 2062

(D) 2063

(E) 2064

119. An Ice-cream parlor buys milk-cream cartons, each containing $2\frac{1}{2}$ cups of milk-cream. If the restaurant uses $\frac{1}{2}$ cup of the milk-cream in each serving of its ice-cream, what is the least number of cartons needed to prepare 98 servings of the ice-cream?

(A) 9
(B) 19
(C) 20
(D) 21
(E) 24

120. Few coins are put into 7 boxes such that each box contains at least two coins. At the most 3 boxes can contain the same number of coins, and the remaining boxes cannot contain an equal number of coins. What is the minimum possible number of coins in the 7 boxes?

(A) 18
(B) 20
(C) 24
(D) 27
(E) 30

121. A volcanic lava laterally moves at the rate of 15/4 feet per hour. How many days does it take the lava to move 3/2 mile? (1 mile = 5,280 feet)

(A) 48
(B) 60
(C) 72
(D) 80
(E) 88

122. At a metal rolling factory, if a iron bar of square cross-section with an area of 4 square foot is moving continuously through a belt conveyor at a constant speed of 360 feet per hour, how many seconds does it take for a volume of 8.4 cubic foot of the iron bar to move through the conveyor?

(A) 21
(B) 22
(C) 24
(D) 27
(E) 30

123. At a factory, each worker is remunerated according to a salary grade G that is at least 1 and at most 7. Each worker receives a monthly wage W, in dollars, determined by the formula $W = 1,140 + 45(G - 1)$. How many more dollars per month a worker with a salary grade-7 receives than a worker with a salary grade of 1?

(A) \$135
(B) \$270
(C) \$405
(D) \$540
(E) \$600

124. At a garage sale, the prices of all the items sold were different. The items sold were radios and DVD players. If the price of a certain radio sold at the garage sale was the 15^{th} highest price as well as the 20^{th} lowest price among the prices of the radios sold, and the price of a certain DVD player sold was the 29^{th} highest price as well as the 37^{th} lowest price among all the prices of all the items sold, how many DVD players were sold at the garage sale?

(A) 30
(B) 31
(C) 32
(D) 64
(E) 65

125. A salesman is paid \$25 per order as commission for the first 150 orders, and \$12.50 as commission for each additional order. If he received a total of \$5,000 as commission, how many orders did he make?

(A) 100
(B) 120
(C) 150
(D) 200
(E) 240

126. An overseas businessman purchased a total of \$2,000 worth of traveler's checks in \$20 and \$50 denominations. During the trip, he cashed only 10 checks and lost all the remaining checks. If the number of \$20 checks cashed was 2 more or 2 less than the number of \$50 checks cashed, what is the minimum possible value of the checks that were lost?

(A) \$1,200
(B) \$1,440
(C) \$1,500
(D) \$1,620
(E) \$1,680

127. A pet shop sells three pack-sizes of dog food of brand X. The 5-kg pack costs \$16, the 10-kg pack costs \$26, and the 25-kg pack costs \$55. If a customer wants to buy a minimum of 40 kg brand X dog food, what is the minimum price he will have to pay?

(A) \$85
(B) \$90
(C) \$97
(D) \$107
(E) \$110

2.9 Interest

128. If a sum of money invested under simple interest, amounts to \$3,200 in 4 years and \$3,800 in 6 years, what is the rate at which the sum of money was invested?

(A) 10%
(B) 12%
(C) 15%
(D) 20%
(E) 24%

129. For a sum of money, the difference between compound interest and simple interest, each invested for 2 years, at the same rate of interest, is \$63. If the simple interest on the sum after 2 years is \$600, at what rate of interest the sum of money was invested?

(A) 25%
(B) 24%
(C) 22%
(D) 21%
(E) 10%

130. Suzy borrows two equal sums of money under simple interest at 10% and 8% rate of interest. She finds that if she repays the former sum on a certain date one year before the latter, she will have to pay the same amount for each borrowing. After how many years did she pay the first sum of money?

(A) 2.5
(B) 3
(C) 3.5
(D) 4
(E) 5

131. A sum of \$100,000 was invested in two deposits at simple interest rates of 3 percent and 4 percent, respectively. If the total interest on the two sums was \$3,600 at the end of one year, what fractional part of the 100,000 was invested at 4 percent?

(A) $\frac{5}{8}$
(B) $\frac{1}{5}$
(C) $\frac{2}{3}$
(D) $\frac{3}{5}$
(E) $\frac{3}{7}$

132. A sum of money is invested at simple interest, partly at 4% and remaining at 7% annual rates of interest. After two years, the total interest obtained was \$2,100. If the total investment is \$18,000, what was the sum of money invested at 4% annual rate of interest?

(A) \$5,500
(B) \$6,000
(C) \$7,000
(D) \$10,500
(E) \$11,000

133. A man invested two equal sums of money in two banks at simple interest, one offering annual rate of interest of 10% and the other offering annual rate of interest of 20%. If the difference between the interests earned after two years is between \$120 and \$140, exclusive, which of the following could be the difference between the amounts earned for the same amounts of money, invested at the same rates of interest as above, but at compound interest?

(A) \$130
(B) \$135
(C) \$137
(D) \$154
(E) \$162

134. At the start of an experiment, a certain population consisted of x organisms. At the end of each month after the start of the experiment, the population size increased by twice of its size at the beginning of that month. If the total population at the end of five months is greater than 1,000, what is the minimum possible value of x?

(A) 2
(B) 3
(C) 4
(D) 5
(E) 6

135. A sum of money is borrowed at 12% per annum interest rate for one year. The interest is calculated after the end of every two-month period and is added to the amount accrued after a period. The amount payable after the end of the year is how many times the sum borrowed?

(A) 1.12
(B) $(1.12)^5$
(C) $(1.02)^6$
(D) $(1.02)^5$
(E) $(1.12)^6$

136. Mary deposited sum of x dollars into an account that earned 4% annual interest compounded annually. One year later she deposited additional x dollars in the account. Consider that there were no other transactions and if the account showed y dollars at the end of the two years, which of the following expresses x in terms of y?

(A) $\frac{y}{2.04}$
(B) $\frac{y}{1.12}$
(C) $\frac{y}{2.2}$

(D) $\dfrac{y}{1.04 \times 2.04}$

(E) $\dfrac{y}{(1.04)^2 \times 2.04}$

137. George invested a certain sum of money on compound interest payable at a certain rate of interest. By the end of the 5^{th} year, the interest on the investment was \$4,800 and by the end of the 6^{th} year, the interest on the investment was \$5,520. What was the rate of interest at which George invested the sum of money?

(A) 10.0%

(B) 12.0%

(C) 12.5%

(D) 15.0%

(E) 20.0%

2.10 Functions

138. If the function f is defined by $f(p) = p^2 + \frac{1}{p^2}$ for all non-zero numbers p, then $\left(f\left(-\frac{1}{\sqrt{p}}\right)\right)^2 =$

(A) $f(p) + 2$

(B) $\frac{2}{f(p^2)}$

(C) $\left(\frac{1}{f(\sqrt{p})}\right)^2$

(D) $1 - (f(\sqrt{p}))^2$

(E) $f(p) - 2$

139. The function f is defined by $f(x) = -\frac{1}{x}$ for all non-zero numbers x. If $f(a) = -\frac{1}{2}$ and $f(ab) = \frac{1}{6}$, then $b =$

(A) 3

(B) $\frac{1}{3}$

(C) $-\frac{1}{3}$

(D) -3

(E) -12

140. The function f is defined by $f(x) = \sqrt{x} - 20$ for all positive numbers x. If $p = f(q)$ for some positive numbers p and q, what is q in terms of p?

(A) $(p + 20)^2$

(B) $\sqrt{p + 20}$

(C) $(\sqrt{p} + 20)^2$

(D) $\sqrt{p^2 + 20}$

(E) $(p^2 + 20)^2$

141. The function f is defined for each positive three-digit integer T by $f(T) = 2^a 3^b 5^c$, where a, b and c are the hundreds, tens and units digits of T, respectively. If K and R are three-digit positive integers such that $f(K) = 18f(R)$, then $K - R =$

(A) 65

(B) 70

(C) 80

(D) 100

(E) 120

142. For which of the following functions f, is $f(x) = f(1-x)$ for all x?

(A) $f(x) = 1 + x$

(B) $f(x) = 1 + x^2$

(C) $f(x) = x^2 - (1-x)^2$

(D) $f(x) = x^2(1-x)^2$

(E) $f(x^2) = \dfrac{x}{1-x}$

143. If $f(x) = \frac{1}{x}$ and $g(x) = \frac{x}{x^2+1}$, for all $x > 0$, what is the minimum value of $f(g(x))$?

(A) 0

(B) $\dfrac{1}{2}$

(C) 1

(D) $\dfrac{3}{2}$

(E) 2

144. If $f(x) = \dfrac{10x}{1-x}$, for what value of x does $f(x) = \frac{1}{2}f(3)$?

(A) 4

(B) 2

(C) 1

(D) -3

(E) -5

145. If $3f(x) + 2f(-x) = 5x - 10$, what is the value of $f(1)$?

(A) 0

(B) 1

(C) 2

(D) 3

(E) 4

146. As per an estimate, the depth $D(t)$, in centimeters, of the water in a tank at t hours past 12:00 a.m. is given by $D(t) = -10(t-7)^2 + 100$, for $0 \le t \le 12$. At what time does the depth of the water in the tank becomes the maximum?

(A) 5:30 a.m.

(B) 7:00 a.m.

(C) 7:30 a.m.

(D) 8:00 a.m.

(E) 9:00 a.m.

2.11 Permutation & Combination & Probability

147. $C_q^p = \dfrac{p!}{(p-q)! \times q!}$ for non-negative integers p and q, $p \geq q$. If $C_3^5 = C_r^5$, which of the following could be the value of r?

(A) 0
(B) 1
(C) 2
(D) 4
(E) 5

148. A color "code" is defined as a sequence of three dots arranged in a row. Each dot is colored either "red" or "black." How many distinct codes can be formed?

(A) 4
(B) 5
(C) 6
(D) 8
(E) 10

149. A daily store stocks two sizes of mugs, each in four colors: black, green, yellow and red. The store packs the mugs in packages that contain either three mugs of the same size and the same color or three mugs of the same size and of three different colors. If the order in which the colors are arranged is not considered, how many different packings of the types described above are possible?

(A) 4
(B) 10
(C) 16
(D) 20
(E) 30

150. A pizza-seller offers six kinds of toppings and two kinds of breads for its pizzas. If each pizza contains at least two kinds of toppings but not all kinds of toppings and only one kind of bread, how many different pizzas could the pizza-seller offer?

(A) 56
(B) 58
(C) 84
(D) 100
(E) 112

151. A botanist designates each plant with a one-, two- or three-letter code, where each letter is one among the 26 letters of the alphabet. If the letters may be repeated and if the same letters used in a different order convey a different code, how many different plants can the botanist uniquely designate with these codes?

(A) 2,951

(B) 9,125

(C) 16,600

(D) 17,576

(E) 18,278

152. A college student can select one out of eight optional subjects from group one and two out of ten optional subjects from group two. If no subject is common in both the groups, how many different sets of three subjects are there to select?

(A) 53

(B) 120

(C) 190

(D) 360

(E) 408

153. A company has to assign distinct four-digit code numbers to its employees. Each code number was formed from the digits 1 to 9 and no digit appears more than once in any one code. How many employees can be assigned codes?

(A) 30

(B) 2,400

(C) 3,024

(D) 6,491

(E) 10,000

154. A company plans to assign identification numbers to its employees. Each number is to consist of four digits from 0 to 9, inclusive, except that the first digit cannot be 0. If any digit can be repeated any number of times in a particular code, how many different identification numbers are possible that are odd numbers?

(A) 2,520

(B) 2,268

(C) 3,240

(D) 4,500

(E) 9,000

155. A fast-food company plans to build four new restaurants. If there are six sites A, B, C, D, E and F, that satisfy the company's criteria for location of the new restaurants, in how many different ways can the company select four sites if the order of selection does not matter, given that both the sites A and B cannot be selected simultaneously?

(A) 4

(B) 5

(C) 6

(D) 9

(E) 15

156. Imran has four Math, five Physics, and six Chemistry books. He has to choose four out of the 15 books such that the selection has at least one book of each subject. In how many ways it is possible?

- **(A)** 600
- **(B)** 720
- **(C)** 760
- **(D)** 800
- **(E)** 960

157. A botanist plans to code each experimental plant used in an experiment with a code that consists of either a single letter or a pair of distinct letters written in an alphabetic order. What is the least number of letters that can be used if there are 15 plants, and each plant is to get a different code?

- **(A)** 3
- **(B)** 4
- **(C)** 5
- **(D)** 7
- **(E)** 15

158. Classes A, B, and C have 30 students each, while class D has 20 students. A team is to be formed by selecting one student from each of classes A, B, and C and two students from class D. How many different task forces are possible?

- **(A)** 1,540,000
- **(B)** 2,200,000
- **(C)** 2,400,000
- **(D)** 3,600,000
- **(E)** 5,130,000

159. A stock broker recommends a portfolio of 2 Information Technology stocks, 4 Retail stocks, and 2 e-commerce stocks. If the broker can choose from 4 Information Technology stocks, 5 Retail stocks, and 3 e-commerce stocks, how many different portfolios of 8 stocks are possible?

- **(A)** 9
- **(B)** 24
- **(C)** 60
- **(D)** 90
- **(E)** 120

160. In a conference of 3 delegates from each of 8 different companies, each delegate shook hands with every person other than those from his or her own organization. How many handshakes took place in the conference?

- **(A)** 48
- **(B)** 96
- **(C)** 252

(D) 270

(E) 504

161. The digits 0 to 9 are used to form three digit codes; however, there are a few conditions to be followed: the first digit cannot be 0 or 9, the second digit must be 0 or 9, and the second and third digits cannot both be '9' in the same code. If the digits may be repeated in the same code, how many different codes are possible?

(A) 152

(B) 156

(C) 160

(D) 729

(E) 1,000

162. A pot contains 30 marbles, of which 15 are green and 15 are yellow. If two marbles are to be picked from this pot at random and without replacement, what is the probability that both marbles will be yellow?

(A) $\frac{1}{5}$

(B) $\frac{7}{29}$

(C) $\frac{7}{30}$

(D) $\frac{8}{29}$

(E) $\frac{23}{30}$

163. A box contains 12 balls; of these, seven are red and five are green. If three balls are to be selected at random from the box, what is the probability that two of the balls selected will be red and one will be green?

(A) $\frac{7}{44}$

(B) $\frac{7}{22}$

(C) $\frac{51}{100}$

(D) $\frac{21}{44}$

(E) $\frac{7}{9}$

164. A badminton club has 21 members. What is the ratio of number of 6-member committees that can be formed from the members of the club to the number of 5-member committees that can be formed from the members of the club?

(A) 6 to 5

(B) 15 to 1

(C) 8 to 3

(D) 17 to 6
(E) 16 to 5

165. A courier company can assign its employees to its offices in such a way that one or more of the offices can be assigned no employee to any number of employees. In how many ways can the company assign four employees to two different offices?

(A) 6
(B) 8
(C) 10
(D) 12
(E) 16

166. A transport company employs five male officers and three female officers. If a core group is to be created that is made up of three male officers and two female officer, how many different core groups are possible?

(A) 10
(B) 16
(C) 24
(D) 30
(E) 60

167. If the probability that Stock X will increase in value during the next week is 0.40 and the probability that Stock Y will increase in value during the next week is 0.60, what is the probability that exactly one of Stock X and Stock Y would increase in value during the next week? It is known that price fluctuations of Stock X in no way affect the price fluctuations of Stock Y.

(A) 0.48
(B) 0.50
(C) 0.52
(D) 0.56
(E) 0.58

168. An unbiased has an equal probability of getting a head or a tail. What is the probability that the coin will land heads at least once when it is tosses twice?

(A) $\frac{1}{5}$
(B) $\frac{1}{4}$
(C) $\frac{1}{3}$
(D) $\frac{2}{3}$
(E) $\frac{3}{4}$

169. A quiz consists of X questions, each of which is to be answered either “Yes” or “No.” What is the least value of X for which the probability is less than $\frac{1}{500}$ such that a participant who randomly guesses the answer to each question will be a winner?

(A) 8
(B) 9
(C) 10
(D) 200
(E) 500

170. A box contains 20 balls: 10 white and 10 black. Five balls are to be drawn at random. If the first three drawn balls are black, what is the probability that the next two drawn balls will also be black?

(A) $\frac{21}{136}$
(B) $\frac{4}{17}$
(C) $\frac{1}{3}$
(D) $\frac{4}{7}$
(E) $\frac{2}{5}$

171. A box contains 16 balls, of which 4 are white, 3 are blue, and the rest are yellow. If two balls are to be selected at random from the box, one at a time without being replaced, what is the probability that one ball selected will be white and the other ball selected will be blue?

(A) $\frac{5}{64}$
(B) $\frac{1}{16}$
(C) $\frac{1}{10}$
(D) $\frac{1}{5}$
(E) $\frac{1}{6}$

172. A batch of eight refrigerators contains two single-door refrigerators and six double-door refrigerators. If two refrigerators are to be chosen at random from this batch, what is the probability that at least one of the two refrigerators chosen will be a single-door?

(A) $\frac{1}{4}$
(B) $\frac{1}{3}$
(C) $\frac{7}{15}$
(D) $\frac{13}{28}$
(E) $\frac{1}{2}$

173. In a jar, 9 balls are white and the rest are red. If two balls are to be chosen at random from the jar without replacement, the probability that the balls chosen will both be white is $\frac{6}{11}$. What is the number of balls in the jar?

(A) 10

(B) 11

(C) 12

(D) 13

(E) 15

174. A pyramid of 12 playing cards is such a state that if any individual card falls, the entire pyramid collapses. If for each individual card, the probability of falling during time period of 1 minute is 0.05, what is the probability that the pyramid will collapse during time period of 1 minute?

(A) 0.05

(B) 0.05^{12}

(C) $1 - 0.95^{12}$

(D) 0.95^{12}

(E) $1 - 0.05^{12}$

175. In a pack of a dozen candies, four candies are orange flavored. If a kid randomly picks two candies from the pack, what is the probability that the kid has no orange flavored candy?

(A) $\frac{1}{7}$

(B) $\frac{2}{11}$

(C) $\frac{14}{33}$

(D) $\frac{7}{33}$

(E) $\frac{8}{33}$

176. On the morning of day 1, Suzy began her tracking tour. She plans to return home at the end of the first day on which it rains. If for the first three days of the tour, the probability of rain on each day is 0.25, what is the probability that Suzy will return home at the end of the day 3?

(A) $\frac{1}{8}$

(B) $\frac{9}{64}$

(C) $\frac{27}{64}$

(D) $\frac{37}{64}$

(E) $\frac{1}{64}$

2.12 Sets

177. A marketing class of a college has a total strength of 30. It formed three groups: G1, G2, and G3, which have 10, 10, and 6 students, respectively. If no student of G1 is in either of the other two groups, what is the greatest possible number of students who are in none of the groups?

(A) 4

(B) 7

(C) 8

(D) 10

(E) 14

178. In a batch of dresses, 1/4 of the dresses are traditional and 3/4 of the dresses are contemporary. Half the dresses are for males and half are for females. If 100 out of a lot of 1,000 dresses are traditional and for males, how many of the dresses are contemporary and for females?

(A) 150

(B) 250

(C) 300

(D) 350

(E) 400

179. According to a report, 7% of students did not use a computer to play games, 11% did not use a computer to write reports, and 95% did use a computer for at least one of the purposes. What percent of the students according to the report did use a computer for both the purposes – play games and write reports?

(A) 13%

(B) 56%

(C) 77%

(D) 87%

(E) 91%

180. In a company survey, 600 employees were each asked whether they take cola or health drink. As per the survey, 70 percent of the employees take cola, 45 percent take health drink, and 25 percent take both cola and health drink. How many employees surveyed take neither cola nor health drink?

(A) 50

(B) 60

(C) 70

(D) 75

(E) 80

181. In Milton school, the number of students who play Badminton is thrice the number of students who play Tennis. The number of students who play both the sports is thrice the number of students who play only Tennis. If 60 students play both the sports, how many students play only Badminton?

(A) 100
(B) 150
(C) 160
(D) 180
(E) 120

2.13 Statistics & Data Interpretation

182. $15, 20, 25, x$: (not in order)

Which of the following could be the median of the four integers listed above (not in order)?

I. 18
II. 22
III. 23

(A) I only
(B) II only
(C) I and II only
(D) II and III only
(E) All of them

183. $44, 52, 56, 65, 73, 75, 77, 95, 96, 97$

The list above shows the scores of 10 students obtained on a scheduled test. If the standard deviation of the 10 scores is 20.50, how many of the scores are greater than one standard deviation above the mean of the 10 scores?

(A) None
(B) One
(C) Two
(D) Three
(E) Four

184. A set consists of 20 numbers. If n is a number in the list and is four times the average (arithmetic mean) of the numbers in the list other than itself, then n is what fraction of the sum of the 20 numbers in the list?

(A) $\frac{1}{20}$
(B) $\frac{4}{23}$
(C) $\frac{1}{5}$
(D) $\frac{1}{10}$
(E) $\frac{5}{11}$

185. If the average (arithmetic mean) of 3, 8 and w is greater than or equal to w and smaller than or equal to $3w$, how many integer values of w exist?

(A) Five
(B) Four
(C) Three
(D) Two
(E) One

186. If the average (arithmetic mean) of seven distinct positive integers is 14, what is the least possible value of the greatest of the seven numbers?

(A) 14
(B) 17
(C) 18
(D) 20
(E) 77

187. If the average (arithmetic mean) of x, y and 10 is equal to the average of x, y, 10 and 20, what is the sum of x and y?

(A) 40
(B) 50
(C) 55
(D) 60
(E) 65

188. A set of 13 different integers has a median of 20 and a range of 20. What is the greatest possible value of the integer in the set?

(A) 23
(B) 27
(C) 30
(D) 34
(E) 40

189. The mean of the set of seven positive integers 1, 2, 3, 4, 5, 6, and x is $\frac{\sqrt{7x}}{2}$. What is the value of x?

(A) 1
(B) 7
(C) 14
(D) 21
(E) 28

190. A company has a total of x employees such that no two employees have the same annual salary. The annual salaries of the x employees are listed in increasing order, and the 22^{nd} salary in the list is the median of their annual salaries. If the sum of the annual salaries of all the employees is \$860,000, what is the average (arithmetic mean) of the annual salaries of all the employees?

(A) \$19,500
(B) \$20,000
(C) \$25,000
(D) \$30,000
(E) \$32,500

191. The table below gives the information about the electricity consumption by four appliances in a household. What was the average number of watts of electricity used per hour per appliance in the household?

Electricity usage in the household		
Appliance	**Number of hours in use**	**Number of watts of electricity used per hour**
Computer	4	105
Music system	2	90
Refrigerator	2	235
LED TV	2	150

(A) 76
(B) 105
(C) 137
(D) 187
(E) 303

192. Heights of citizens in a large population has a distribution that is symmetric about the mean $\bar{x}$. If 68 percent of the distribution lies within one standard deviation d of the mean, what percent of the distribution is greater than $(\bar{x} - d)$?

(A) 16%
(B) 50%
(C) 68%
(D) 84%
(E) 95%

2.14 Linear Equations

193. A seller mistakenly reversed the digits of a customer's correct amount of change and returned an incorrect amount of change. If he received 63 cents more than he should have, which of the following could be the correct amount of change he should have got, in cents?

(A) 25

(B) 38

(C) 73

(D) 89

(E) 92

194. A merchant sold screwdrivers for \$11 each and spanners for \$3 each. If a customer purchased both screwdrivers and spanners for a total of \$109, what could be the total number of screwdrivers and spanners the customer purchased?

(A) 10

(B) 13

(C) 15

(D) 22

(E) 32

195. If $x + y + z = 2$, and $x + 2y + 3z = 6$ and $y \neq 0$, then what is the value of $\frac{x}{y}$?

(A) $-\frac{1}{2}$

(B) $-\frac{1}{3}$

(C) $-\frac{1}{6}$

(D) $\frac{1}{3}$

(E) $\frac{1}{2}$

196. A stationary shop sells a book for \$25 per piece and a notebook for \$15 per piece. In the previous month it sold 2 more books than notebooks. If the total revenue from the sale of books and notebooks in the previous month was \$490, what was the total number of books and notebooks that the shop sold in the previous month?

(A) 18

(B) 20

(C) 24

(D) 30

(E) 33

2.15 Quadratic Equations & Polynomials

197. If $a \geq 0$ and $a = \sqrt{8ab - 16b^2}$, then in terms of b, $a =$

(A) $-4b$

(B) $\frac{b}{4}$

(C) b

(D) $4b$

(E) $4b^2$

198. What is the difference between the maximum and the minimum value of $\frac{x}{y}$ for which $(x-2)^2 = 9$ and $(y-3)^2 = 25$?

(A) $-\frac{15}{8}$

(B) $\frac{3}{4}$

(C) $\frac{9}{8}$

(D) $\frac{19}{8}$

(E) $\frac{25}{8}$

199. If x and y are positive integers and $2x + 3y + xy = 12$, what is the value of $(x + y)$?

(A) 2

(B) 4

(C) 5

(D) 6

(E) 8

200. A ball thrown up in air is at a height of h feet, t seconds after it was thrown, where $h = -3(t - 10)^2 + 250$. What is the height of the ball once it reached its maximum height and then descended for 7 seconds?

(A) 96 feet

(B) 103 feet

(C) 164 feet

(D) 223 feet

(E) 250 feet

2.16 Inequalities

201. Suzy's college is 12 kilometers from his hostel. She travels 6 kilometers from the college to basketball practice, and from there 4 kilometers for a computer class. If she is then D kilometers away from her home, what is the range of possible values for D?

(A) $1 \leq D \leq 5$

(B) $2 \leq D \leq 6$

(C) $2 \leq D \leq 10$

(D) $2 \leq D \leq 22$

(E) $4 \leq D \leq 24$

202. $2a + b = 12$, and $|b| \leq 12$

How many ordered pairs (a, b) are solutions of the above system such that a and b both are integers?

(A) 9

(B) 10

(C) 11

(D) 12

(E) 13

203. If the cost of 15 pencils varies between \$3.60 and \$4.80, and the cost of 21 pens varies between \$33.30 and \$42.90, then the cost of 5 pencils and 7 pens varies between

(A) \$8.20 and \$12.20

(B) \$8.30 and \$10.20

(C) \$10.20 and \$16.30

(D) \$12.30 and \$15.90

(E) \$13.30 and \$16.60

204. Given that x is a negative number and $0 < y < 1$, which of the following is the greatest?

(A) x^2

(B) $(xy)^2$

(C) $\left(\frac{x}{y}\right)^2$

(D) $\frac{x^2}{y}$

(E) x^2y

205. David traveled from City A to City B in 5 hours, and his speed was between 20 miles per hour and 30 miles per hour, while Mark also traveled from City A to City B along the same route in 3 hours, and his speed was between 40 miles per hour and 60 miles per hour. Which of the following could be the distance, in miles, from City A to City B?

(A) 105

(B) 135
(C) 155
(D) 160
(E) 165

2.17 Geometry: Lines & Triangles

206. If line p is parallel to line q, which of the following MUST be correct?

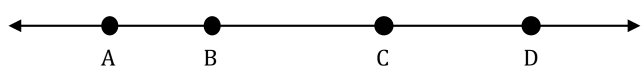
I. The distance from any point on Line p to any point on Line q is the shortest distance between the two lines.

II. The perpendicular dropped from any point on Line p to Line q is the shortest distance between the two lines.

III. The distance from any point on line p to any point on line q is constant.

(A) Only I
(B) Only II
(C) Only III
(D) Only I and II
(E) Only II and III

207. On the line segment AD shown below (not to scale), AB = $\frac{1}{3}$CD and BD = 2AC. If BC = 36, then CD =



(A) 48
(B) 72
(C) 96
(D) 108
(E) 110

208. A, B, C, and D are points on a line, and D is the midpoint of line segment BC. If the lengths of line segments AB, AC, and BC are 20, 6, and 14, respectively, what is the length of line segment AD?

(A) 8
(B) 10
(C) 12
(D) 13
(E) 16

209. Mike's home is at the same distance from his gym and school. The distance between gym and school is 10 miles, which of the following could be the distance between the Mike's home and his gym?

I. 4 miles
II. 12 miles
III. 15 miles

(A) I only

(B) II only

(C) III only

(D) I and II

(E) II and III

210. A right triangle has sides of length a, b and c, where $a < b < c$. If the area of the triangle is 2, which of the following indicates all of the possible values of a?

(A) $a < 2$

(B) $a < \frac{1}{2}$

(C) $a < \frac{2}{3}$

(D) $2 > a > \frac{3}{4}$

(E) $\frac{2}{3} > a > \frac{1}{2}$

211. A right triangle has sides of length x, y and z, where $x < y < z$. If the area of the triangle is 2, which of the following is correct about the value of z?

(A) $z > 2\sqrt{2}$

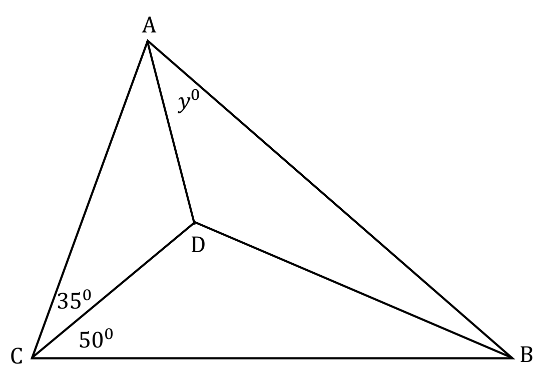
(B) $z < 2$

(C) $2\sqrt{2} < z < 4$

(D) $2\sqrt{2} < z < 3$

(E) $2 < z < 4$

212. In the figure below, AD = BD = CD. What is the value of $y°$?



(A) 5°

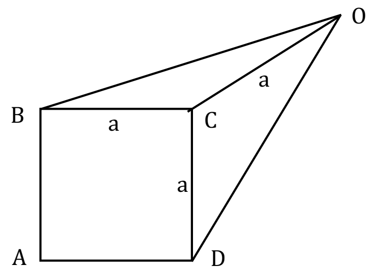
(B) 10°

(C) 15°

(D) 20°

(E) 25°

213. In the figure given below, ABCD is a square with side of length a unit. The length of line segment CO is also a unit, and the length of line segment BO is equal to the length of line segment DO. Note that all the points are in a plane. What is the area of the triangular region BCO?



(A) $\frac{a^2}{3}$

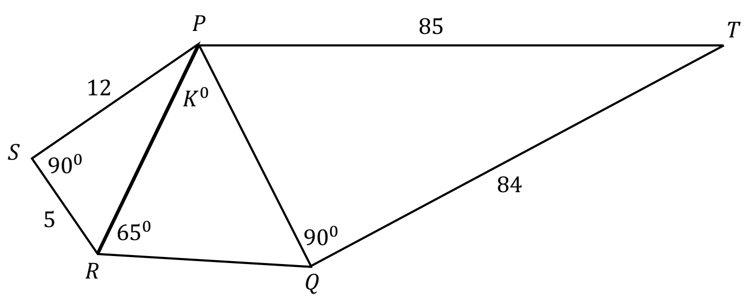
(B) $\frac{a^2}{2}$

(C) $\frac{3a^2}{4}$

(D) $\frac{a^2\sqrt{2}}{4}$

(E) $\frac{a^2\sqrt{2}}{2}$

214. In the figure shown below, what is the value of $K°$?



(A) 45

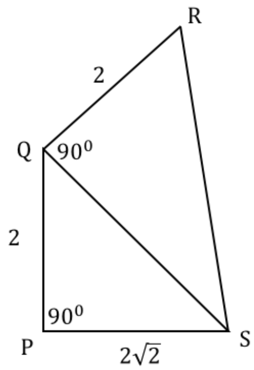
(B) 50

(C) 55

(D) 65

(E) 70

215. In the figure below, what is the perimeter of triangle QRS?



(A) 6

(B) $2 + 2\sqrt{3}$

(C) $6 + 2\sqrt{3}$

(D) $4 + 4\sqrt{3}$

(E) $8\sqrt{2}$

216. In an isosceles triangle ABC, if the measure of angle A is 70°, which of the following could be the measure of angle BCA?

I. 40°

II. 55°

III. 70°

(A) Only I

(B) Only III

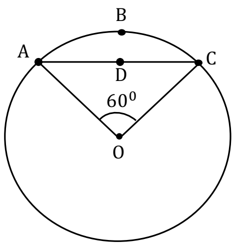
(C) Only I and II

(D) Only II and III

(E) I, II and III

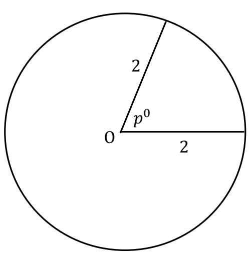
2.18 Geometry–Circles

217. If the circle below has centre O and length of the arc ABC is 24π, what is the perimeter of the region ABCD?



(A) $12(\pi + 2)$
(B) $12(\pi + 3)$
(C) $24(\pi + 2)$
(D) $24(\pi + 3)$
(E) $24(\pi + 4)$

218. In the figure below, O is the center of the circle that has a radius of 2 units. If the area of the sector containing the angle p° is $\frac{\pi}{2}$, what is the value of p in degrees?

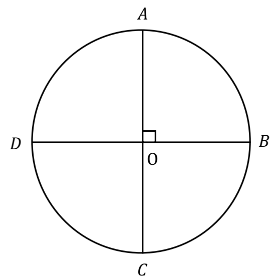


(A) 15°
(B) 30°
(C) 45°
(D) 60°
(E) 75°

219. There are two co-centric circles of unequal diameters. The area between the two circles is shaded. If the area of the shaded region is 3 times the area of the smaller circle, what is the ratio of the radius of the larger circle to the radius of the smaller circle?

(A) 3 : 1
(B) 5 : 2
(C) 2 : 1
(D) $\sqrt{3} : 1$
(E) $\sqrt{2} : 1$

220. In the figure shown below, O is the center of the circle and angle AOB is 90 degrees. If the distance between A and D is $\frac{10}{\sqrt{2}}$, what is the area of the circle?



(A) 4π

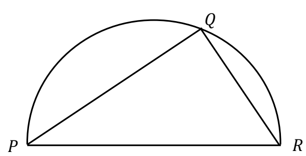
(B) 5π

(C) 25π

(D) 50π

(E) 100π

221. In the figure shown below, the triangle PQR is inscribed in a semicircle. If the length of line segment PQ is 5 and the length of line segment QR is 12, what is the length of arc PQR?



(A) 5π

(B) 12π

(C) $\frac{5\pi}{4}$

(D) $\frac{5\pi}{2}$

(E) $\frac{13\pi}{2}$

222. An equilateral triangle that has an area of $8\sqrt{3}$ is inscribed in a circle. What is the area of the circle?

(A) 4π

(B) $\frac{8\pi}{3}$

(C) $\frac{32\pi}{3}$

(D) $6\sqrt{3}\,\pi$

(E) $10\sqrt{3}\,\pi$

2.19 Geometry–Polygon

223. A circular-shaped cloth with radius 10 inches is rested on a square tabletop that has its sides equal to 24 inches. Which of the following is closest to the fraction of the tabletop NOT covered by the cloth?

(A) $\frac{1}{2}$

(B) $\frac{3}{5}$

(C) $\frac{2}{3}$

(D) $\frac{1}{4}$

(E) $\frac{9}{20}$

224. A rectangular floor having perimeter of 16 meters is to be covered with square carpets that measure 1 meter by 1 meter each and cost $6 apiece. What is the maximum possible cost for the number of square carpets needed to cover the rectangular floor if the sides of the floor are integers?

(A) $42

(B) $72

(C) $90

(D) $96

(E) $120

225. A photograph rectangular in shape is surrounded by a border that is 2 centimeters wide on each side. The combined area of the photograph and the border is a square inches. Had the border been 4 centimeters wide on each side, the total area would have been $(a + 100)$ square centimeters. What is the perimeter, in centimeters, of the photograph?

(A) 18

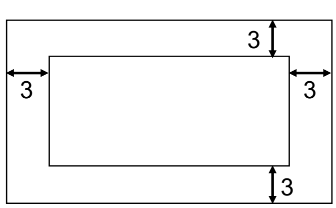
(B) 20

(C) 24

(D) 26

(E) 52

226. A photograph, rectangular in shape, is surrounded by a border of 3 centimeters, as shown in the figure below. Without the border, the length of the photograph is twice its width. If the area of the border is 216 square centimeters, what is the width, in centimeters, of the photograph, excluding the border?



(A) 10
(B) 20
(C) 30
(D) 40
(E) 50

227. Two farmers together had a rectangular field of dimension 100 feet by 140 feet. If they decide to split the rectangular land into two equal rectangles, then what is the minimum cost required to fence one rectangular field at the rate of $3 per feet?

(A) $510
(B) $570
(C) $720
(D) $1,020
(E) $1,140

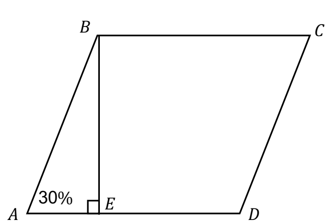
228. If the perimeter of a rectangular park is 480 feet, what is its maximum possible area, in square feet?

(A) 14,400
(B) 15,000
(C) 16,600
(D) 16,900
(E) 19,600

229. A municipal corporation is to paint a solid white stripe in the middle of a national highway. If 1 gallon of paint covers an area of a square feet of the road, how many barrels of paint will be needed to paint a stripe b inches wide on a stretch of the highway that is c miles long? (1 mile = 5,280 feet, 1 foot = 12 inches, and 1 barrel = 31.5 gallons)

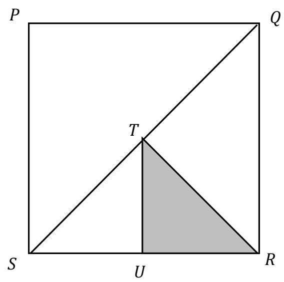
(A) $\frac{5,280bc}{31.5 \times 12a}$
(B) $\frac{5,280ab}{31.5 \times 12c}$
(C) $\frac{5,280abc}{31.5 \times 12}$
(D) $\frac{5,280 \times 12c}{31.5 \times ab}$
(E) $\frac{5,280 \times 12a}{31.5 \times bc}$

230. In the parallelogram ABCD shown below (not per the scale), if AB = 2 and BC = 3, what is the area of ABCD?



(A) 3
(B) 4
(C) 6
(D) $3\sqrt{3}$
(E) $6\sqrt{3}$

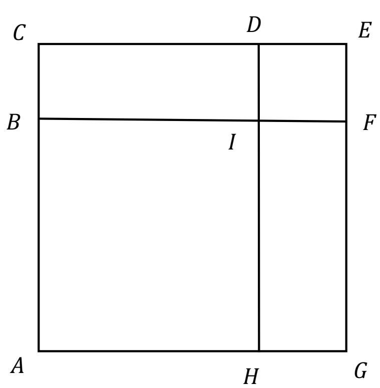
231.



In square PQRS above, if ST = TQ and SU = RU, then the area of the shaded region is what fraction of the area of square region PQRS?

(A) $\frac{1}{16}$
(B) $\frac{1}{8}$
(C) $\frac{1}{6}$
(D) $\frac{1}{4}$
(E) $\frac{1}{3}$

232. In the figure shown below, the area of square region ACEG is 729, and the ratio of the area of square region IDEF to the area of square region ABHI is 1 to 4. What is the length of segment CD?



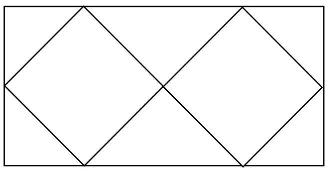
(A) 12
(B) 15

(C) 18

(D) 24

(E) 36

233. In the figure given below, two squares having equal area are inscribed in a rectangle. If the perimeter of the rectangle is $36\sqrt{2}$, what is the perimeter of each square?



(A) 6

(B) 12

(C) 20

(D) 24

(E) 36

234. A school wishes to place few desks and few benches, at least one each, along a corridor that is 16.5 meters long. Each desk is 2 meters long, and each bench is 1.5 meters long. How many maximum number of desks and benches can be placed along the corridor?

(A) 7

(B) 8

(C) 9

(D) 10

(E) 11

235. A 20-meter long metal wire is cut into two pieces. If one piece is used to form a circle with radius r, and the other is used to form a square, which of the following represents the area of the square, in square meters?

(A) $\left(5 - \frac{1}{4}\pi r\right)^2$

(B) $(5 - 2\pi r)^2$

(C) $\frac{1}{4}\pi^2 r^2$

(D) $(10 - 2\pi r)^2$

(E) $\left(5 - \frac{1}{2}\pi r\right)^2$

2.20 Geometry–3 Dimensional

236. A right circular cylinder has a diameter of 10 inches. Water fills the cylinder to a height of 9 inches. The water from this cylinder is poured into a second right circular cylinder; the water fills the second cylinder to a height of 4 inches. What is the diameter of the second cylinder, in inches?

(A) 12

(B) 13

(C) 14

(D) 15

(E) 16

237. In a certain duration, the distance covered by a smaller circular rim 24 inches in diameter and the distance covered by a larger circular rim 36 inches in diameter are equal. If the smaller rim makes r rotations per minute, how many rotations per minute does the larger rim make in terms of r?

(A) $\frac{3r}{2}$

(B) $\frac{4r}{9}$

(C) $\frac{2r}{3}$

(D) $\frac{9r}{4}$

(E) $\frac{r}{3}$

238. A rectangular solid (cuboid) has three faces, having areas 12, 45, and 60. What is the volume of the solid?

(A) 180

(B) 200

(C) 240

(D) 600

(E) 900

239. A cuboid (rectangular solid) has a volume of n cubic feet and a ratio of length to width to height of 4 : 3 : 2. In terms of n, which of the following equals the length of the cuboid, in feet?

(A) $\sqrt[3]{\frac{n}{8}}$

(B) $2\sqrt[3]{\frac{n}{3}}$

(C) $\frac{1}{2} \times \sqrt[3]{\frac{n}{3}}$

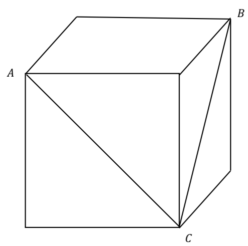
(D) $\sqrt[3]{\frac{n}{3}}$

(E) $8\sqrt[3]{\frac{n}{3}}$

240. There are two right circular cylinders A and B. The height and the diameter of cylinder B are each twice those of cylinder A. If the capacity of cylinder A is 10 barrels, what is the capacity of cylinder B, in barrels?

(A) 36
(B) 40
(C) 60
(D) 80
(E) 100

241. For the cube shown below, what is the degree measure of ∠ABC?



(A) 15°
(B) 30°
(C) 45°
(D) 60°
(E) 75°

242. A largest possible solid cube is placed in a cylindrical container having its height equal to the edge of the cube. Which of the following is the ratio of the volume of the cube to the volume of the cylinder? (Assume $\pi = 3$)

(A) $\frac{2}{9}$
(B) $\frac{4}{7}$
(C) $\frac{1}{3}$
(D) $\frac{1}{2}$
(E) $\frac{2}{3}$

2.21 Co-ordinate geometry

243. In the coordinate plane, a diameter of a circle has the end points $(-3, -6)$ and $(5, 0)$. What is the area of the circle?

(A) 5π
(B) $10\sqrt{2}\pi$
(C) 25π
(D) 50π
(E) 100π

244. A straight line in the XY-plane has a slope of 3 and a Y-intercept of 4. On this line, what is the X-coordinate of the point whose Y-coordinate is 10?

(A) 2
(B) 4
(C) 6
(D) 7
(E) 7.5

245. In the XY-plane, a line l passes through the origin and has a slope 3. If points $(1,\ a)$ and $(b,\ 2)$ are on the line l, what is the value of $\frac{a}{b}$?

(A) 2
(B) 3
(C) $\frac{2}{3}$
(D) $\frac{2}{9}$
(E) $\frac{9}{2}$

246. In the XY-plane, the point $(3, 2)$ is the center of a circle. The point $(-1, 2)$ lies inside the circle and the point $(3, -4)$ lies outside the circle. Which of the following could be the value of r?

(A) 5
(B) 4
(C) 3
(D) 2
(E) 1

247. In the Cartesian XY-plane, the three vertices of a square are represented by points (a, b), $(a, -b)$ and $(-a, -b)$. If $a < 0$ and $b > 0$, which of the following points is in the same quadrant as the fourth vertex point of the square?

(A) $(-2, -6)$
(B) $(-2, 6)$
(C) $(2, -6)$

(D) $(6, -2)$
(E) $(6, 2)$

248. In the XY-plane, the vertices of a triangle have coordinates $(0, 0)$, $(5, 5)$ and $(10, 0)$. What is the perimeter of the triangle?

(A) 12
(B) 13
(C) $5 + 10\sqrt{2}$
(D) $10 + 5\sqrt{2}$
(E) $10 + 10\sqrt{2}$

249. If the points $(a, 0)$, $(0, b)$ and $(1, 1)$ are collinear, what is the value of a in terms of b?

(A) $\dfrac{b-1}{b}$
(B) $\dfrac{b}{b+1}$
(C) $\dfrac{b}{b-1}$
(D) $\dfrac{b+1}{b}$
(E) $\dfrac{1}{b-1}$

250. In the XY-plane, what is the area of the triangle formed by the line $3y - 4x = 24$ and the X and Y axes?

(A) 6
(B) 14
(C) 24
(D) 36
(E) 48

Chapter 3

Data Sufficiency Question Bank

Data Sufficiency

For most of you, Data Sufficiency (DS) may be a new format. The DS format is very unique to the GMAT exam. The format is as follows: There is a question stem followed by two statements, labeled statement (1) and statement (2). These statements contain additional information.

Your task is to use the additional information from each statement alone to answer the question. If none of the statements alone helps you answer the question, you must use the information from both the statements together. There may be questions which cannot be answered even after combining the additional information given in both the statements. Based on this, the question always follows standard five options which are always in a fixed order.

(A) Statement (1) ALONE is sufficient, but statement (2) ALONE is not sufficient to answer the question asked.

(B) Statement (2) ALONE is sufficient, but statement (1) ALONE is not sufficient to answer the question asked.

(C) BOTH statements (1) and (2) TOGETHER are sufficient to answer the question asked, but NEITHER statement ALONE is sufficient to answer the question asked.

(D) EACH statement ALONE is sufficient to answer the question asked.

(E) Statements (1) and (2) TOGETHER are NOT sufficient to answer the question asked, and additional data specific to the problem are needed.

3.1 Numbers

251. If $M^\$$ is defined by $M^\$ = M^2 - 2$. What is the value of the positive integer M?

(1) $14 < M^\$ < 34$

(2) $M^\$$ is an odd number

252. Gold gym has few members in two batches, A and B. The gym can divide the members in batch A into eight groups of x members each. However, if it divides the members in batch B into four groups of y members each, three member will be left over. How many members are in the gym?

(1) $x = \frac{y-1}{2}$

(2) Number of members in batch B is seven more than that in batch A.

253. For a positive integer p, the index-3 of p is defined as the greatest integer n such that 3^n is factor of p. For example, the index-3 of 162 is 4 as 4 is the greatest exponent of 3 and is a factor of 162. If q and r are positive integers, is the index-3 of q greater than the index-3 of r?

(1) $q - r > 0$

(2) $\frac{q}{r}$ is a multiple of 3

254. How many distinct positive factors does the integer m have?

(1) $m = p^3q^2$, where p and q are distinct positive prime numbers.

(2) The only positive prime factors of m are 2 and 3.

255. If $\sqrt{m}$ is an integer, what is the value of $\sqrt{m}$?

(1) $13 \le m \le 16$

(2) $3 \le \sqrt{m} \le 4$

256. If $xy^{\left(\frac{4}{3}\right)} = \sqrt[3]{432}$, is $x + y = 5$?

(1) y is a positive integer.

(2) x is an integer.

257. If $y \neq 0$, what is the value of $\left(\frac{5x}{y}\right)^2$?

(1) $x = 3$

(2) $5x - 2y = 0$

258. If $|x + 3| = 2$, what is the value of x?

(1) $x < 0$

(2) $x^2 + 6x + 5 = 0$

259. If $|x + 3| = 3$, what is the value of x?

(1) $x^2 \neq 0$

(2) $x^2 + 6x = 0$

260. If $2 < m < 3$, is the tenths digit of the decimal representation of m equal to 8?

(1) $m + 0.01 < 3$

(2) $m + 0.05 > 3$

261. If a and b are integers, is b even?

(1) $5a + 6b$ is even.

(2) $5a + 3b$ is even.

262. If x, y, p and q are positive integers, is x^p a factor of y^q?

(1) x is a factor of y.

(2) $p < q + 1$

263. A list is: $\{10, -2, -8, 0, X\}$ what is the value of the integer X?

(1) The product of the five integers in the list is 0.

(2) The sum of the given four integers divided by X is 0.

264. If P, Q and R are points on the number line, what is the distance between Q and R?

(1) The points P and Q are 20 units apart.

(2) The points P and R are 25 units apart.

265. If m is a positive integer, what is the remainder when 2^m is divided by 10?

(1) m divided by 10 leaves a remainder of 0.

(2) m divided by 4 leaves a remainder of 0.

266. If a, b, and c are integers, is $(a - b - c)$ even?

(1) a and b are even and c is odd.

(2) a, b and c are consecutive integers.

267. If m, n and p are positive integers and $4m + 5n = p$, do p and 10 have a common factor other than 1?

(1) m is a multiple of 5.

(2) n is a multiple of 5.

268. If p and q are integers, what is the value of $(p + q)$?

(1) $pq = 6$

(2) $(p + q)^2 = 49$

269. If m and n are integers and $p = 13m + 25n$, is p odd?

(1) One of m and n is odd.

(2) n is even.

270. If positive integers a, b and c are such that $a < b < c$, is the product of $a,\ b,\ \&\ c$ even?

(1) $c - b = b - a$

(2) $c - 16 = a$

271. Is $\frac{x}{3}$ an integer?

(1) x is an integer.

(2) $\frac{x}{6}$ is an integer.

272. If x and y are positive integers, is $\frac{x}{y}$ an even integer?

(1) y is divisible by 4.

(2) x is divisible by 8.

273. If n is a positive integers, is $\frac{n}{6}$ an integer?

(1) n is a product of three consecutive integers.

(2) n is a multiple of 3.

274. If n is a positive integer, what is the remainder when $(n^2 - 1)$ is divided by 24?

(1) n is not a multiple of 2.

(2) n is not a multiple of 3.

275. If n is a positive integer, is $n\,(n-1)\,(n+1)$ divisible by 4?

(1) n is an odd integer.

(2) $n\,(n+1)$ is divisible by 6.

276. Is a positive integer x odd?

(1) $5x$ is odd.

(2) $(x + 5)$ is even.

277. What is the value of a positive integer x?

(1) x divided by 3 leaves the remainder 2.

(2) x^2 divided by 3 leaves the remainder 1.

278. For a positive integer x, what is the value of the hundreds digit of 30^x?

(1) $x \geq 3$.

(2) $\frac{x}{3}$ is an integer.

279. If x is an integer that lies between 100 and 200, inclusive, what is the value of x?

(1) x is a multiple of 36.

(2) x is an even multiple of 45.

280. If $2 < x < 6$, what is the value of x?

(1) 15 is a multiple of x.

(2) 21 is a multiple of x.

281. If m is an integer and $x^m = \frac{1}{x^m}$, what is the value of x?

(1) x is an integer.

(2) m in a non-zero integer.

282. If x is a two-digit number, is x less than 85?

(1) The sum of the two digits of x is prime.

(2) Each of the two digits of x is prime.

283. If n is an integer, is $\frac{n}{13}$ an integer?

(1) $\frac{5n}{13}$ is an integer.

(2) $\frac{3n}{13}$ is an integer.

284. If x is an integer, is $10^x \le \frac{1}{1000}$?

(1) $x \le -2$

(2) $x > -4$

285. If $a,\ b,\ c$ and d are non-zero integers, is $\dfrac{a}{b} = \dfrac{c}{d}$?

(1) $c = 5a$ and $d = 5b$

(2) $5a = 4b$ and $5c = 4d$

286. If a, b and c are positive prime numbers, what is the value of $a^3b^3c^3$?

(1) $a^3bc = 2,457$

(2) $b = 7$

287. If the positive integer x is a multiple of 24 and the positive integer y is a multiple of 21, is 648 a factor of x^2y?

(1) x is a multiple of 8.

(2) y is a multiple of 18.

288. If r is the remainder when 18 is divided by n $(2 < n < 18)$, what is the value of r?

(1) $n > 12$

(2) $n = 2^m$, where m is a positive integer.

289. If x is a positive number, is y also a positive number?

(1) $y \le x$

(2) $y \ge x$

290. If x and y are integers, is x divisible by 3?

(1) xy is divisible by 9.

(2) y is divisible by 3.

291. If x and y are non-zero integers, is $\frac{x}{y}$ an integer?

(1) $\frac{(x-1)}{(y+1)(y-1)} = 1$

(2) $x - y = 2$

292. If x and y are integers, what is the value of y?

(1) $y^x = y$

(2) $x > 1$

293. If p is a constant and $a_{n-1} + a_n = pn(n-1)$ for all positive integers n, what is the value of p?

(1) $a_{31} - a_{29} = 120$

(2) $a_2 = 6$

294. If P, Q, & R are numbers on the number line, not necessarily in that order, is $|P - R| \geq 13$?

(1) $|P - Q| = 65$

(2) $|Q - R| = 52$

295. If the sum of three positive integers even?

(1) The sum of the first and the second integer is even.

(2) The sum of the second and the third integer is even.

296. If $a, b, \& c$ are positive numbers such that $c = 10a + 12b$ and $a + b = 1$, is $c > 11$?

(1) $a > \frac{1}{2}$

(2) $a > b$

297. Set S is a set of 14 consecutive integers. Is an integer '7' present in Set S?

(1) The integer -5 is present in the set.

(2) The integer 6 is present in the set.

298. Sequence S is such that the difference between a term and its previous term is constant and has 250 terms. What is the 200^{th} term of sequence S?

(1) The 150^{th} term of Sequence S is 305.

(2) The 100^{th} term of Sequence S is -95.

299. If the digit h is the hundredths digit in the decimal number $n = 0.3h7$, what is the value of n rounded to the nearest tenth digit?

(1) $n < \frac{7}{20}$

(2) $h < 5$

300. What is the value of a positive integer x?

(1) x has exactly two distinct factors.

(2) The difference between any two distinct factors of x is odd.

301. If the product of the digits of the two-digit positive integer n is 12, what is the value of n?

(1) n can be expressed as the sum of two perfect squares in exactly one way.

(2) n is smaller than 40.

302. If the sum of three integers is divisible by 2, is their product divisible by 4?

(1) The three integers are same.

(2) The product of the three integers is divisible by 2.

303. If the units digit of a three-digit positive number X is other than 0, what is the tens digit of X?

(1) The tens digit of the number $(X + 9)$ is 3.

(2) The tens digit of the number $(X + 3)$ is 2.

304. If $x \neq y$, is $x = 0$?

(1) $xy = x^2$

(2) $y \neq 0$

305. If none of $x,\ y,\ \&\ z$ are equal to 0, is $x^4y^5z^6 > 0$?

(1) $y > x^4$

(2) $y > z^5$

306. If x and y are integers, is y an odd integer?

(1) $y\,(y + 2) = x(x + 1)$

(2) x is not an even integer.

307. If a and b are integers, what is the value of $(8a^{6b} - 2)$?

(1) $a^{2b} = 2^4$

(2) $ab = 2^2$

308. If x and y are positive integers and 18 is a multiple of xy^2, what is the value of y?

(1) x is a factor of 54 and is less than half of 54.

(2) y is a multiple of 3.

309. If x and y are positive integers and $x^{2y} = x^{4y-6}$, what is the value of y^{2x}?

(1) $x^2 = 4$

(2) $-3 < x < 3$

310. If x and y belong to the set {2, 4}, and $x^{ky} = x^{(ly^2-8)}$, is $kl > 2$?

(1) $k = -6$

(2) $3l - k = 3$

311. If x and y are non-zero integers, what is the value of $(x^{2y} - 1)$?

(1) $|x| + |y| = 5$, where $1 < |x| < y$

(2) $|x^2 - 4| + |y - 3| = 0$

312. If x and y are positive integers and r is the remainder when $(7^{4x+3} + y)$ is divided by 10, what is the value of r?

(1) $x = 10$

(2) $y = 2$

313. If x and y are positive integers, what is the value of y?

(1) $y - x = 3$

(2) x and y are prime numbers.

314. If x and y are positive integers, what is the value of x?

(1) $3^x + 5^y = 134$

(2) $y = 3$

315. If x and y are positive integers, is xy a multiple of 18?

(1) x is a multiple of 9.

(2) y is a multiple of x.

316. If x and y are positive integers, is $(x + y)(x - y)$ a prime number?

(1) x is the smallest prime number.

(2) y^2 is the smallest prime number.

317. If x is a positive integer, does the remainder, when $(3^x + 2)$ is divided by 100, have 1 as the units digit?

(1) $x = 2(2n + 1)$, where n is a positive integer.

(2) $10 > x > 4$

318. If x, y and z are positive integers, is xz odd?

(1) $x(2y - 1)$ is even

(2) $x(x + z)$ is even

319. If x, y and z are positive integers, is $y - x > 0$?

(1) $\frac{y}{x} = \frac{z}{y}$

(2) $z > x$

320. If z is positive, is $|x - y|$ a positive number?

(1) $xy + z = 0$

(2) $x(x - 2) = 0$

321. If x & y are integers and $y = x^2 + x^3$, is $y < 0$?

(1) $x < 0$

(2) $y < 1$

322. In the decimal representation of d, where $0 < d < 1$, is the tenths digit of d greater than 0?

(1) $12d$ is an integer.

(2) $6d$ is an integer.

323. In the sequence of non-zero numbers $t_1,\ t_2,\ t_3, \ldots t_n, \ldots$, the value of $t_{(n+1)} = \frac{t_n}{3}$, for all positive integers n. What is the value of t_5?

(1) $t_2 = \frac{1}{3}$

(2) $t_2 - t_5 = \frac{26}{81}$

324. Is $3^x > 100$?

(1) $3^{\sqrt{x}} = 9$

(2) $\frac{1}{3^x} > 0.01$

325. Is $|x| < 1$?

(1) $|x + 2| = 3\,|x - 1|$

(2) $|2x - 5| \neq 0$

326. Is $\sqrt{(p - 3)^2} = (3 - p)$?

(1) $p < |p|$

(2) $3 > p$

327. Is $\frac{m}{n} < mn$?

(1) mn is positive

(2) $n < -1$

3.2 Percents

328. A broker charges a brokerage which is a fixed percent of the value of a property. The brokerage was what percent of the value of the property?

(1) The property values \$1.8 million.

(2) The broker charged \$3,000 as the brokerage.

329. Do at least 24 percent of Loral business school students aspire to do masters in economics?

(1) In the school, the ratio of male students to female students is 6 : 11.

(2) In the school, of the total number of students, 35 percent of the male students and 25 percent of female students aspire to do the masters in economics.

330. By what percent was the price of a smartphone increased?

(1) The price of the smartphone was increased by \$40.

(2) The price of the smartphone after the increase was \$400.

331. Did John pay less than a total of $\$d$ dollars for the phone?

(1) The price John paid for his phone was $\$0.85d$, excluding the 20 percent sales tax.

(2) The price John paid for his phone was \$170, excluding the 20 percent sales tax.

332. Does Suzy have $\frac{1}{3}$ more marbles than George?

(1) The number of marbles George has is 75 percent of the number of marbles Suzy has.

(2) The number of marbles Suzy has is 133.33% percent of the number of marbles George has.

333. A salesperson is paid a fixed monthly salary of \$2,000 and a commission equal to 15 percent of the amount of total sales that month over \$10,000. What was the total amount paid to the salesperson last month?

(1) The total amount the salesperson was paid last month is equal to 17.5 percent of the amount of total sales last month.

(2) The salesperson's total sales last month was \$20,000.

334. Every month Tim receives a fixed salary of \$1,000 and a 10 percent commission on the total sales exceeding \$10,000 in that month. What was the total amount of Tim's sales last month?

(1) Last month Tim's fixed salary and commission was $\$1,500$.

(2) Last month Tim's commission was \$500.

335. The total cost for an air conditioning consists of the cost of an air conditioner and the cost of installation. A fixed sales tax of 10% is charged on both the cost of the air conditioner and installation. If the cost of the air conditioner, excluding sales tax, was \$600, what was the total amount of the air conditioner and installation, including sales tax?

(1) The sales tax on installation cost was \$6.

(2) The total sales tax was \$66.

336. What percent of juice bottles are labeled correctly; that is, Guava Juice label on the bottles that have guava juice in them and Orange Juice label on the bottles that have orange juice in them.

(1) Of those which are labeled guava juice, 20 percent have orange juice in them.

(2) 80 percent of the bottles are labeled orange Juice.

337. From 2001 to 2010, what was the percent increase in total sales revenue of Company X?

(1) Total sales revenue of Company X in 2001 was 20 percent of the industry's sales revenue in 2001.

(2) Total sales revenue of Company X in 2010 was 25 percent of the industry's sales revenue in 2010.

338. By what percent the sales revenue of Company X increased from 2001 to 2005?

(1) In each of the two years, 2001 and 2005, the sales revenue of Company X was 20 percent of the total sales revenue of the industry in that year.

(2) In 2005, the total sales revenue of the industry was 20 percent more than that in 2001.

339. What was the ledger balance in the saving bank account on January 31?

(1) Had the increase in the ledger balance, from January 1 to January 31, in the saving bank account been 15 percent, the ledger balance in the account on January 31 would have been $1,150.

(2) From January 1 to January 31, the increase in the ledger balance in the saving bank account was 10 percent.

340. Mark's net income equals his salary less taxes. By what percent did Mark's net income increase or decrease on January 1, 2016?

(1) Mark's salary increased by 10 percent on January 1, 2016.

(2) Mark's taxes increased by 15 percent on January 1, 2016.

341. How many male teachers in a school of 80 teachers have masters degree?

(1) 50 percent of all the teachers in the school have masters degree.

(2) 50 percent of all the teachers in the school are male.

342. If the number of students in School A and School B in 2015 were each 10 percent higher than their respective number of students in 2014, what was School A's number of students in 2014?

(1) The sum of School A's and School B's number of students in 2014 was 1,000.

(2) The sum of School A's and School B's number of students in 2015 was 1,100.

343. Is 25% of n greater than 20% of the sum of n and $\frac{1}{2}$?

(1) $0 < n < 1$

(2) $n > 0.5$

344. If x and z are positive, is 100% of x equal to 33.33% percent of z?

(1) z is 200% greater than x.

(2) x is 75% less than $(x + z)$.

345. If, for an office, the total expenditure for computers, software, and printers was $54,000, what was the expenditure on computers?

(1) The expenditures for printers were 30 percent greater than the expenditures for software.

(2) The total of the expenditures for software and printers was 65 percent less than the expenditures for computers.

346. In 2001, John paid 5 percent of his taxable income as taxes. In 2002, what percent of his taxable income did he pay as taxes?

(1) In 2001, John's taxable income was $40,000.

(2) In 2002, John paid $250 more in tax than he did in 2001.

347. In 2001, Joe paid 5.1 percent of his income in taxes. In 2002, did Joe pay less than 5.1 percent of his income in taxes?

(1) From 2001 to 2002, Joe's income increased by 10 percent.

(2) Taxes paid in 2002 are 3.4 percent of Joe's income in 2001.

348. In 2005, there were 1,050 students at a school. If the number of students at the school increased by 50 percent from 1995 to 2000, by what percent did the number of students at the school increase from 2000 to 2005?

(1) The number of students increased by 110 percent from 1995 to 2005 at the school.

(2) There were 500 students in 1995 at the school.

349. In 2001, what was the ratio of the number of employees in Company A to the number of employees in Company B?

(1) In 2001, Company A had 60 percent more employees than Company B had in 2000.

(2) In 2001, Company B had 20 percent more employees than it had in 2000.

3.3 Profit & Loss

350. If a shopkeeper purchased an item at a cost of x dollars and sold it for y dollars, by what percent of its cost did he make profit?

(1) $y - x = 60$

(2) $5y = 6x$

351. A used car reseller was paid a total of $5,000 for a used car. The reseller's only costs for the car were for buying the used car and repairing it. Was the reseller's profit from selling the car more than $1,500?

(1) The reseller's total cost was three times the cost of buying the car.

(2) The reseller's profit was more than the cost of repairing the car.

352. A shopkeeper offered discounts on the sale price of a book and the sale price of a notebook. Was the discount in dollars on the book not equal to that on the notebook?

(1) The percent discount on the book was 10 percentage points greater than the percent discount on the notebook.

(2) The original sale price of the book was $1 less than the original sale price of the notebook.

353. A trader purchased a Type A gas stove and a Type B gas stove for an equal sum and then sold them at different prices. The trader's gross profit on the Type A gas stove was what percent greater than its gross profit on the Type B gas stove?

(1) The price at which the trader sold the Type A gas stove was 10 percent greater than the price at which the trader sold the Type B gas stove.

(2) The trader's gross profit on the Type B gas stove was $50.

354. If the marked price of a bike was $6,250, what was the cost of the bike to the trader?

(1) The cost price when raised by 25 percent was equal to the marked price.

(2) The bike was sold for $5,500, which was 10 percent more than the cost to the trader.

3.4 Averages (including weighted averages)

355. If a clerk enters a total of 24 amounts on an MS-Office Excel sheet that has six rows and four columns, what is the average of all the 24 amounts entered on the Excel sheet?

(1) The sum of averages of the amounts in six rows is 720.

(2) The sum of averages of the amounts in four columns is 480.

356. All 50 employees in Company X take one of the two courses, NLP and HLP. What is the average (arithmetic mean) age of the employees in the company?

(1) In the company, the average age of the employees enrolled for the NLP course is 40.

(2) In the company, the average age of the employees enrolled for the HLP course is $\frac{3}{4}$ of the average age of the employees enrolled for the NLP course.

357. Department X of a factory has 100 workers. What is the average (arithmetic mean) annual wage of the workers at the factory?

(1) The average annual wage of the workers in Department X is \$15,000.

(2) The average annual wage of the workers at the factory other than those in Department X is \$20,000.

358. If a computer dealer sold a few desktop computers and a few laptop computers, what was the average (arithmetic mean) sale price for all the computers that were sold by the dealer last month?

(1) The average sale price for the desktop computers that were sold by the dealer last month was \$800.

(2) The average sale price for the laptop computers that were sold by the dealer last month was \$1,100.

359. If Dave's average (arithmetic mean) score on three tests was 74, what was his lowest score?

(1) Dave's highest score was 82.

(2) The sum of Dave's two highest scores was 162.

360. A group of 20 friends went out for lunch. Five of them spent \$21 each and each of the rest spent \$$x$ less than the average of all of them. Is the the average amount spent by all the friends \$12?

(1) $x = 3$

(2) The total amount spent by all the friends is \$240.

3.5 Ratio & Proportion

361. A teacher distributed a number of candies, cookies, and toffees among the students in the class. How many students were there in the class?

(1) The numbers of candies, cookies, and toffees that each student received were in the ratio 3 : 4 : 5, respectively.

(2) The teacher distributed a total of 27 candies, 36 cookies, and 45 toffees.

362. At the beginning of the session, a class of MBA (Finance) and a class of MBA (Marketing) of a college each had n candidates. At the end of the session, 6 candidates left MBA (Finance) course and 4 candidates left MBA (Marketing) course. How many candidates did MBA (Finance) course have at the beginning of the session?

(1) The ratio of the total number of candidates who left at the end of the session to the total number of candidates at the beginning of the session was 1 : 5.

(2) At the end of the session, 21 candidates remained on MBA (Marketing) course.

363. Tub A and Tub B contain milk, Tub A was partially full, and Tub B was half full. If all of the milk in Tub A was poured into Tub B, then what fraction of the capacity of Tub B was filled with milk?

(1) Tub A was one-third full, when the milk from it was poured into Tub B.

(2) Tub A and Tub B have the same capacity.

364. A bag has red, blue, green, and yellow marbles in the ratio 6 : 5 : 2 : 2. How many green marbles are there in the bag?

(1) There are 2 more red marble than blue marbles.

(2) The bag has a total of 30 marbles.

365. How many milliliters of Chemical X were added to the Chemical Y in a vessel?

(1) The amount of Chemical X that was added was $\frac{2}{3}$ times the amount of Chemical Y in the vessel.

(2) There was 60 milliliters of Chemical Y in the vessel.

366. If no worker of Company X who worked in it last year quit, how many workers does the company have now on its payroll?

(1) Last year the ratio of the number of male workers to the number of female workers was 2 to 5.

(2) Since last year, Company X recruited 300 new male workers and no new female workers, raising the ratio of the number of male workers to the number of female workers to 2 to 3.

367. If Steve and David each bought some candies, did Steve buy more candies than David?

(1) Steve bought $\frac{3}{5}$ of the total number of candies they bought together.

(2) They together bought a total of 50 candies.

368. The ratio of the number of male and the number of female workers in a company in 2002 was 3 : 4. Was the percent increase in the number of men greater than that in the number of women from 2002 to 2003?

(1) The ratio of the number of male workers in 2002 to that in 2003 was 3 : 5.

(2) The ratio of the number of male and female workers in 2003 was 10 : 7.

369. In Company X, are more than $\frac{1}{4}$ of the employees over 55 years of age?

(1) Exactly 40 percent of the female employees are over 50 years of age, and, of them, $\frac{2}{5}$ are over 55 years of age.

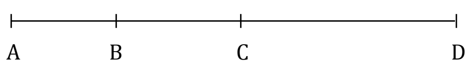
(2) Exactly 20 male employees are over 55 years of age.

370. In a professional club, are more than $\left(\frac{1}{3}\right)^{\text{rd}}$ of the members mechanical engineers? Only those who are engineers can be mechanical engineers.

(1) Exactly 75 percent of the female members are engineers, and, of them, $\left(\frac{1}{3}\right)^{\text{rd}}$ are mechanical engineers.

(2) Exactly 30 percent of the male members are engineers.

371. What is the length of the line AD?



(1) AC = 10, BD = 15

(2) $\frac{AB}{BC} = \frac{BC}{CD}$

3.6 Mixtures

372. Two containers contain milk and water solutions of volume x liters and y liters, respectively. What would be the minimum concentration of milk in either of the containers so that when the entire contents of both the containers are mixed, 30 liters of 80 percent milk solution is obtained?

(1) $x = 2y$

(2) $x = y + 10$

373. From a cask containing y liters of only milk, x liters of content is drawn out and z liters of water is then added. This process is repeated one more time. What is the fraction of milk finally present in the mixture in the cask?

(1) $x = 20$ & $y = 100$

(2) x and z form 20% and 10% of y, respectively

374. Three friends, A, B and C decided to have a beer party. If each of the three friends consumed equal quantities of beer, and paid equally for it, what was the price of one beer bottle?

(1) A, B and C brought along 4, 6 and 2 bottles of beer, respectively; all bottles of beer being identical.

(2) C paid a total of $16 to A and B for his share.

375. What is the volume of milk present in a mixture of milk and water?

(1) When 2 liters of milk is added to the mixture, the resultant mixture has equal quantities of milk and water.

(2) The initial mixture had 2 parts of water to 1 part milk.

3.7 Speed, Time, & Distance

376. Truckers Jack and Dave drove their truck along a straight route. If Jack made the trip in 12 hours, how many hours did it take Dave to make the same trip?

(1) Dave's average speed for the trip was $\frac{3}{5}$ of Jack's average speed.

(2) The length of the route is 720 miles.

377. How many miles long is the route from Washington DC to New York?

(1) It will take 20 minutes less time to travel the entire route at an average speed of 65 miles per hour than at an average rate of 60 miles per hour.

(2) It will take 2.5 hours to travel the first half of the route at an average speed of 52 miles per hour.

378. Suzy estimated both the distance of her trip to her hometown, in miles, and the average speed, in miles per hour. Was the estimated time within 30 minutes of the actual time of the trip?

(1) Suzy's estimate for the distance was within 10 miles of the actual distance.

(2) Suzy's estimate for her average speed was within 5 miles per hour of her actual average speed.

379. Is the time required to travel d miles at r miles per hour greater than the time required to travel D miles at R miles per hour?

(1) $d = D + 20$

(2) $r = R + 20$

3.8 Time & Work

380. If a lathe machine manufactures screws and bolts at a constant rate, how much time will it take to manufacture 1,000 bolts?

(1) It takes the lathe machine 28 seconds to manufacture 20 screws.

(2) It takes the lathe machine 1.5 times more time to manufacture one bolt than to manufacture one screw.

381. If two lathe machines work simultaneously at their respective constant rates to manufacture bolts, how many bolts do they manufacture in 10 minutes?

(1) One of the machines manufactures bolts at the constant rate of 50 bolts per minute.

(2) One of the machines manufactures bolts at twice the rate of the other machine.

382. A group of 5 equally efficient skilled workers together take 18 hours to finish a job. How long will it take for a group of 4 skilled workers and 3 apprentices to do the same job, if each skilled worker works at an identical rate and each apprentice works at an identical rate?

(1) An apprentice works at $\frac{2}{3}$ the rate of a skilled worker.

(2) 6 apprentices and 5 skilled workers take 10 hours to complete the same job.

3.9 Computational

383. A computer dealership has a number of computers to be sold by its sales persons. How many computers are up for the sale?

(1) If each of the sales persons sells 5 of the computers, 18 computers will remain in stock.

(2) If each of the sales persons sells 4 of the computers, 28 computers will remain in stock.

384. Employees of Company X are paid \$10 per hour for an 8-hour shift in a day. If the employees are paid $1\frac{1}{4}$ times this rate for time worked in excess of 8 hours during any day, how many hours did employee P work today?

(1) Employee P was paid \$25 more today than yesterday.

(2) Yesterday employee P worked 8 hours.

385. A large-size battery pack contains more numbers of batteries and costs more than the popular-size battery pack. What is the cost per battery of the large-size battery pack?

(1) A large-size battery pack contains 10 more batteries than a popular-size battery pack.

(2) A large-size battery pack costs \$20.

386. A teacher distributed 105 candies to 50 students in her class, with each student getting at least one candy. How many students received only one candy?

(1) None of the students received more than three candies.

(2) Fifteen students received only two candies each.

387. At a school, one-fourth of the teachers are male and half of the teachers are non-academic staff. What is the number of teachers at this school?

(1) Exactly 14 of the teachers at the school are males who are non-academic staff.

(2) There are 32 more female teachers than male teachers at the school.

388. At a retail shop, the price of a pencil was \$0.20 more than the price of an eraser. What was the revenue from the sale of erasers at the shop yesterday?

(1) The number of erasers sold at the shop yesterday was 10 more than the number of pencils.

(2) The total revenue from the sale of pencils at the shop yesterday was \$30.

389. On the first day of last month, a magazine seller had in stock 300 copies of Magazine X, costing \$4 each. During the month, the seller purchased more copies of Magazine X. What was the total amount of inventory, in dollars, of Magazine X at the end of the month?

(1) The seller purchased 100 copies of Magazine X for \$3.75 each during the month.

(2) The total revenue from the sale of Magazine X was \$800 during the month.

390. A university canteen owner determined that the number of new chairs needed in the canteen is proportional to the number of new admissions in the university minus the number of pass-outs from the university. If C is the number of new chairs needed in the canteen and N is the number of new admissions minus the number of pass-outs of the university, how many new chairs did the canteen owner determined to order?

(1) The number of new admissions minus the number of pass-outs from the university was 100.

(2) As per the relationship determined by the canteen owner, if the number of new admissions minus the number of pass-outs of the university were 450, then 90 new chairs would be needed.

391. How much did it cost, per mile, for the diesel consumed by Truck T for the trip?

(1) For the trip, Truck T consumed diesel that cost \$2.70 per gallon.

(2) For the trip, Truck T was driven 540 miles.

392. On a certain week, 950 visitors chose one of weekdays from Monday through Sunday to visit a pagoda. If twice as many visitors chose Monday than Tuesday, did at least 100 visitors choose Sunday?

(1) None of the weekdays was chosen by more than 150 visitors.

(2) None of the weekdays was chosen by fewer than 75 visitors.

393.

a	b	c
d	e	f
g	h	i

If the letters in the table above represent one of the numbers 1, 2, or 3 such that each of these numbers occurs only once in each row and in each column, what is the value of a?

(1) $e + i = 6$

(2) $b + c + d + g = 6$

394. For all integers x and y, the operation $\triangle$ is defined by $x \triangle y = (x + 2)^2 + (y + 3)^2$. What is the value of integer t?

(1) $t \triangle 2 = 74$

(2) $2 \triangle t = 80$

395. A dealer sold good for \$$X$. If Y percent was deducted for taxes and then \$$Z$ dollars was deducted for the cost of good, what was dealer's gross profit after the deductions?

(1) $X - Z = 400$

(2) $XY = 11{,}000$

396. If a public distribution company loses 5 percent of its monthly allotment of wheat in a month because of wastage, pilferage and theft, what is the cost in dollars to the company per month for this loss?

(1) The company's monthly wheat allotment is 400 million tons.

(2) The cost to the company for each 10,000 tons of wheat loss is \$5.

397. If Suzy spends s dollars each month and Dave spends d dollars each month, what is the total amount they together spend per month?

(1) Dave spends $100 more per month than Suzy spends per month.

(2) It takes Suzy seven months to spend the same amount that Dave spends in six months.

398. If Martin bought two one-pound pieces of same cake in a scheme, what percent of the total regular price of the two pieces did he save?

(1) Martin paid the regular price for the first piece and paid three-fourth of the regular price for the second piece.

(2) The regular price of the cake Martin bought was $10 per one-pound piece.

399. If the symbol '#' represents either addition, subtraction, multiplication or division, what is the value of 14 # 7?

(1) 25 # 5 = 5

(2) 2 # 1 = 2

400. At the beginning of the year, Steve bought a total of x shares of stock P and David bought a total of 200 shares of stock P. If they held all of their respective shares throughout the year, and Steve's dividends on his x shares totaled $225 in that year, what was David's total dividend on his 200 shares in that year?

(1) In that year, the annual dividend on each share of stock P was $1.25.

(2) In that year, Steve bought a total of 180 shares of stock P.

401. To understand the Population Density (Population divided by total area of a region), in persons per square kilometers, of a country, the population and the total area, in square kilometers, were estimated. Both the estimates had their lower and upper limits. Was the Population Density for the country greater than 500 persons per square kilometers?

(1) The upper limit for the estimate of the population was 50 million persons.

(2) The upper limit for the estimate of the total area was 90,000 square kilometers.

402.

$$\blacksquare + \triangle = \forall$$

In the addition problem above, each of the symbols $\blacksquare$, $\triangle$ and $\forall$ represents a positive digit. If $\blacksquare < \triangle$, what is the value of $\triangle$?

(1) $3 < \forall < 5$

(2) $\blacksquare < 2$

3.10 Interest

403. A total of $\$80,000$ was invested for one year. Part of this amount earned simple annual interest at the rate of x percent per year, and the rest earned simple annual interest at the rate of y percent per year. If the total interest earned on the investment of $\$80,000$ for that year was $\$7,400$, what is the value of x?

(1) $x = \frac{5}{4}y$

(2) The ratio of the first part of amount to the second part of amount was 5 to 3.

404. John lent one part of an amount of money at 10 percent rate of simple interest and the remaining at 22 percent rate of simple interest, both for one year. At what rate was the larger part lent?

(1) The total amount lent was \$2,400.

(2) The average rate of simple interest he received on the total amount was 15 percent.

405. A hundred dollars is deposited in a bank account that pays r percent annual interest compounded annually. The amount $A(t)$, in dollars, with interest in t years is given by $A(t) = 100\left(1 + \frac{r}{100}\right)^t$. What amount will \$100 be in 3 years?

(1) $A(2) = 121$

(2) $r = 10$

3.11 Functions

406. The function f is defined by $f(x) = p^x$, where x is an integer and p is a constant. What is the value of $f(1)$?

(1) $f(2) = 81$

(2) $f(3) = -729$

407. For all numbers x, the function h is defined by $h(x) = 2x - 1$, and the function g is defined by $g(x) = \frac{2x-3}{5}$. If k is a positive number, what is the value of $g(k)$?

(1) $h(k) = 7$

(2) $h(1) = \frac{k}{4}$

408. If f is the function defined by $f(x) = 27x$ for $x \geq 0$ and $f(x) = x^4$ for $x < 0$, what is the value of $f(k)$?

(1) $|k| = 3$

(2) $k < 0$

3.12 Permutation & Combination

409. A bag contains a total of 30 only green and black balls such that the number of green balls is less than the number of black balls. If two balls are to be drawn simultaneously from the bag, how many balls in bag are green?

(1) The probability that the two balls to be drawn will be green is $\frac{3}{29}$.

(2) The probability that the two balls to be drawn will be black is $\frac{38}{87}$.

410. A box contains only b black tokens, w white tokens, and g green tokens. If one token is randomly drawn from the box, is the probability that the drawn token will be green greater than the probability that the drawn token will be white?

(1) $g(b+g) > w(b+w)$

(2) $b > w + g$

411. In a university, there are 19 departments. 13 males and 6 females head one of the departments. If one of the heads of the departments is selected at random, what is the probability that the head of the department selected will be a female who is pursuing Ph. D. program?

(1) Among the females, three are pursuing Ph. D. program.

(2) Among the females, three are not pursuing Ph. D. program.

412. A bag contains only red, or green, or blue tokens. If one token is to be drawn at random, what is the probability that the token will be green?

(1) There are 10 red tokens in the bag.

(2) The probability that the token will be blue is $\frac{1}{2}$.

413. If two different persons are to be selected at random from a group of 10 members and p is the probability that both the persons selected will be men, is $p > 0.5$?

(1) The number of men is greater than the number of women.

(2) The probability that both the persons selected will be women is less than $\frac{1}{10}$.

414. How many employees are there in Company X?

(1) If an employee is to be chosen at random from the company, the probability that the employee chosen will be a male is $\frac{4}{7}$.

(2) There are 10 more males in the company than females.

3.13 Sets

415. In a conference, if each of the 1,230 participants ordered for either Tea or Coffee (but not both), what percent of the female participants ordered for Coffee?

(1) 70 percent of the female participants ordered Tea.

(2) 80 percent of the male participants ordered Coffee.

416. In a survey of 320 employees, 35 percent said that they take tea, and 45 percent said that they take coffee. What percent of those surveyed said that they take neither tea nor coffee?

(1) 25 percent of the employees said that they take coffee but not tea.

(2) $\frac{400}{7}$ percent of the employees who said that they take tea also said that they also take coffee.

417. Is the number of clients of Company X greater than the number of clients of Company Y?

(1) Of the clients of Company X, 25 percent are also clients of Company Y.

(2) Of the clients of Company Y, 37.5 percent are also clients of Company X.

3.14 Statistics & Data Interpretation

418. Principal of a school recorded the number of students in each of the 15 classes. What was the standard deviation of the numbers of students in the 15 classes?

(1) The average (arithmetic mean) number of students for all the 15 classes was 30.

(2) Each classes had the same number of students.

419. Each of the 23 mangoes in box X weighs less than each of the 22 mangoes in box Y. What is the median weight of the 45 mangoes in the boxes?

(1) The heaviest mango in box X weighs 100 grams.

(2) The lightest mango in box Y weighs 120 grams.

420. If each of the 10 students working with an NGO received cash prize, was the amount of each cash prize the same?

(1) The standard deviation of the amounts of the cash prizes was 0.

(2) The sum of the 10 cash prizes was $500.

421. If the average (arithmetic mean) of seven unequal numbers is 20, what is the median of these numbers?

(1) The median of the seven numbers is equal to $\frac{1}{6}$ of the sum of the six numbers other than the median.

(2) The sum of the six numbers other than the median is equal to 120.

422. If the average (arithmetic mean) of four unequal numbers is 40, how many of the numbers are greater than 40?

(1) No number is greater than 70.

(2) Two of the four numbers are 19 and 20.

423. If the average (arithmetic mean) of the scores of x students of class X is 40 and the average of the scores of y students of class Y is 30, what is the average of the scores of the students of both the classes?

(1) $x + y = 60$

(2) $x = 3y$

424. Is the standard deviation of the scores of Class A's students greater than the standard deviation of the scores of Class B's students?

(1) The average (arithmetic mean) score of Class A's students is greater than the average score of Class B's students.

(2) The median score of Class A's students is greater than the median score of Class B's students.

3.15 Linear Equations

425. If a stationery shop sells notebooks in A-4 size and A-5 size paper, what is the price of a A-5 size notebooks?

(1) The total price of one A-4 size and one A-5 size notebooks is \$4.

(2) The total price of three A-4 size and one A-5 size notebooks is \$9.

426. If a gym charges its members a one-time registration fee of $\$r$ and a monthly fee of $\$m$, what is the amount of the registration fee?

(1) The total charge, including the registration fee, for 12 months is \$620.

(2) The total charge, including the registration fee, for 24 months is \$1,220.

427. A pencil and an eraser cost a total of \$2.00. How much does the eraser cost?

(1) The pencil costs thrice as much as the eraser.

(2) The pencil costs \$1.50.

428. A gym sold only individual and group memberships. It charged a fee of \$200 for an individual membership. If the gym's total revenue from memberships was \$240,000, what was the charge for a group membership?

(1) The revenue from individual memberships was $\frac{1}{3}$ of the total revenue from memberships.

(2) The gym sold twice as many group memberships as individual memberships.

429. At a used item shop, all caps were priced equally and all sunglasses were priced equally. What was the price of 4 caps and 5 sunglasses at the sale?

(1) The price of a cap was \$2.00 more than the price of a sunglasses.

(2) The price of 8 caps and 10 sunglasses was \$45.

430. A number of bottles are packed in standard size cartons with each holding 75 bottles. If these bottles were to be packed in smaller cartons with each can hold 50 bottles, how many smaller cartons would be needed to hold all the bottles?

(1) The number of smaller cartons needed is 10 more than the standard size cartons.

(2) All the bottles are packed in 20 standard size cartons.

431. Is $2m - 3n = 0$?

(1) $m \neq 0$

(2) $6m = 9n$

432. An electricity distribution company charges its customers at the rate of $\$x$ per unit for the first 200 units a customer consumes in a month and charges at the rate of $\$y$ per unit for the additional units over 200 units. What would be the charge for a customer who consumes 200 units in a month?

(1) $y = 1.25x$

(2) If a customer consumes 210 units in a month, the company would charge \$425.

433. At a hotel, a buffet lunch is charged \$50 for the first dish and x dollars for each additional dish. What is the charge for additional dish?

(1) The average cost of a dish for a buffet lunch with a total of 4 dishes is \$27.50.

(2) The average cost of a dish for a buffet lunch with a total of 4 dishes is \$2.50 more than the corresponding cost for 6 dishes.

434. A shopkeeper sells a pen for \$1.50 and a pencil for \$0.50. If last week, a total of 200 items were sold, how many of the pens were sold?

(1) Last week, total revenue from the sale of these two items was \$150.

(2) The average (arithmetic mean) price per item for the 200 items sold was \$0.75.

435. For a week Jack is paid at the rate of x dollars per hour for the first t hours $(t > 4)$ he works and \$2 per hour for the hours worked in excess of t hours. If x and t are integers, what is the value of t?

(1) If Jack works $(t - 3)$ hours in one week, he will earn \$14.

(2) If Jack works $(t + 3)$ hours in one week, he will earn \$23.

436. If from 1991 to 2000, the number of students of School X tripled, how many number of students of the school were there in 1991?

(1) From 2000 to 2009, the number of students of the school doubled.

(2) From 2000 to 2009, the number of students of the school increased by 120.

437. How many marbles does Kevin have?

(1) If Kevin had 10 fewer marbles, he would have only half as many marbles as he actually has.

(2) Kevin has thrice as many black marbles as white marbles.

438. How many years did Mrs. Peterson live?

(1) Had Mrs. Peterson become a professor 20 years earlier than she actually did, she would have been a professor for exactly $\left(\frac{3}{4}\right)^{\text{th}}$ of her life.

(2) Had Mrs. Peterson become a professor 20 years later than she actually did, she would have been a professor for exactly $\left(\frac{1}{4}\right)^{\text{th}}$ of her life.

439. If $x + y = 2p$ and $x - y = 2q$, what is the value of $(p + q)$?

(1) $y = 8$

(2) $x = 3$

440. If $\frac{x}{6} = \frac{y}{3}$, is $y = 10$?

(1) $x + y = 30$

(2) $3x = 60$

441. In which year was Chris born?

(1) Chris's brother, Kevin, who is 5 years older than Chris, was born in 1990.

(2) In 2007, Kevin turned 17 years old.

3.16 Quadratic Equations & Polynomials

442. How many more boys than girls are in the class?

(1) There are a total of 10 boys and girls in the class.

(2) The number of boys in the class equals the cube of the number of girls in the class.

443. If $a^2 + b^2 = 1$, is $(a + b) = 1$?

(1) $ab = 0$

(2) $b = 0$

444. If $x \neq y$, is $x + y - xy = 0$?

(1) $(1 - x)(1 - y) = 1$

(2) $(x + y)(x - y) = xy(x - y)$

445. If $a(a - 5)(a + 2) = 0$, is a negative?

(1) $a(a - 7) \neq 0$

(2) $a^2 - 2a - 15 \neq 0$

446. If $ab \neq 0$, what is the value of $\left(\frac{1}{a} + \frac{1}{b}\right)$?

(1) $a + b = -1$

(2) $ab = 6(a + b)$

447. If $a^2 - b = n$, what is the value of a?

(1) $n + b = 4$

(2) $b = 1$

448. If $(n + 3)(n - 1) - (n - 2)(n - 1) = m(n - 1)$, what is the value of n?

(1) $|m| = 5$

(2) $m = 5$

449. If m, n and p are constants and $x^2 + mx + n = (x + p)^2$ for all values of x, what is the value of n?

(1) $p = 3$

(2) $m = 6$

450. If $x^2 + 3x + c = (x + a)(x + b)$ for all x, what is the value of c?

(1) $a = 1$

(2) a and b are positive integers.

3.17 Inequalities

451. Was the average (arithmetic mean) score that Steve got per subject greater than the average score that David got per subject?

(1) Twice the average score that Steve got per subject was greater than 5 less than twice the average score that David got per subject.

(2) Twice the average score that David got per subject was less than 5 more than twice the average score that Steve got per subject.

452. If $\frac{1}{5}$ of the larger of two positive numbers is greater than 6 times the smaller of the same two numbers, is the smaller number less than 5?

(1) The larger number is greater than 120.

(2) The larger number is less than 150.

453. If $xy \neq 0$, is $x = y$?

(1) $|x| = |y|$

(2) $xy > 0$

454. If $abc \neq 0$, is $a\,(b + c) \geq 0$?

(1) $|b + c| = |b| + |c|$

(2) $|a + b| = |a| + |b|$

455. If $R = \dfrac{M}{N}$, is $R \leq M$?

(1) $M > 40$

(2) $0 < N \leq 15$

456. If $x^7y^4z^3 < 0$, is $xyz < 0$?

(1) $z < 0$

(2) $x > 0$

457. If $xy = 6$, is $x < y$?

(1) $y \geq 3$

(2) $y \leq 3$

458. If $x < -\dfrac{3y}{2}$, is $x < 0$?

(1) $y > 0$

(2) $2x + 5y = 20$

459. If $a > 0$ and $b > 0$, is $\dfrac{1}{a + b} < 1$?

(1) $\dfrac{a}{b} = 2$

(2) $a + b > 1$

460. If each of w, x, y and z are positive numbers, is $\left(\frac{w}{x}\right) \times \left(\frac{y}{z}\right) > \frac{y}{x}$?

(1) $y > x$

(2) $w > z$

461. If x and y are integers, is $x > 0$?

(1) $x + y > 60$

(2) $y > 58$

462. If $xy < 2$, is $y < 1$?

(1) $x > 2$

(2) $y < 3$

463. If x is positive, is $x^2 < x$?

(1) $\frac{1}{10} < x < \frac{2}{5}$

(2) $x^3 < x^2$

464. If $x > 1$ and $y > 2$, is $x < y$?

(1) $x^2 < xy + x$

(2) $xy < y(y - 1)$

465. If $x \neq 0$, is $x^2 < |x|$?

(1) $x < 1$

(2) $x > -1$

466. If x and y are integers and $y = |x + 5| + |6 - x|$, is $y = 11$?

(1) $x \leq 6$

(2) $x \geq -5$

467. If $x > 0$, is $y > 0$?

(1) $2y < 7x$

(2) $y > -x$

468. If x and y are integers, is $(x + y) > 2$?

(1) $x^2 < 1$

(2) $y < 1$

469. If x and y are positive integers and $y^2 = 9 - x$, what is the value of y?

(1) $x \leq 7$

(2) $y \geq 2$

470. If x and y are positive, is $3x > 8y$?

(1) $x - y > 4$

(2) $x > \frac{14y}{5}$

471. If x and y are positive, is $8x > 5y$?

(1) $x^2 > y^2$

(2) $x^3 > y^3$

472. If x is a negative integer, is $x < -3$?

(1) $x^2 + 6x < 7$

(2) $x^2 + |x| \leq 2$

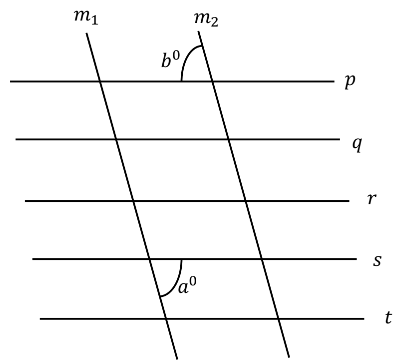
473. If $x + y > 0$, is $xy < 0$?

(1) $x^{2y} < 1$

(2) $x + 2y < 0$

3.18 Geometry–Lines & Triangles

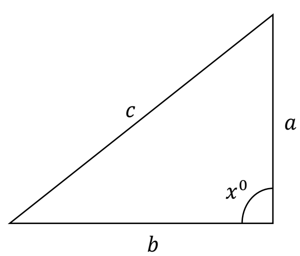
474. If $m_1||m_2$ in the figure given below, is $a^\circ = b^\circ$?



(1) $p||r$ and $r||t$

(2) $q||s$

475. In the triangle below, is $x > 90$?



(1) $a^2 + b^2 < 25$

(2) $c > 5$

476. In triangle ABC, point P is the midpoint of side AC and point Q is the midpoint of side BC. If point R is the midpoint of line segment PC and if point S is the midpoint of line segment QC, what is the area of the triangular region CRS ?

(1) The area of the triangular region ABP is 40.

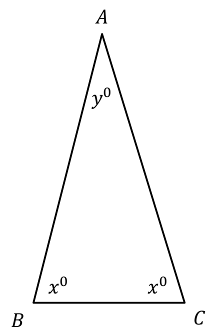
(2) The length of one of the altitudes of triangle ABC is 12.

477. In triangle ABC, the measure of angle A is 40° greater than twice the measure of angle B. What is the measure of angle C?

(1) AB = BC

(2) The measure of angle A is 80°.

478. In triangle ABC below, what is the value of y?

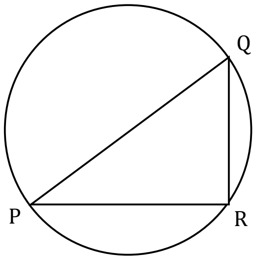


(1) $x = 80$

(2) $x = 100 - y$

3.19 Geometry–Circles

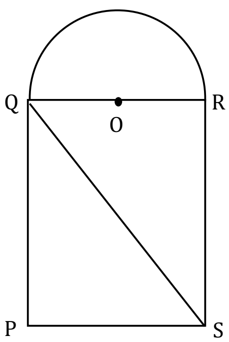
479. In the figure shown, triangle PQR is inscribed in the circle. What is the radius of the circle?



(1) The perimeter of the triangle PQR is 60.

(2) The ratio of the lengths of QR, PR, and PQ respectively, is 3 : 4 : 5.

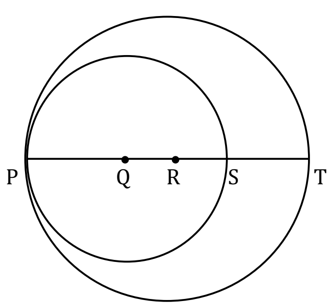
480. In the figure below, PQRS is a rectangle. What is the radius of the semi-circular region with centre O and diameter QR?



(1) $\frac{PQ}{QR} = \frac{4}{3}$

(2) QS = 25

481. In the figure below, points P, Q, R, S, and T lie on a line. Q is the center of the smaller circle and R is the center of the larger circle. P is the point of contact of the two circles, S is a point on the smaller circle, and T is a point on the larger circle. What is the area of the region between inside the larger circle and outside the smaller circle?



(1) PS = 6 and QR = 2

(2) ST = 4 and RS = 1

3.20 Geometry–Polygon

482. A rectangular table cloth is placed on a rectangular tabletop such that its edges are parallel to the edges of the tabletop. Does the table cloth cover the entire tabletop?

(1) The tabletop is 40 inches wide by 70 inches long.

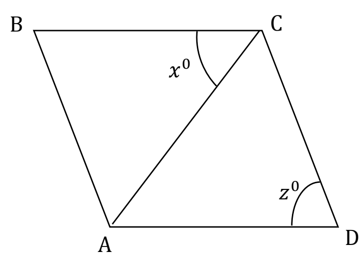
(2) The area of the table cloth is 4,000 square inches.

483. If the length of a rectangle is 1 greater than the width of the rectangle, what is the perimeter of the rectangle?

(1) The length of the diagonal of the rectangle is 5.

(2) The area of the rectangular region is 12.

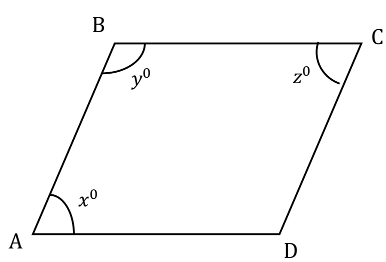
484. In the figure shown below, the line segment AD is parallel to the line segment BC. Is AC the shortest side of triangle ACD?



(1) $x = 50$

(2) $z = 70$

485. In the parallelogram ABCD shown below, what is the value of x?



(1) $x = \frac{y}{3}$

(2) $x + z = 90$

3.21 Co-ordinate geometry

486. A circle in the XY-plane has its center at the origin. If M is a point on the circle, what is the sum of the squares of the coordinates of M?

(1) The radius of the circle is 5.

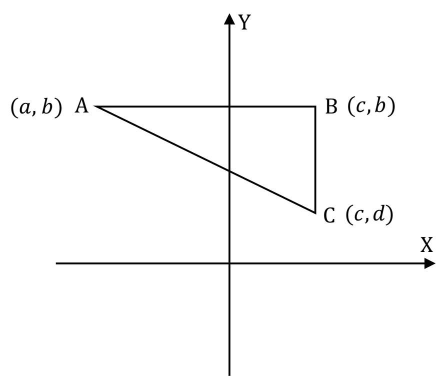
(2) The sum of the coordinates of M is 7.

487. The equation of line L in the XY-plane is $y = mx + c$, where m and c are constants, what is the slope of line L?

(1) Line L is parallel to the line $y = (1 - 2m)\,x + 2c$.

(2) Line L intersects the line $y = 2x - 4$ at the point (3, 2).

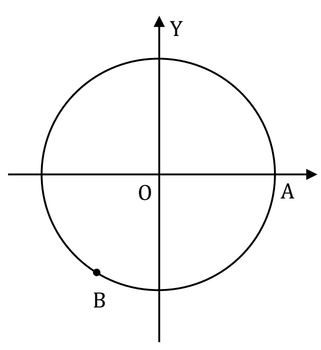
488. In the figure below, AB and BC are parallel to the X-axis and Y-axis, respectively. What is the sum of the coordinates of point B?



(1) The Y-coordinate of point C is 2.

(2) The X-coordinate of point A is −8.

489. In the figure shown below, the circle has center at the origin O, and point A has coordinates $(13, 0)$. If point B is on the circle, what is the length of line segment AB?



(1) The X-coordinate of point B is −5.

(2) The Y-coordinate of point B is −12.

490. In the XY-plane, are the points with their coordinates (a, b) and (c, d) equidistant from the origin?

(1) $a + b = 2$

(2) $c = 1 - a$ and $d = 1 - b$

491. In the XY-plane, does the point (m, n) lie below the line $y = x$?

(1) $m = 4$

(2) $n = m + 4$

492. In the XY-plane, is the slope of the line k positive?

(1) Line k is perpendicular to the line passing though the points $(1,\ 1)$ and $(-2,\ 5)$.

(2) Line k makes a negative intercept on the X-axis and a positive intercept on the Y-axis.

493. In the XY-plane, lines m and n intersect at the point $(-5, 4)$. What is the slope of line m?

(1) The product of the slopes of lines m and n is -1.

(2) Line n passes through the origin.

494. In the XY-plane, lines L and K are parallel. If the Y-intercept of line L is -1, what is the Y-intercept of line K?

(1) The X-intercept of line L is -1.

(2) Line K passes through the point $(5, 10)$.

495. In the XY-plane, the point (a, b) lies on a circle with centre at the origin. What is the value of $(a^2 + b^2)$?

(1) The circle has radius 5.

(2) The point $(3, -4)$ lies on the circle.

496. In the XY-plane, region X consists of all the points (x, y) such that $3x + 4y \leq 12$. Is the point $(r,\ s)$ in region X?

(1) $4r + 3s = 12$

(2) $r \leq 4$ and $s \leq 3$

497. In the XY-plane, the line l passes through the origin and the point (m, n), where $mn \neq 0$. Is $n > 0$?

(1) The line l has a negative slope.

(2) $m < n$

498. In the XY-plane, the line with equation $ax + by + c = 0$, where $abc \neq 0$, has slope -3. What is the value of b?

(1) $a = 2$

(2) $c = \frac{5}{2}$

499. In the XY-plane, the sides of a rectangle are parallel to the X and Y axes. If one of the vertices of the rectangle is $(-2, -3)$, what is the area of the rectangle?

(1) One of the vertices of the rectangle is $(4, -3)$.

(2) One of the vertices of the rectangle is $(4, 5)$.

500. In the XY-plane, what is the slope of line m?

(1) Line m is parallel to the line $y = -x + 1$.

(2) Line m is perpendicular to the line $y = x - 1$.

Chapter 4

Answer key

4.1 Problem Solving Questions

(1) E	(23) B	(45) B	(67) B	(89) C
(2) C	(24) D	(46) C	(68) C	(90) D
(3) D	(25) C	(47) B	(69) B	(91) C
(4) D	(26) C	(48) B	(70) B	(92) C
(5) E	(27) C	(49) B	(71) E	(93) E
(6) C	(28) D	(50) A	(72) D	(94) A
(7) C	(29) B	(51) D	(73) B	(95) E
(8) A	(30) A	(52) C	(74) A	(96) B
(9) D	(31) D	(53) D	(75) C	(97) B
(10) A	(32) C	(54) C	(76) C	(98) D
(11) C	(33) D	(55) C	(77) C	(99) B
(12) E	(34) C	(56) E	(78) C	(100) D
(13) A	(35) D	(57) B	(79) E	(101) E
(14) C	(36) B	(58) D	(80) C	(102) E
(15) E	(37) D	(59) E	(81) C	(103) A
(16) D	(38) D	(60) A	(82) C	(104) C
(17) A	(39) B	(61) E	(83) D	(105) C
(18) D	(40) D	(62) C	(84) E	(106) C
(19) C	(41) A	(63) D	(85) C	(107) E
(20) C	(42) D	(64) C	(86) B	(108) C
(21) C	(43) B	(65) B	(87) E	(109) B
(22) A	(44) B	(66) D	(88) B	(110) B

(111) D	(135) C	(159) D	(183) D	(207) D
(112) D	(136) D	(160) C	(184) B	(208) D
(113) B	(137) D	(161) A	(185) B	(209) E
(114) C	(138) A	(162) B	(186) B	(210) A
(115) D	(139) D	(163) D	(187) B	(211) A
(116) C	(140) A	(164) C	(188) D	(212) A
(117) B	(141) E	(165) E	(189) E	(213) B
(118) C	(142) D	(166) D	(190) B	(214) B
(119) C	(143) E	(167) C	(191) C	(215) C
(120) C	(144) D	(168) E	(192) D	(216) E
(121) E	(145) D	(169) B	(193) E	(217) D
(122) A	(146) B	(170) A	(194) C	(218) C
(123) B	(147) C	(171) C	(195) A	(219) C
(124) B	(148) D	(172) D	(196) C	(220) C
(125) D	(149) C	(173) C	(197) D	(221) E
(126) D	(150) E	(174) C	(198) E	(222) C
(127) C	(151) E	(175) C	(199) B	(223) E
(128) C	(152) D	(176) B	(200) B	(224) D
(129) D	(153) C	(177) D	(201) D	(225) D
(130) D	(154) D	(178) D	(202) E	(226) A
(131) D	(155) D	(179) D	(203) D	(227) D
(132) C	(156) B	(180) B	(204) C	(228) A
(133) D	(157) C	(181) C	(205) B	(229) A
(134) D	(158) E	(182) C	(206) B	(230) A

(231) B	(235) E	(239) B	(243) C	(247) E
(232) C	(236) D	(240) D	(244) A	(248) E
(233) D	(237) C	(241) D	(245) E	(249) C
(234) D	(238) A	(242) E	(246) A	(250) C

4.2 Data Sufficiency Questions

(251) A
(252) E
(253) B
(254) A
(255) A
(256) C
(257) B
(258) E
(259) A
(260) B
(261) C
(262) C
(263) E
(264) E
(265) B
(266) A
(267) A
(268) E
(269) A
(270) E
(271) B
(272) E
(273) A
(274) C
(275) A
(276) D
(277) E
(278) D
(279) B
(280) B
(281) E
(282) B
(283) D
(284) E
(285) D
(286) A
(287) B
(288) B
(289) B
(290) E
(291) A
(292) E
(293) A
(294) C
(295) E
(296) D
(297) E
(298) C
(299) D
(300) B
(301) E
(302) A
(303) A
(304) A
(305) A
(306) A
(307) A
(308) B
(309) A
(310) D
(311) D
(312) B
(313) C
(314) A
(315) E
(316) C
(317) A
(318) A
(319) C
(320) A
(321) E
(322) B
(323) D
(324) D
(325) C
(326) D
(327) C
(328) C
(329) B
(330) C
(331) A
(332) D
(333) D
(334) D
(335) D
(336) E
(337) E
(338) C
(339) C
(340) E
(341) E
(342) E
(343) A
(344) D
(345) B
(346) E
(347) C
(348) D
(349) C
(350) B
(351) C
(352) E
(353) E
(354) D
(355) D
(356) E
(357) E
(358) E
(359) B
(360) D

(361) E	(385) E	(409) D	(433) D	(457) A
(362) D	(386) C	(410) A	(434) D	(458) D
(363) C	(387) B	(411) D	(435) B	(459) B
(364) D	(388) E	(412) E	(436) C	(460) B
(365) C	(389) C	(413) E	(437) A	(461) E
(366) C	(390) C	(414) C	(438) C	(462) A
(367) A	(391) E	(415) A	(439) B	(463) D
(368) B	(392) A	(416) D	(440) D	(464) B
(369) E	(393) D	(417) C	(441) A	(465) C
(370) C	(394) C	(418) B	(442) C	(466) C
(371) C	(395) C	(419) A	(443) E	(467) E
(372) D	(396) C	(420) A	(444) D	(468) C
(373) B	(397) C	(421) D	(445) C	(469) D
(374) C	(398) A	(422) C	(446) B	(470) B
(375) C	(399) A	(423) B	(447) E	(471) D
(376) A	(400) D	(424) E	(448) E	(472) B
(377) A	(401) E	(425) C	(449) D	(473) B
(378) E	(402) A	(426) C	(450) D	(474) E
(379) E	(403) C	(427) D	(451) E	(475) C
(380) C	(404) B	(428) C	(452) B	(476) A
(381) E	(405) D	(429) B	(453) C	(477) D
(382) D	(406) B	(430) D	(454) C	(478) D
(383) C	(407) D	(431) B	(455) E	(479) C
(384) C	(408) A	(432) C	(456) E	(480) C

(481) D	(485) D	(489) A	(493) C	(497) C
(482) E	(486) A	(490) C	(494) C	(498) A
(483) D	(487) A	(491) B	(495) D	(499) B
(484) B	(488) E	(492) D	(496) E	(500) D

Chapter 5

Solutions – Problem Solving Questions

5.1 Number properties

1. Here, the given expression is in the format $a^2 - b^2 = (a + b)(a - b)$

$=> 99,996^2 - 4^2 = (99,996 + 4)(99,996 - 4)$

$=> 100,000 \times (100,000 - 8) = 10^5 \times (10^5 - 8)$

The correct answer is Option E.

2. The highest exponent of 5 in $n!$ can be calculated by adding the quotients (integer parts) when n is successively divided by 5:

If $[x]$ denotes the integer part of x, we have

$$\left[\frac{n}{5}\right] + \left[\frac{\left[\frac{n}{5}\right]}{5}\right] + \cdots = 6$$

Assuming that only $\left[\frac{n}{5}\right]$ equals 6, we have $n = 5 \times 6 = 30$

However, for $n = 30$, the actual value of the exponent of 5 is:

- $\frac{30}{5} = 6$
- $\frac{6}{5} = 1$

The exponent is $6 + 1 = 7$, which is greater by $7 - 6 = 1$ than what was required.

Thus, we need to reduce 30 by '1' multiple of 5 i.e. $1 \times 5 = 5$.

Thus, the approximate value of $n = 30 - 5 = 25$.

For $n = 25$, the actual value of the exponent of 5 is:

- $\frac{25}{5} = 5$
- $\frac{5}{5} = 1$

The exponent is $5 + 1 = 6$, which is the exact exponent required.

However, since we need to find the largest value of the highest exponent of '7' in $n!$, we need to check if any higher value of n is possible.

We have obtained the highest exponent of '5' equals to 6 in 25!

However, we can increase n till a point before the next multiple of 5 is included.

Thus, we can increase n to 29! as in 30 includes a multiple of '5.'

Let us verify:

For $n = 29$, the actual value of the exponent of 5 is:

- $\frac{29}{5} = 5.8 \equiv 5$
- $\frac{5}{5} = 1$

Thus the exponent is $5 + 1 = 6$, which is the exact exponent required.

Thus, the maximum value of $n! = 29!$

Thus, for $n = 29$, the value of the highest exponent of 7 is:

- $\frac{29}{7} = 4.14 \equiv 4$

Thus the highest exponent of '7' in 29! is 4.

The correct answer is Option C.

Alternate approach:

Let us count the number of multiples of '5' in $n!$.

The multiples of '5' would be there in 5, 10, 15, 20, 25, 30, ...

We should stop counting till we get 6 multiples. Since 5, 10, 15, and 20 would give one each, and 25 would give two multiples, the total count of multiples $= 1 + 1 + 1 + 1 + 2 = 6 =$ the number of required multiples to get the greatest value of a.

We see that if $n < 30$, the value of $a = 6$, thus the greatest value of $n = 29$.

Now let's count the number of multiples of '7' in $n! = 29!$.

The multiples of '7' would be there in 7, 14, 21, and 28.

There are one multiple in each of 7, 14, 21, and 28: a total of four multiples.

3. We have $0 < a < 1$

Also, $b = a^2$ and $c = \sqrt{a}$

Multiplying both sides of the inequality, $a < 1$, by a (since a is positive, multiplying a will not change the sign of inequality):

$a \times a < 1 \times a$

$=> a^2 < a$

Thus, we have

$a > a^2 = b$

Again, since $a < 1$, taking square root on both the sides, we have $\sqrt{a} < 1$

Multiplying both sides of the above inequality by $\sqrt{a}$, we have

$\sqrt{a} \times \sqrt{a} < \sqrt{a}$

$=> a < \sqrt{a} = c$

Thus, we have

$a^2 < a < \sqrt{a}$

$=> b < a < c$

The correct answer is Option D.

Alternate approach:

For any number less than 1, its squares, cubes & higher order numbers would be less than the number, and its square roots, cube roots & n^{th} roots would be greater than the number.

Since $a = 0.999 < 1$, this follows that $b < a < c$.

4. Given that,

$p = \frac{1}{150} \times \frac{1}{151} \times \cdots \times \frac{1}{250}$

$q = \left(\frac{1}{150} \times \frac{1}{151} \times \cdots \times \frac{1}{250}\right) \times \frac{1}{251} = \frac{p}{251}$

Thus, we have

$p^{-1} + q^{-1} = \frac{1}{p} + \frac{1}{q}$

$= \frac{1}{p} + \frac{251}{p}$

$=> \frac{252}{p}$

The correct answer is Option D.

5. The sum of all integers from 1 to n is given by $\frac{n\,(n+1)}{2}$.

Thus, the sum of all integers from 1 to 100 = $\frac{100 \times 101}{2} = 50 \times 101$.

And, the sum of all integers from 1 to 50 = $\frac{50 \times 51}{2} = 25 \times 51$.

Thus, the sum of all integers from 51 to 100 = $50 \times 101 - 25 \times 51 = 25(202 - 51) = 25 \times 151 = 3,775$.

The correct answer is Option E.

6. $x = \frac{1}{51} + \frac{1}{52} + \cdots + \frac{1}{60}$

Let us try to find the range of values of x.

We know that x is the sum of 10 terms.

Thus, we can say:

$x < \frac{1}{51} + \frac{1}{51} + \ldots (10 \text{ times})$

$=> x < \frac{10}{51} = \frac{1}{5.1}$

$=> x < \frac{1}{5}$

Again, we have

$x > \frac{1}{60} + \frac{1}{60} + \ldots (10 \text{ terms})$

$=> x > \frac{10}{60} = \frac{1}{6}$

Thus, we have

$\frac{1}{6} < x < \frac{1}{5}$

$\Rightarrow 6 > \frac{1}{x} > 5$

Similarly, we can deduce that $7 > \frac{1}{y} > 6$

Thus, $\frac{1}{y} > \frac{1}{x}$

The correct answer is Option C.

7. A number, here $4p25q$ is divisible by 4, if the number formed by the last two digits of the number is divisible by 4.

Thus, the number $5q$ is divisible by 4.

This is possible if $q = 2$ or 6 (since both 52 and 56 are divisible by 4).

A number, here number $4p25q$ is divisible by 9, if the sum of the digits of the number is divisible by 9.

The sum of the digits = $4 + p + 2 + 5 + q = 11 + p + q$.

Thus, $(11 + p + q)$ should be divisible by 9.

If $q = 2$:

$11 + p + q$

$= 11 + p + 2$

$= 13 + p$.

Thus, $(13 + p)$ is divisible by 9 if $p = 5$ (since $13 + 5 = 18$, which is divisible by 9).

If $q = 6$:

$11 + p + q$

$= 11 + p + 6$

$= 17 + p$.

Thus, $(17 + p)$ is divisible by 9 if $p = 1$ (since $17 + 1 = 18$, which is divisible by 9).

Thus we have two possible situations:

$p = 5,\ q = 2 \Rightarrow \frac{p}{q} = \frac{5}{2}$

OR

$p = 1,\ q = 6 => \frac{p}{q} = \frac{1}{6}$

Thus, the minimum value of $\frac{p}{q} = \frac{1}{6}$.

The correct answer is Option C.

8. We know that if $a\%$ of $(a - 2b)$ when added to $b\%$ of b, the value obtained is 0.

$=> a\% \times (a - 2b) + b\% \times b = 0$

$=> \dfrac{a}{100} \times (a - 2b) + \dfrac{b}{100} \times b = 0$

$=> \dfrac{a^2 - 2ab}{100} + \dfrac{b^2}{100} = 0$

$=> \dfrac{a^2 - 2ab + b^2}{100} = 0$

$=> a^2 - 2ab + b^2 = 0$

$=> (a - b)^2 = 0$

$=> a - b = 0$

$=> a = b$

Thus, only statement I is correct.

The correct answer is Option A.

9. According to the problem:

If m is in the set, $(m^2 + 3)$ is also in the set.

However, it does NOT imply that if $(m^2 + 3)$ is in the set, then m must be in the set.

What it does imply is that: If $(m^2 + 3)$ is NOT in the set, m is NOT in the set.

Thus, if we have $m = -1$ as a member of the set, $(m^2 + 3) = 4$ is also a member of the set.

Thus, statement II is correct.

Proceeding in the same way:

Since $m = 4$ is a member of the set, then $(m^2 + 3) = 19$ is a member of the set.

Thus, statement III is also correct.

The correct answer is Option D.

10. We have

$t_2 = 5$

$t_3 = 2 \times t_2 - 1$
$= 2 \times 5 - 1$
$= 9$

$t_3 = 2 \times t_2 - 1$
$= 2 \times 9 - 1$
$= 17$

Thus, we see that the sequence follows the pattern:

$t_1, 5, 9, 17, ...$

We can calculate the value of t_1 too.

$t_2 = 2 \times t_1 - 1$
$5 = 2 \times t_1 - 1$
$t_1 = 3$

Again, we see that the sequence follows the pattern:

$3, 5, 9, 17, ...$

We can rewrite the above terms as following.

$(2^1 + 1), (2^2 + 1), (2^3 + 1), (2^4 + 1)...$

From the analogy, we can deduce that $t_{10} = 2^{10} + 1$ and $t_9 = 2^9 + 1$

Thus, $t_{10} - t_9 = (2^{10} + 1) - (2^9 + 1)$

$= 2^{10} + 1 - 2^9 - 1$

$= 2^9(2 - 1)$

$= 2^9$

The correct answer is Option A.

11. $660 = 2^2 \times 3 \times 5 \times 11$

We see that there is an extra '2' since the exponent of 2 is 2.

This extra '2' can be combined with the other factors to generate different values.

Also, keeping the two 2s separate, the other factors may be combined to generate different values of m, n, p and q.

Thus, the possible combination for the distinct values of m, n, p and q are:

m	n	p	q
3	$2 \times 2 = 4$	5	11
2	$2 \times 3 = 6$	5	11
2	3	5	$2 \times 11 = 22$
2	3	11	$2 \times 5 = 10$

Thus, there are four possible combinations.

The correct answer is Option C.

12. Looking at the expression, we can deduce that $\sqrt{x^{2/3} + y^{2/3} + 2(xy)^{1/3}}$ and $\sqrt{x^{2/3} + y^{2/3} - 2(xy)^{1/3}}$ are basically $(a+b)^2$ and $(a-b)^2$, respectively, where $a = x^{1/3}$ and $b = y^{1/3}$

So, $\sqrt{x^{2/3} + y^{2/3} + 2(xy)^{1/3}} = \sqrt{a^2 + b^2 + 2ab} = \sqrt{(a+b)^2} = a + b$

Similarly, $\sqrt{x^{2/3} + y^{2/3} - 2(xy)^{1/3}} = \sqrt{a^2 + b^2 - 2ab} = \sqrt{(a-b)^2} = b - a$; since $b > a$

Note that $x = 125$ and $y = 216$, or, $y > x$; thus, $y^{1/3} > x^{1/3}$. Or $b > a$

So, $\left(\sqrt{x^{2/3} + y^{2/3} + 2(xy)^{1/3}} + \sqrt{x^{2/3} + y^{2/3} - 2(xy)^{1/3}}\right) = (a+b) + (b-a) = 2b = 2y^{1/3}$

$= 2 \times (125)^{1/3} = 2 \times (5)^{(3 \times 1/3)} = 2 \times 5 = 10$

The correct answer is Option E.

13. We observe that all the options for the value of $\left(\frac{1}{\sqrt{m}}\right)$ are greater than 1. This is possible only if $\sqrt{m}$ is less than 1, i.e. m is less than 1.

Thus, we have

For $0 < m < 1$, Multiplying m throughout:

$=> 0 < m^2 < m$

Taking square root throughout:

$=> 0 < m < \sqrt{m}$

Thus, we have

$\sqrt{m} > m$

Taking reciprocal:

$\frac{1}{\sqrt{m}} < \frac{1}{m} \ldots \text{(i)}$

We know that

$m \geq 0.9$

$=> \frac{1}{m} \leq \frac{1}{0.9} = 1.11 \ldots \text{(ii)}$

Thus, from (i) and (ii), we have

$\frac{1}{\sqrt{m}} < 1.11$

The correct answer is Option A.

Alternate approach:

Say $m = 1$,

$=> \left(\frac{1}{\sqrt{m}}\right) = \left(\frac{1}{\sqrt{1}}\right) = 1$

We see that as the value of m increases, the value of $\left(\frac{1}{\sqrt{m}}\right)$ decreases; however, in the options, we see that there is no less than 1 value.

Since all the values in options are more than 1, we need to probe further.

If we plug in a value for m, lying between 1 and 0.9, the value of $\left(\frac{1}{\sqrt{m}}\right)$ would be greater than 1. Although all the option values are greater than 1, this does not mean that the problem can't be solved.

Since this is a question of MCQ category and only one among the five options is correct, at least Option A (1.01, least among all the options) must be correct.

14. We have $a = \dfrac{b^3}{90}$

=> $b^3 = 90a$

$90 = 2 \times 3^2 \times 5$

Given that b is an integer, $90a$ must be a perfect cube, we have

$a = 2^2 \times 3 \times 5^2 \times k^3$, where k is a positive integer.

In that case, we have

$90a = 2^3 \times 3^3 \times 5^3 \times k^3$, which is a perfect cube.

Thus, among the statements I, II and III, only those would be an integer in which the denominator is a factor of $a = 2^2 \times 3 \times 5^2 = 300$.

Only in Statement III, in which the denominator is 300, a is completely divisible by the denominator and hence would be an integer.

The correct answer is Option C.

15. Given that,

$$\begin{array}{ccc} & X & Y \\ + & Y & X \\ \hline X & X & Z \\ \hline \end{array}$$

In the addition in the units digits, we have

$Y + X = Z + \text{carry}$

(We must have 'carry' since in the tens position, the same addition $(X + Y)$ results in a different value (X))

The value of the 'carry' must be 1 (adding two digits can result in a maximum carry of '1')

We observe that in the addition of the tens digits, i.e. $(1 + X + Y)$, we get a 'carry' to the hundreds position (since the result is a three-digit number).

Also, we have

$(1 + X + Y)$ results in the digit X in the tens position

=> $1 + X + Y = 10 + X$

=> $1 + Y = 10$

(Since only $(X + 10)$ would result is the digit X in the tens position)

$=> Y = 9$

Since the hundreds position in the sum comes only from the 'carry' from the tens position, we have

$X = 1$

Thus, the correct addition is:

$$\begin{array}{ccc} & 1 & 9 \\ + & 9 & 1 \\ \hline 1 & 1 & 0 \\ \hline \end{array}$$

Thus, the value of the units digit of the integer XXZ, i.e. $Z = 0$.

The correct answer is Option E.

Alternate approach:

As XY and YX are two digit positive integers, we must have:

$XY + YX = XXZ \leq 198$; since a two digit positive integer ≤ 99

$=> X$ must be equal to 1

$=> XXZ = 11Z$, where Z is the units digit

We can write a two digit positive number with digits X and Y as:

$XY \equiv 10X + Y$

Similarly, we have, the two digit positive number: $YX \equiv 10Y + X$

Thus, we have

$XY + YX \equiv (10X + Y) + (10Y + X) = 11(X + Y)$

We know $XY + YX = XXZ$

$=> XXZ = 11Z \equiv 11(X + Y)$

Thus, XXZ is a multiple 11, and also less than or equal to 198:

$=> XXZ \equiv 110$

$=> Z = 0$

16. Amount saved by Suzy in the 1st month = \$20 = 20 × 1 = \$20.

Amount saved by Suzy in the 2nd month = \$(20 + 20) = \$40 = 20 × 2 = \$40.

Amount saved by Suzy in the 3rd month = \$(40 + 20) = \$60 = 20 × 3 = \$60.

Thus, the amount saved in the 30th month = 20 × 30 = \$600.

Thus, the average amount saved every month

$$= \frac{(\text{Amount saved in the } 1^{\text{st}} \text{ month}) + \left(\text{Amount saved in the } 30^{\text{th}} \text{ month}\right)}{2}$$

$$= \$\left(\frac{20 + 600}{2}\right) = \$310$$

Thus, total amount saved in 30 months

= (Average amount saved per month) × (Number of months)

= \$310 × 30

= \$9, 300

The correct answer is Option D.

Alternate approach:

Sum of first n positive integers = $\frac{n \times (n+1)}{2}$

Thus, the sum of first 30 positive integers = $\frac{30 \times 31}{2} = 15 \times 31 = 465$

Thus, total amount saved in 30 months = \$20 × 465 = \$9, 300.

17. We have $t_n = t_{(n+1)} + 2t_{(n-1)}$ for $n \geq 1$

Since the relationship $t_n = t_{(n+1)} + 2t_{(n-1)}$ is among three terms, to get the value of t_4, we must have the values of t_2 and t_3. But we do not have the value of t_3. So, we will first calculate the value of t_3.

Plugging-in $n = 2$ in $t_n = t_{(n+1)} + 2t_{(n-1)}$, we get

$t_2 = t_3 + 2t_1$

Plugging-in the values of $t_1 = 0$, and $t_2 = 2$, we get

$2 = t_3 + 2 \times 0$

$t_3 = 2$

Again, plugging-in $n = 3$ in $t_n = t_{(n+1)} + 2t_{(n-1)}$, we get

$t_3 = t_4 + 2t_2$

Plugging-in the values of $t_2 = 2$, and $t_3 = 2$, we get

$2 = t_4 + 2 \times 2$

$t_4 = -2$

The correct answer is Option A.

18. Let us check the remainders when 2^n is divided by 3, for $n = 1, 2, 3, 4, 5 \ldots$:

n	2^n	Remainder when 2^n is divided by 3
1	2	2
2	4	1
3	8	2
4	16	1
5	32	2

> Taking 2 terms: $2 + 2^2$: Remainder when $2 + 2^2$ divided by 3 = 2 + 1 = 3 => 0
> Taking 3 terms: $2 + 2^2 + 2^3$: Remainder when $2 + 2^2 + 2^3$ is divided by 3 = 2 + 1 + 2 = 5 => 2
> Taking 4 terms: $2 + 2^2 + 2^3 + 2^4$: Remainder when $2 + 2^2 + 2^3 + 2^4$ is divided by 3 = 2 + 1 + 2 + 1 = 6 => 0
> Taking 5 terms: $2 + 2^2 + 2^3 + 2^4 + 2^5$: Remainder when $2 + 2^2 + 2^3 + 2^4 + 2^5$ is divided by 3 = 2 + 1 + 2 + 1 + 2 = 8 => 2

Note that when the number of terms is even (2 and 4), the remainder is 0 and when the number of terms is odd (3 and 5), the remainder is 2.

Thus, when the number of terms ($n > 9$) is even (10, 12, ...), the remainder would be 0 and when the number of terms ($n > 9$) is odd (11, 13, ...), the remainder would be 2.

Thus, statements I and III are true.

The correct answer is Option D.

5.2 Percents

19. The cost of repairing the current machine = \$1,200

The cost of new machine = \$2,800

Since the new machine lasts for two years, the average cost per year = $\$\left(\frac{2,800}{2}\right)$ = \$1,400.

Thus, the required percentage = $\frac{1,400 - 1,200}{1,200} \times 100$ = 16.67%.

The correct answer is Option C.

20. Let the price of the item be $\$x$.

So tax is applicable on $\$(x - 200)$

Thus, tax paid = 10% of $\$\ (x - 200)$

=> $\$\left(\frac{10}{100} \times (x - 200)\right)$

=> $\$\left(\frac{x - 200}{10}\right)$, which is equals to \$10.

Thus, we have

$\frac{x - 200}{10} = 10$

=> $x = 300$

The correct answer is Option C.

Alternate approach:

We see that tax paid = 10% of excess amount = \$10

=> Excess amount = \$100

Thus, the price = \$(200 + 100) = \$300

21. Tax paid on \$25 = \$0.54

Thus, a tax, which is four times as much as the above, would be $\$(0.54 \times 4)$ = \$2.16 on \$25.

Thus, the tax for item B on \$100 = 4 × Tax paid on \$25

= $\$2.16 \times 4$ = \$8.64

Thus, this tax, expressed as a percentage = $\frac{8.64}{100} \times 100 = 8.64\%$.

The correct answer is Option C.

22. Cyclist P increased his speed from 10 mph to 25 mph.

Total increase in speed of Cyclist P = 25 – 10 = 15 mph

Thus, the percentage increase in speed of Cyclist P = $\frac{15}{10} \times 100 = 150\%$.

Cyclist Q increased his speed from 8 mph to 24 mph.

Total increase in speed of Cyclist Q = 24 – 8 = 16 mph

Thus, the percentage increase in speed of Cyclist Q = $\frac{16}{8} \times 100 = 200\%$.

Apparently it seems that the required answer is simply: 200% – 150% = 50%.

However, it is not so since we are here asked to find percent change not percent point change

Here absolute change is 200% – 150% = 50%, which we are going to compare with percent change with the speed of Cyclist P, which is 150%.

The required percent = $\frac{50}{150} \times 100 = 33.33\%$.

The correct answer is Option A.

23. Kilometers traveled by Carrier X = 101,098 =≈ 100,000 kilometers

Fuel consumed by Carrier X = 9,890 liters =≈ 10,000 liters.

Thus, mileage of Carrier X = $\frac{100,000}{10,000}$ = 10 kmpl

Kilometers traveled by Carrier Y = 203,000 =≈ 200,000 kilometers

Fuel consumed by Carrier Y = 24,896 liters =≈ 25,000 liters

Thus, mileage of Carrier Y = $\frac{200,000}{25,000}$ = 8 kmpl

Thus, the percent by which mileage of Carrier X is greater than that of Carrier Y

$= \left(\frac{10-8}{8}\right) \times 100$

= 25%

The correct answer is Option B.

24. Since we need to find the overall percent change, we can assume the original price equal to \$100 (the overall percent change does not depend on the actual value of the bicycle).

Price after the price was reduced by 25%

$= (100 - 25)\,\%$ of \$100

$= \$100 \times \left(\frac{75}{100}\right)$

$= \$75$

Price after the new price was increased by 25%

$= (100 + 25)\,\%$ of \$75

$= \$75 \times \left(\frac{125}{100}\right)$

$= \$93.75$

Since the base price is \$100, the final price would be 93.75% of the base price. We need not take the actual price of the bicycle into the consideration.

The correct answer is Option D.

Alternate approach:

We can find the overall percent change using the relation:

$\left(x + y + \frac{xy}{100}\right)\%$, where $x\%$ and $y\%$ represent successive percent changes.

Applying in this problem, we get:

$\left(25 - 25 - \frac{25 \times 25}{100}\right) = -6.25\%$

Thus, the overall percent change is 6.25% and the final price = 93.75% of the original price.

25. The mixing for 68 liters of base was 3.4 liters of red color.

The recommended mixing for every 10 liter of base was 0.7 liters of red color.

Thus, as per the recommendation, the amount of red color required for 68 liters of base $= \frac{0.7}{10} \times 68 = 4.76$ liters

Thus, the mixing quantity must increase by $(4.76 - 3.4) = 1.36$ liters

Thus, the percent change needed in the mixing $= \frac{1.36}{3.4} \times 100 = 40\%$

The correct answer is Option C.

26. Number of employees who worked for 30 hours in the week = 30% of 200 = 60.

Rate of pay per hour = \$7.50.

Thus, pay per employee = $\$(7.50 \times 30) = \$225$.

Thus, total pay for all 60 employees = $\$\ (225 \times 60) = \$13,500 \ldots$(i)

Number of employees who worked for 44 hours in the week = 40% of 200 = 80.

Rate of pay per hour = \$7.50.

Thus, pay per employee = $\$(7.50 \times 44) = \$330$.

Thus, total pay for all 80 employees = $\$(330 \times 80) = \$26,400 \ldots$(ii)

Number of employees who worked for 50 hours in the week = $200 - (60 + 80) = 60$.

Rate of pay is \$7.50 per hour for the first 44 hours and $\$\left(7.50 \times 1\frac{1}{3}\right) = \$\left(7.50 \times \frac{4}{3}\right) = \$10$ per hour for the remaining $(50 - 44) = 6$ hours.

Thus, remuneration per employee = $\$(7.50 \times 44 + 10 \times 6) = \$390$.

Thus, total remuneration for all 60 employees = $\$(390 \times 60) = \$23,400 \ldots$(iii)

Thus, total remuneration for all the 200 employees
$= \$(13,500 + 26,400 + 23,400) = \$63,300$.

The correct answer is Option C.

27. On the first \$35 million in sales, amount received in commission = \$5 million

Thus, ratio of commission to sales = $\frac{5}{35} = \frac{1}{7}$

On the next \$121 million in sales, amount received in commission = \$11 million

Thus, ratio of commission to sales = $\frac{11}{121} = \frac{1}{11}$

Since $\frac{1}{7} > \frac{1}{11}$, there is a decrease in commission.

Thus, the required percent decrease

$$= \left(\frac{\frac{1}{7} - \frac{1}{11}}{\frac{1}{7}}\right) \times 100\%$$

$= \frac{11-7}{11} \times 100\%$

$= \frac{4}{11} \times 100$

$= 36.36\%$

The correct answer is Option C.

28. Total sales = \$24,000.

Thus, commission on the first \$20,000 = 8% of \$20,000 = $\$\left(\frac{8}{100} \times 20,000\right) = \$1,600$.

Total commission received by the sales representative = \$2,000.

Thus, commission received on the remaining sales = $\$(2,000 - 1,600) = \$400$.

Commission received on the remaining $\$(24,000 - 20,000) = \$4,000$ at $x\%$

$= x\%$ of \$4,000

$= \$\left(\frac{x}{100} \times 4,000\right)$

$= \$40x$.

Thus, we have

$40x = 400$

$=> x = 10\%$

The correct answer is Option D.

29. Total cost of the 120,000 computer chips = \$3,600,000

Cost of $\frac{2}{5}$ of the above computer chips = $\$\left(3,600,000 \times \frac{2}{5}\right) = \$1,440,000$.

These were sold at a 25% higher than the cost price.

Thus, selling price of the above computer chips

= (100 + 25)% of \$1,440,000

$= \$\left(\frac{125}{100} \times 1,440,000\right)$

$= \$1,800,000 \ldots$ (i)

Cost of the remaining computer chips = $\$(3,600,000 - 1,440,000) = \$2,160,000$

Later, these remaining computer chips were sold at a 25% lower than the cost price.

Thus, selling price of the above computer chips

= (100 – 25)% of $2,160,000

$= \$\left(\frac{75}{100} \times 2,160,000\right)$

$= \$1,620,000 \ldots$ (ii)

Thus, total selling price = $\$(1,800,000 + 1,620,000) = \$3,420,000$.

Since total selling price (= $3,420,000) < total cost price (= $3,600,000), there is a loss

Thus, percent loss

$$= \left(\frac{\text{Cost price} - \text{Selling price}}{\text{Cost price}}\right) \times 100$$

$$= \left(\frac{3,600,000 - 3,420,000}{3,600,000}\right) \times 100$$

= 5% (Loss)

The correct answer is Option B.

Alternate approach:

Percent profit made on $\frac{2}{5}$ of the stock = 25%

Percent loss made on the remaining $\frac{3}{5}$ of the stock = −25% (since price is 25% less)

Thus, overall percent profit/loss

$$= \left(\frac{2}{5} \times 25 + \frac{3}{5} \times (-25)\right)$$

$= 10 - 15$

$= -5\%$

30. We know that the price of milk increased by 20%.

Let the original price of milk per liter be $\$x$.

Thus, the price of milk per liter after the price increase

$= \$\,(100 + 20)\,\%$ of $x = \$(120\%$ of $x) = \$\left(\frac{6x}{5}\right)$.

Number of liters of milk $= \left(\frac{\text{Total Price}}{\text{Price per liter}}\right)$

Thus, difference in quantity of milk obtained for $60

$$= \frac{60}{x} - \frac{60}{\frac{6x}{5}} = 5$$

$$=> \frac{60}{x} - \frac{50}{x} = 5$$

$$=> \frac{10}{x} = 5$$

$$=> x = 2$$

Thus, the correct answer is Option A.

Alternate approach:

If the price of an item goes up/down by $x\%$, the quantity consumed should be reduced/increased by $\left(\frac{100x}{100 \pm x}\right)\%$ so that the total expenditure remains the same.

Since the price of milk increased by 20%, the quantity obtained for $60 would reduce by $100 \times \left(\frac{20}{100 + 20}\right) = \frac{50}{3}\%$

Thus, $\frac{50}{3}\%$ of the original quantity = 5 liters

$$=> \text{Original quantity} = \frac{5}{\frac{50}{3}\%} = \frac{500}{\frac{50}{3}} = 30 \text{ liters}$$

Thus, the initial price per liter of diesel $= \left(\frac{\text{Total Initial Price}}{\text{Total Initial number of liters}}\right) = \$\left(\frac{60}{30}\right) = \$2$.

31. Since the problem asks us to find a percent value, we can assume any suitable value of the annual sum of money for ease of calculation as the initial value does not affect the final answer.

Since we have to deal with factions $\frac{1}{4}$ and $\frac{1}{6}$, we can assume the sum equal to $24 (= LCM of 4 and 6).

Thus, the sum spent during the first quarter $= \$\left(\frac{1}{4} \times 24\right) = \$6$.

Amount of money left $= \$\,(24 - 6) = \$18$.

Thus, the sum spent during the second quarter $= \$\left(\frac{1}{6} \times 18\right) = \$3$.

Thus, the sum left at the beginning of the third quarter $= \$\,(18 - 3) = \$15$.

Total the sum spent in the last two quarters = \$ $(6+3)$ = \$9.

Thus, the required percent

$= \frac{15-9}{9} \times 100$

$= \frac{200}{3}\%$

= 66.66%

The correct answer is Option D.

32. Amount David spent in 2013 = \$450.

Amount David spent in 2014

= 10% more than what he spent in 2013

= (100 + 10) % of what he spent in 2013

$= \$ \left(\frac{110}{100} \times 450\right)$

= \$495

Total amount spent by David and Suzy in 2014 = \$600.

Thus, amount spent by Suzy in 2014 = \$ $(600-495)$ = \$105.

We know that Suzy had spent \$450 in 2013.

Thus, the required percent

$= \frac{\text{(Amount spent by Suzy in 2013)} - \text{(Amount spent by Suzy in 2014)}}{\text{(Amount spent by Suzy in 2013)}} \times 100\%$

$= \frac{450-105}{450} \times 100\%$

$= \frac{345}{450} \times 100\%$

$= \approx 77\%$

The correct answer is Option C.

33. It is easier to solve this question can be solved by observing the answer options than by actual solving.

We observe that the options are very large in value compared to the price change by the end of day 2, i.e. \$1.

Let the original price of the item be \$$x$.

By the end of day 2, the price of the item decreases by \$1

Thus, by the end of day 2, the price of the item = \$$(x - 1)$

The subsequent increase would be calculated on \$$(x - 1)$ instead of \$$x$

However, since \$1 is negligible compared to x (note that x is one among very large option values), we can conclude that the decrease in price would be very slightly less than \$1.

Thus, the final price on day 4 $=\approx$ \$ $((x - 1) - 1) =$ \$$(x - 2)$.

Thus, we have

$(x - 2) =\approx 398$

$=> x =\approx 400$

Thus, the only option that satisfies is D: \$400.

The actual calculation is shown below:

Assuming the initial price of a share to be \$$x$, we have

$$x - \left[x\left(1 + \frac{k}{100}\right)\left(1 - \frac{k}{100}\right)\right] = 1 \ldots \text{(i)}$$

$$x\left(1 + \frac{k}{100}\right)\left(1 - \frac{k}{100}\right)\left(1 + \frac{k}{100}\right)\left(1 - \frac{k}{100}\right) = 398 \ldots \text{(ii)}$$

We need to solve for x from the above two equations.

Note: The actual solution is time taking and very involved, and hence, not suggested.

The correct answer is Option D.

34. Cost of x items = \$$y$

Since the cost increases by 20%, the new cost of x items

$=$ \$ $(100 + 20)$ % of y

$= \$\left(\frac{120}{100} \times y\right)$

$= \$\left(\frac{6y}{5}\right)$

Thus, with a budget of $\$\left(\frac{6y}{5}\right)$, x items can be bought next year.

Thus, with a budget of $\$(3y)$, the number of items can be bought

$= \frac{3y}{\left(\frac{6y}{5}\right)} \times x$

$= \frac{5}{2}x = 2.50x$

The correct answer is Option C.

35. Since the question asks for a percent value, we can choose any suitable initial value of the total weight of the solution for the ease of calculation; the initial value will not affect the final answer.

Let the total weight of the solution initially = 100 liters.

Thus, weight of water = 30% of 100 = 30 liters.

Weight of the remaining solution = 100 – 30 = 70 liters.

Loss of water = 70% by weight.

Thus, final weight of water after 15 minutes of boiling = (100 − 70)% of 30 = 30% of 30 = 9 liters.

Since there is no weight loss in the other part of the solution, final weight of the solution = 70 + 9 = 79 units.

Thus, the required percent value $= \left(\frac{\text{Final weight of water}}{\text{Final weight of solution}}\right) \times 100$

$= \frac{9}{79} \times 100$

$= \frac{900}{79}\%$

The correct answer is Option D.

36. Since the question asks about a percent value, we can choose any suitable initial value of the total volume of the mix for ease of calculation; the initial value will not affect the final answer.

Let the total volume of the mixed juice be 100 units.

Thus, volume of banana pulp = 25% of 100 = 25 units

=> Volume of papaya pulp = 100 − 25 = 75 units

Let the price of 100 units (an equal quantity) of banana pulp be \$100x.

Since the mixed juice costs 20 percent more than the cost of an equal quantity of only banana pulp, the price of 100 units of the mixed juice

$= \$((100+20)\,\%\text{ of }100x)$

$= \$120x$

The price of 25 units of banana pulp present in the mix = $\$\left(\frac{100x}{100}\times 25\right) = \$25x$.

Thus, the price of 75 units of papaya pulp present in the mix = $\$\,(120x - 25x) = \$95x$.

Thus, the price of 100 units of papaya pulp = $\$\left(\frac{95x}{75}\times 100\right)$

$= \$126.67x$

Thus, the percent by which papaya pulp are more expensive than banana pulp

$$= \frac{(\text{Price of 100 units of papaya pulp}) - (\text{Price of 100 units of banana pulp})}{\text{Price of 100 units of banana pulp}}\times 100$$

$$= \frac{126.67x - 100x}{100x}\times 100$$

$= 26.67\%$

The correct answer is Option B.

37. Let us assume the number of days in a year to be 365.

Thus, in a 3-year period, total number of days = $3 \times 365 = 1,095$.

We know that bacteria P multiplies itself in every 18 days and bacteria Q multiplies itself in every 15 days.

Thus, we have

Number of times bacteria P multiplies itself

$= \frac{1,095}{18} = 60... = 60$; bacteria P multiplies only 60 times.

Number of times bacteria Q multiplies itself

$= \frac{1,095}{15} = 73$; bacteria Q multiplies 73 times.

Since there is no information whether the 3-year period includes a leap year (366 days in the year), we must consider that scenario too.

In that case,

Number of times bacteria P multiplies itself

$= \frac{1,096}{18} = 60... = 60$; bacteria P still multiplies only 60 times.

Number of times bacteria Q multiplies itself

$= \frac{1,096}{15} = 73... = 73$; bacteria Q still multiplies only 73 times.

Even if we had not considered the leap year scenario, we would not have made any mistake. Since this is PS problem, and there cannot be two answers to the same problem.

Thus, the required percent difference

$$= \frac{\text{(Number of times bacteria Q multiplies)} - \text{(Number of times bacteria P multiplies)}}{\text{Number of times bacteria P multiplies}} \times 100\%$$

$$= \frac{73 - 60}{60} \times 100\%$$

$$= \approx 22\%$$

The correct answer is Option D.

38. Cost of the phone purchased by Jack = \$1,500.

Sales tax paid = 5% of \$1500 = $\$ \left(\frac{5}{100} \times 1,500\right) = \$75$.

Thus, total price paid by Jack = $\$ \,(1,500 + 75) = \$1,575$.

Cost of the phone purchased by Tom = \$1,200.

Sales tax paid = 15% of \$1,200 = $\$ \left(\frac{15}{100} \times 1,200\right) = \$180$.

Thus, total price paid by Tom = $\$ \,(1,200 + 180) = \$1,380$.

Thus, the amount which Tom paid less compared to Jack = $\$ \,(1,575 - 1,380) = \$195$.

Thus, the required % value

$$= \left(\frac{\text{Total price paid by Jack} - \text{Total price paid by Tom}}{\text{Total price paid by Jack}}\right) \times 100\%$$

$$= \left(\frac{195}{1,575}\right) \times 100\%$$

$$= \frac{260}{21} = \approx 12\%$$

The correct answer is Option D.

39. Let the number of boys and girls be b and g, respectively.

Number of boys who play basketball = 65% of b

$$= \frac{65}{100} \times b$$

$$= \frac{13b}{20}$$

Number of girls who play basketball = 78% of g

$$= \frac{78}{100} \times g$$

$$= \frac{39g}{50}$$

Thus, total number of students play basketball = $\left(\frac{13b}{20} + \frac{39g}{50}\right)$

Total number of students = $(b + g)$

Since 72% of all students play basketball, we have

$$\frac{72}{100} \times (b + g) = \frac{13b}{20} + \frac{39g}{50}$$

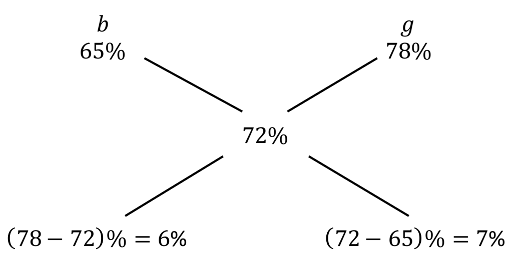
Upon solving, we get,

$$=> \frac{g}{b} = \frac{7}{6}$$

The correct answer is Option B.

Alternate approach:

We can solve the problem using the method of alligation, as shown below:



Thus, we have
$b : g = 6 : 7$

$g : b = 7 : 6$

40. Total number of spectators = S

Since 40% of the spectators belonged to natives, percent of other than native spectators = $(100 - 40) = 60\%$

Thus, the number of other than native spectators

= 60% of S

= $0.6S$

Of the above, Royal Challengers had a support of 10%.

Thus, the number of other than native supporters

= 10% of $0.6S$

= $0.06S$

Number of native supporters = 24,500

Thus, total number of supporters = $0.06S + 24,500$

The correct answer is Option D.

41. Since the problem asks for a percent value, we can assume any suitable value of the number of students for ease of calculation.

Let the number of students be 100.

Number of students of Science stream = 40% of 100 = 40.

Number of Science stream students who go to special classes

= 60% of 40

= 24

Total number of students who go to special classes = 30% of 100 = 30.

Thus, the number of students who do not study Science go to special classes

= 30 – 24

= 6

Thus, the percent of the students who do not study Science go to special classes

$= \frac{6}{100} \times 100$

= 6%

The correct answer is Option A.

42. Let the total number of students = 100 (since the question asks for ratio, the answer is independent of the initial number chosen, so we choose a suitable number for ease of calculation).

The number of boys = 40% of 100 = 40.

Thus, the number of girls = 100 − 40 = 60.

Let the number of students transferred = x.

Thus, number of boys transferred = 30% of $x = \frac{30}{100} \times x = \frac{3x}{10}$

Thus, number of girls transferred = $\left(x - \frac{3x}{10}\right) = \frac{7x}{10}$

Here we know that:

Transfer rate for students of a certain gender = $\frac{\text{Number of students of that gender transferred}}{\text{Total number of students of that gender}}$

Thus, the transfer rate for the boys = $\left(\frac{\frac{3x}{10}}{40}\right) = \frac{3x}{400}$.

Also, the transfer rate for the girls = $\left(\frac{\frac{7x}{10}}{60}\right) = \frac{7x}{600}$.

Thus, the required ratio = $\frac{3x}{400} : \frac{7x}{600}$

$= \frac{3}{2} : \frac{7}{3}$

$= 9 : 14$

The correct answer is Option D.

43. Since the problem asks us about a percent change, we can assume a suitable initial value of the original price for ease of calculations.

We see that we need to take $\frac{5}{7}$ and $\frac{3}{5}$ of the original price.

So, we should assume a value, which is a multiple of 35 (LCM of denominators, 7 and 5) for ease of calculations.

Thus, let the original price be \$35.

Thus, the value of the car at the start of the year = \$ $\left(\frac{5}{7} \times 35\right)$ = \$25.

The value of the car in the end of the year = \$ $\left(\frac{3}{5} \times 35\right)$ = \$21.

Thus, the required percent decrease

$$= \left(\frac{\text{Change in value}}{\text{Initial value}}\right) \times 100\%$$

$$= \frac{25 - 21}{25} \times 100$$

$$= 16\%$$

The correct answer is Option B.

Alternate approach:

Say the original price is \$1.

Thus, the required percent decrease

$$= \left(\frac{\text{Change in value}}{\text{Initial value}}\right) \times 100$$

$$= \frac{\frac{5}{7} - \frac{3}{5}}{\frac{5}{7}} \times 100$$

$$= \frac{\frac{4}{35}}{\frac{7}{5}} \times 100$$

$$= \frac{4}{25} \times 100$$

$$= 16\%$$

44. Remuneration as per the first offer = 5% commission on sales plus monthly bonus of \$500

Remuneration as per the second offer = 7% of commission on sales

Thus, we have

(5% commission on sales) + (\$500) = (7% commission on sales)

=> (7% commission on sales) − (5% commission on sales) = \$500

=> 2% of sales = \$500

=> Sales = $\$\left(500 \times \frac{100}{2}\right) = \$25,000$

The correct answer is Option B.

45. Number of retailers at the beginning of the year = 35% of 120 = $\frac{35}{100} \times 120 = 42$.

Number of retailers after the 24-month period = 25% of 240 = $\frac{25}{100} \times 240 = 60$.

Thus, increase in the number of retailers = 60 − 42 = 18.

Let the simple annual percent growth rate in the number of retailers be r%.

Thus, in two years (the 24-month period), increase in the number of retailers at r% rate

$= \left(\frac{42 \times r \times 2}{100}\right)$

(The value is calculated on 42 since 42 is the value at the start of the year)

Thus, we have

$\frac{42 \times r \times 2}{100} = 18$

$=> r = \frac{18 \times 100}{2 \times 42} = 21.43\%$

The correct answer is Option B.

46. Since we need to find the greatest overall percent increase, let us assume a suitable initial value.

Let the initial value be 100.

Let there be x% increase initially.

Thus, value after x% increase

$= (100 + x)\%$ of 100

$= \frac{100 + x}{100} \times 100$

$= (100 + x)$

Let there be y% increase next.

Thus, the final value after y% increase

$= (100 + y)\%$ of $(100 + x)$

$= \frac{(100 + y)}{100} \times (100 + x)$

$$= \frac{(100 + y)\,(100 + x)}{100}$$

$$= \frac{100^2 + 100\,(x + y) + xy}{100}$$

Thus, overall percent increase

$$= \frac{(\text{Final value}) - (\text{Initial value})}{(\text{Initial value})} \times 100\%$$

$$= \frac{\left(\frac{100^2 + 100\,(x + y) + xy}{100} - 100\right)}{100} \times 100\%$$

$$= \left(\frac{100\,(x + y) + xy}{100}\right)\%$$

$$= \left(x + y + \frac{xy}{100}\right)\%$$

In each of the above options, we observe that:

$x + y = 60$

Thus, the option with the highest value of xy will have the highest overall percent increase.

We know that if the sum of two terms is a constant, the product of the two terms becomes the maximum only when both the terms are equal

$=> x = y = \frac{60}{2} = 30$

Thus, the correct answer is Option C.

Alternately, working with the options one at a time:

- A: $x = 10, y = 50 => xy = 500$
- B: $x = 25, y = 35 => xy = 875$
- C: $x = 30, y = 30 => xy =$ **900**: Correct answer.
- D: $x = 40, y = 20 => xy = 800$
- E: $x = 45, y = 15 => xy = 675$

47. Since the problem asks us about a percent value, we can assume a suitable value of the number of voters for ease of calculations.

Let the number of voters be 100.

Thus, the number of boys = 70% of 100 = 70

Number of girls = 100 − 70 = 30

Number of boys who would vote for John = 30% of 70 = 21.

Number of girls who would vote for John = 70% of 30 = 21.

Thus, total number of votes for John = 21 + 21 = 42.

Thus, the required percent = $\frac{42}{100} \times 100 = 42\%$.

The correct answer is Option B.

48. We see some ugly numbers to deal with.

Region-wise distribution of companies in the state	
Region P	2,345
Region Q	3,456
Region R	3,421
Region S	5,721
Region T	3,445
Region U	80
Region V	4,532
Total	**23,000**

In the GMAT, you would be seldom asked to do calculations that consume a lot of time. Even if you see some ugly numbers to deal with, you need not put in too much time on it. Mostly, there would be a smarter approach to deal with the question.

We are asked to find out the percentage difference between the number of companies of Region S and that of Region R. Instead of calculating the individual percentages, let's save time and directly calculate the percentage difference.

It is given that the number of companies of Region S = 5,721 and the number of companies of Region R = 3,421

Thus, the difference = 5,721 − 3,421 = 2,300.

Thus, the percentage difference of number of companies of Region S and that of region R of the total

$$= \frac{2,300}{23,000} \times 100\% = 10\%.$$

The correct answer is Option B.

5.3 Profit & Loss

49. Since $\left(\frac{4}{5}\right)^{\text{th}}$ of the stock was sold, the remaining $\left(1 - \frac{4}{5}\right) = \left(\frac{1}{5}\right)^{\text{th}}$ of the stock was not sold.

Thus, $\left(\frac{1}{5}\right)^{\text{th}}$ of the total stock = 100.

Thus, $\left(\frac{4}{5}\right)^{\text{th}}$ of the total stock = $4 \times 100 = 400$.

Thus, 400 items were sold each at $3.00.

Thus, total amount received = $\$(400 \times 3) = \$1,200$.

The correct answer is Option B.

50. We know that the trader bought 900 cartons a cost of $20 per carton.

Thus, the total cost of the cartons = $\$\ (20 \times 900) = \$18,000$

Selling price of $\left(\frac{2}{3} \text{ of } 900\right)$ or 600 cartons = $\$\ (1.25 \times 20) = \$25$ per carton

Thus, selling price of 600 cartons = $\$\ (25 \times 600) = \$15,000 \ldots$(i)

Selling price of the remaining $(900 - 600)$ or 300 cartons = $\$\ (100 - 20)\%$ of 20 = $\$\left(\frac{80}{100} \times 20\right) = \$16$ per carton

Thus, selling price of 300 cartons = $\$\ (16 \times 300) = \$4,800 \ldots$(ii)

Thus, from (i) and (ii):

Total selling price = $\$(15,000 + 4,800) = \$19,800$.

Thus, gross profit = Total selling price − Total cost price

$= \$(19,800 - 18,000) = \$1,800$.

The correct answer is Option A.

51. Selling price of a brand A bicycle = $150.

Thus, 60% of the selling price of a brand B bicycle = $150

Thus, selling price of a brand B bicycle = $\$\left(150 \times \frac{100}{60}\right) = \$250$

Total number of bicycles sold by the dealer = 100

Thus, the number of brand B bicycles sold = $\frac{3}{5} \times 100 = 60$

Thus, the number of brand A bicycles sold = $100 - 60 = 40$

Thus, total sale from the sale of all bicycles

= Sale from brand A bicycles + Sale from brand B bicycles

$= \$\,(150 \times 40) + \$\,(250 \times 60)$

$= \$\,(6,000 + 15,000)$

$= \$21,000$

The correct answer is Option D.

52. Purchase price of the consignment = \$800.

Percent profit made on the Purchase price = 30%.

Thus, selling price of the consignment
= (100 + 30) % of \$800

$= \$\left(\frac{130}{100} \times 800\right)$

$= \$1,040$

This selling price is 20% less than the marked price.

Thus, (100 – 20) % = 80% of the marked price is equal to the selling price \$1,040.

Thus, the marked price

$= \$\left(1,040 \times \frac{100}{80}\right)$

$= \$1,300$

The correct answer is Option C.

53. Cost of production of each unit = \$2.50

Selling price of each unit = \$4.50

Thus, margin on each unit = \$ (4.50 – 2.50) = \$2.00

Investment made on the equipment = \$10,000.

Thus, number of units required to be sold to recover the investment in machines

$$= \frac{\text{Investment}}{\text{Margin on each unit}} = \frac{10,000}{2.00}$$

$= 5,000$

The correct answer is Option D.

Alternate approach:

Let the number of required units o be sold to recover the investment in machines = n.

Thus, total cost = \$ $(10,000 + 2.5n)$.

Total selling price = \$$4.5n$

Thus, we have

$10,000 + 2.5n = 4.5n$

$=> n = 5,000$

54. Original selling price of the house

= $(100 + 20)\,\%$ of the cost of the house

= 120% of the cost of the house

New selling price of the house

= $(100 + 30)\,\%$ of the cost of the house

= 130% of the cost of the house

Thus, difference between the above two selling prices

= $(130\% - 120\%)$ of the cost of the house

= 10% of the cost of the house

Since it is given that the difference between the two selling prices is \$10,000, we have

10% of the cost of the house = \$10,000

=> Cost of the house = $ \left(10,000 \times \frac{100}{10}\right) = \$100,000$

Thus, the original selling price of the house

= 120% of the cost of the house

$= \$ \left(100,000 \times \frac{120}{100}\right)$

= $120,000

The correct answer is Option C.

55. Total number of television sets assembled = 600.

Contractor payment for each of the first 100 television sets = $20

Thus, the total contractor payment for the first 100 television sets = $\$\,(20 \times 100) = \$2,000$.

Contractor payment for each of the remaining 500 (= 600 – 100) television sets = $15

Thus, the total contractor payment for the remaining 500 television sets = $\$\,(15 \times 500) = \$7,500$.

Thus, the total contractor payment for 600 television sets = $\$\,(2,000 + 7,500) = \$9,500$.

Total invoice value for the 600 television at $25.00 each = $\$\,(25 \times 600) = \$15,000$.

Thus, gross profit = Total invoice value – Total contractor payment

= $15,000 – $9,500

= $5,500

The correct answer is Option C.

56. Initial selling price of the item = $99.

Since the initial percent profit was 10% of the cost, we have

$(100 + 10)\,\%$ of the cost of the item = $99

=> Cost of the item = $\$ \left(\frac{99}{110} \times 100\right) = \$90$

Increased selling price of the item = $117.

Thus, the required percent profit

$$= \left(\frac{\text{Selling price} - \text{Cost price}}{\text{Cost price}}\right) \times 100$$

$$= \left(\frac{117 - 90}{90}\right) \times 100$$

$$= \frac{27}{90} \times 100$$

$= 30\%$

The correct answer is Option E.

57. The merchant has 2,400 fans priced at (cost price) \$30 each.

Thus, total cost price = $\$\,(2,400 \times 30) = \$72,000$.

Number of fans sold at \$40 each = 60% of 2,400 = $\frac{60}{100} \times 2400 = 1,440$.

Thus, sales revenue of these 1,440 fans = $\$\,(1440 \times 40) = \$57,600$.

Number of fans sold at \$35 each = 2,400 − 1,440 = 960.

Thus, sales revenue of these 960 fans = $\$\,(960 \times 35) = \$33,600$.

Thus, sales revenue of 2,400 fans = 57,600 + 33,600 = \$91,200

Thus, profit made by selling the 2,400 fans = $91,200 - 72,000 = \$19,200$.

Thus, average profit made per fan = $\$\left(\frac{19,200}{2,400}\right) = \$8$.

The correct answer is Option B.

Alternate approach:

The merchant sold 60% of the fans each at a profit of $\$\,(40 - 30) = \$10$.

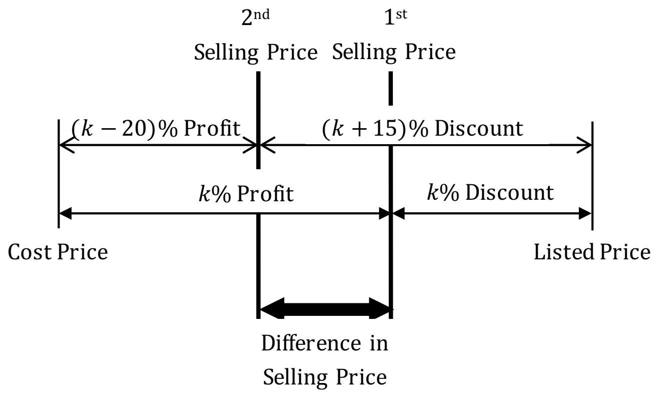
He sold the remaining 40% of the fans each at a profit of $\$\,(40 - 35) = \$5$.

Thus, his average profit per radio = $\$\left(10 \times \frac{60}{100} + 5 \times \frac{40}{100}\right)$

$= \$\,(6 + 2)$

$= \$8$

58. Let us understand the problem using the diagram shown below:



Let us calculate the difference in the two selling prices:

Since in the first case, the profit was $k\%$ and in the second, the profit was $(k-20)\%$, the difference in selling price

$= (k - (k-20))\%$ of Cost Price; (Since percent discount is calculated on the cost price)

$= 20\%$ of Cost price ... (i)

Again, in the first case, the discount was $k\%$ and in the second, the discount was $(k+15)\%$, the difference in selling price

$= ((k+15) - k)\%$ of Listed Price; (Since percent discount is calculated on the listed price)

$= 15\%$ of Listed price ... (ii)

Thus, from (i) and (ii), we have

20% of Cost price = 15% of Listed price

$$\Rightarrow \frac{\text{Listed price}}{\text{Cost price}} = \frac{20}{15} = \frac{4}{3}$$

Thus, if no discount were offered (the listed price becomes the selling price), percent profit

$$= \left(\frac{\text{Listed price} - \text{Cost price}}{\text{Cost price}}\right) \times 100$$

$$= \left(\frac{\text{Listed price}}{\text{Cost price}} - 1\right) \times 100$$

$$= \left(\frac{4}{3} - 1\right) \times 100$$

$= 33.3\%$

The correct answer is Option D.

59. Total number of units sold = 800 + 900 = 1,700

Cost of producing each unit = $6

Thus, total cost of producing 1700 units = $(6 × 1700) = $10,200

Selling price of 800 units of the product = $(800 × 8) = $6,400

Selling price of 900 units of the product = $(900 × 5) = $4,500

Thus, the total selling price of 1,700 units = $(6,400 + 4,500) = $10,900

Thus, profit = $\$\left(10,900 - 10,200\right) = \$700$

The correct answer is Option E.

60. Let the book and stationary sales in 2014 be b and s, respectively.

Thus, total sales revenue in 2014 = $(b + s)$

Thus, the sales revenue from book sales in 2015 = $(100 - 10)\%$ of $b = 90\%$ of $b = 0.9b$.

And, the sales revenue from stationary sales in 2015 = $(100 + 6)\%$ of $s = 106\%$ of $s = 1.06s$.

Thus, total sales revenue in 2015 = $(0.9b + 1.06s)$

Thus, we have

$(0.9b + 1.06s) = (100 + 2)\%$ of $(b + s)$

$=> 0.9b + 1.06s = 1.02b + 1.02s$

$=> 0.04s = 0.12b$

$$=> \frac{b}{s} = \frac{0.04}{0.12} = \frac{1}{3}$$

$=> b : s = 1 : 3$

The correct answer is Option A.

61. Let the profit of the trader in 2001 be $100 (the assumption of $100, or any other number does not affect the answer since we have to find the percent change).

Thus, the profit of the trader in 2002 = $\$((100 + 20)\%$ of $100) = \$120$.

Thus, the profit of the trader in 2003 = $\$((100 + 25)\%$ of $120) = \$150$.

Thus, the percent change in profit from 2001 to 2003 = $\frac{150 - 100}{100} \times 100 = 50\%$.

The correct answer is Option E.

Alternate approach:

If the value of a commodity changes by $x\%$ and then by $y\%$ successively, the overall percent change is given by:

$$\left(x + y + \frac{xy}{100}\right)\%$$

Here, we have

x = Percentage change from 2001 to 2002 = 20 %
y = Percentage change from 2002 to 2003 = 25 %

Thus, the overall percent change

$= 20 + 25 + \frac{20 \times 25}{100}$

$= 50\%$

5.4 Averages

62. Number of teachers = $\frac{\text{Total annual salaries}}{\text{Average annual salaries}} = \frac{3,780,000}{42,000} = 90$

=> Number of students = $\frac{25}{2} \times 90 = 1,125$

The correct answer is Option C.

63. Let the number of male employees and female employees be m and f, respectively.

Total salary of male employees = $65,000m$.

Total salary of female employees = $80,000f$.

Thus, total salaries of all the employees = $65,000m + 80,000f$.

Thus, average salaries of all the employees

$$= \left(\frac{\text{Total salaries of the employees}}{\text{Total number of employees}}\right) = \left(\frac{65,000m + 80,000f}{m+f}\right).$$

Thus, we have

$$\left(\frac{65,000m + 80,000f}{m+f}\right) = 70,000$$

$$=> 65m + 80f = 70m + 70f$$

$$=> 10f = 5m$$

$$=> \frac{m}{f} = \frac{2}{1}$$

We cannot get the absolute number of male employees and female employees. There are infinite number of possibilities.

Among the options, the value that bears the ratio 2 : 1 would be the correct answer. We see that only Option D (14; 7) bears that ratio 2: 1.

The correct answer is Option D.

64. It is given that the total number of students = 40.

Let the number of students in section A = n.

Thus, the number of students in section B = $(40 - n)$.

Total score of all the students in the two sections combined = $85n + 80(40 - n)$.

Thus, average score considering all students

$$= \frac{\text{Total score}}{\text{Total number of students}} = \frac{85n + 80\,(40 - n)}{40}$$

Thus, we have

$$\frac{85n + 80\,(40 - n)}{40} = 82$$

$=> 17n + 640 - 16n = 656$

$=> n = 16$

The correct answer is Option C.

65. The juice manufacturer has $(1,200 + 400) = 1,600$ liters of mango pulp.

Amount of water in the first stock = 25% of 1200 = 300 liters

Amount of water in the second stock = 20% of 400 = 80 liters

Thus, the total amount of water = 300 + 80 = 380 liters

Thus, the percent of water in the total stock

$$= \frac{380}{1,600} \times 100$$

= 23.75%.

The correct answer is Option B.

Alternate approach:

The required percent is the weighted average of the percentages of the above two stocks

$$= \left(\frac{\left(1,200 \times \frac{25}{100}\right) + \left(400 \times \frac{20}{100}\right)}{1,200 + 400} \right) \times 100$$

$$= \left(\frac{300 + 80}{1,600}\right) \times 100$$

$$= \left(\frac{380}{1,600}\right) \times 100$$

= 23.75%.

66. Let the number of students in the sections P, Q, R and S be p, q, r and s, respectively.

Thus, the average weight of all students together in the four sections

$$= \left(\frac{\text{Total weight of all the students combined}}{\text{Total number of students}}\right)$$

$$= \left(\frac{45 \times p + 50 \times q + 55 \times r + 65 \times s}{p + q + r + s}\right) \text{lb.}$$

Thus, we have

$$\left(\frac{45 \times p + 50 \times q + 55 \times r + 65 \times s}{p + q + r + s}\right) = 55$$

$=> 45p + 50q + 55r + 65s = 55p + 55q + 55r + 55s$

$=> 10p + 5q = 10s$

$=> 2p + q = 2s$

Since we need to maximize r, we need to find the minimum possible values of p, q and s so that the above equation holds true.

Since the RHS of the above equation is $2s$, it is even.

Also, in the LHS of the above equation, $2p$ is even.

Thus, q must be even.

The smallest even number that we can consider for q is 2 since we have at least one student in each section. Thus, we have $q = 2$.

Thus, the equation gets modified to:

$2p + 2 = 2s$

$=> p + 1 = s$

Thus, we use the minimum possible values: $p = 1,\ s = 2$.

Thus, we have $p = 1,\ q = 2$ and $s = 2$.

Since there are a total of 40 students in all sections combined, the maximum value of students in section R = $r = 40 - (p + q + s)$

$= 40 - 5 = 35$

The correct answer is Option D.

67. Since the set starts with an odd number (1) and has an odd numbers of integers, the set would end with an odd number, too. Let's see the set.

Set N: {1, 2, 3, 4, 5, ..., (2n + 1)}, where n is a positive integer.

=> Number of odd terms is one more than the number of even terms.

Thus, the number of even terms = n

The number of odd terms = $(n + 1)$

We know that the sum (M) of p terms of an arithmetic progression having first term as a and common difference as d is given by:

$$M = \frac{p}{2}\left(2a + (p - 1) \times d\right)$$

Say, X is the average of the odd integers in set N and Y is the average of the even integers in set N

Thus, we have

$$X = \frac{(1 + 3 + 5 + \cdots + (2n + 1))}{n + 1} = \frac{\left(\frac{n + 1}{2}\right) \times (2 \times 1 + ((n + 1) - 1) \times 2)}{n + 1} = n + 1$$

$$Y = \frac{(2 + 4 + \cdots + 2n)}{n} = \frac{2 \times (1 + 2 + \cdots + n)}{n} = \frac{2 \times \left(\frac{n(n + 1)}{2}\right)}{n} = n + 1$$

Thus, we have

$$X - Y = (n + 1) - (n + 1) = 0$$

The correct answer is Option B.

Alternate approach:

Since there is no restriction on the number of terms, let us try to find $(X - Y)$ using a few values of the number of terms.

Say there are only three terms in the set.

S = {1, 2, 3}

$$X = \frac{1 + 3}{2} = 2$$

$$Y = 2$$

$$=> X - Y = 0$$

Again, say there are only five terms in the set:

S = {1, 2, 3, 4, 5}

$$X = \frac{1+3+5}{3} = 3$$

$$Y = \frac{2+4}{2} = 3$$

$=> X - Y = 0$

Since $(X - Y) = 0$ for the number of terms = 3 and the number of terms = 5, we can conclude that the value of $(X - Y)$ would be the same for any odd number of terms in the set, as we have a definite answer among the given answer options.

68. Let the seven numbers be a, b, c, d, e, f, g, h and i.

Thus, we have

$$\frac{a+b+c+d+e+f+g+h+i}{9} = 25$$

$=> a + b + c + d + e + f + g + h + i = 225 \ldots$(i)

Since the average of the first five numbers is 20, we have

$$\frac{a+b+c+d+e}{5} = 20$$

$=> a + b + c + d + e = 100 \ldots$(ii)

Since the average of the last five numbers is 32, we have

$$\frac{e+f+g+h+i}{5} = 32$$

$=> e + f + g + h + i = 160 \ldots$(iii)

Adding (ii) and (iii), we have

$a + b + c + d + 2e + f + g + h + i = 260 \ldots$(iv)

Subtracting (i) from (iv), we have

$e = 260 - 225 = 35$

Thus, the value of the fifth number is 35.

The correct answer is Option C.

69. Let the radius of each green ball = x inches.

Each green ball is 4 inches less than the average radius of the balls in Box X.

Thus, the average radius of balls in Box X = $(x + 4)$ inches.

Also, each green ball is 2 inches greater than the average radius of the balls in Box Y.

Thus, the average radius of balls in Box Y = $(x - 2)$ inches.

Thus, the required difference = $((x + 4) - (x - 2)) = 6$ inches.

Note: In this problem, there is a lot of data which has been given to make the question appear complicated. The radius of yellow balls is of no consequence. One should carefully read the problem statement and use only the information required to answer the question.

The correct answer is Option B.

70. We know that

Average salary

$$= \frac{(\text{\# of emps of group I} \times \text{Av. salary}) + (\text{\# of emps of group II} \times \text{Av. salary}) + (\text{\# of emps of group III} \times \text{Av. salary})}{\text{Total number of employees}}$$

$$=> \text{Average salary} = \$\left(\frac{10 \times 35,000 + 35 \times 30,000 + 15 \times 60,000}{60}\right)$$

$= \$38,333$

The correct answer is Option B.

Note: While calculating the average, we may work with the salaries as \$35, \$30 and \$60, respectively; and after calculating the average, multiply the result with 1,000.

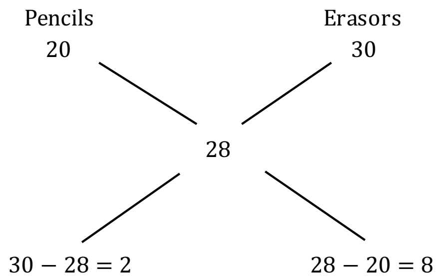
71. Let us use the method of alligation to solve this problem:

Total number of pencils and erasers bought = 20.

Price of each pencil = 20 cents.

Price of each eraser = 30 cents.

Average price of all 20 pieces = 28 cents.



Thus, ratio of the number of pencils to the number of erasers = 2 : 8 = 1 : 4.

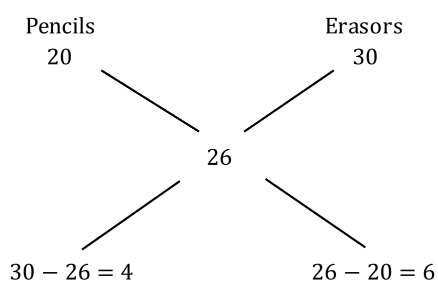
Since total number of pieces purchased are 20, we have

Number of pencils = $\left(\frac{1}{1+4}\right) \times 20 = 4$

Number of erasers = $\left(\frac{4}{1+4}\right) \times 20 = 16$

We now need to find the number of erasers required to be returned so that the average price falls to 26 cents.

So the situation is this,



Thus, ratio of the number of pencils to the number of erasers now = 4 : 6 = 2 : 3.

Since the number of pencils remains the same from the initial condition (only erasers are returned) and we had obtained 2 pencils on ratio scale, so here too, the number of pencils should be 2 on ratio scale.

Thus, the number of erasers must be 6 (since the ratio of pencils to erasers = 2 : 3).

Since initially, there were 16 erasers, number of erasers returned = 16 − 6 = 10.

The correct answer is Option E.

Alternate approach 1:

Average amount spent for 20 pieces (pencils and erasers) = 28 cents.

Total amount spent for 20 pieces = $28 \times 20 = 560$ cents.

Let us assume that the boy returned x erasers so that the average amount spent is 26 cents.

Thus, total amount spent for $(20 - x)$ pieces = $26 \times (20 - x)$ cents.

Thus, price of x erasers returned = $(560 - 26 \times (20 - x))$ cents.

Since the price of one eraser is 30 cents, we have

$$30 = \frac{560 - 26 \times (20 - x)}{x}$$

$$=> 30x = 560 - 520 + 26x$$

$$=> x = 10$$

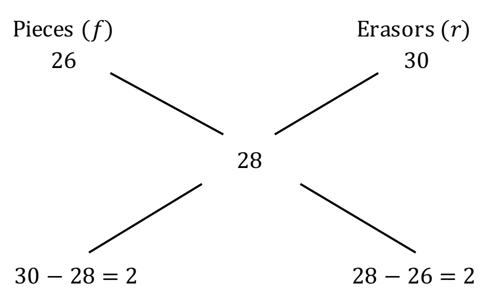
Alternate approach 2:

The average price of 20 pieces was 28 cents and after returning some erasers, say x, the average of $(20 - x)$ pieces became 26 cents.

Alternately, we can say that:

The average price of some pieces, say f, was 26 cents and after adding some erasers, say r (at 30 cents each), the average of $(f + r = 20)$ pieces became 28 cents.

Thus, by alligation method:



Thus, we have

$$f : r = 2 : 2 = 1 : 1$$

However, we know that:

$f + r = 20$

$=> f = r = \left(\frac{1}{1+1} \times 20\right) = 10$

Thus, the number of erasers returned is 10.

Alternate approach 3:

We infer the same conclusion as in the previous approach:

The average price of some pieces, say f, was 26 cents and after adding some erasers say r (at 30 cents each), the average of $(f + r = 20)$ pieces became 28 cents.

Thus, the price of each of the f pieces increased by $(28 - 26) = 2$ cents, resulting in a total increase of $2 \times f = 2f$ cents.

Also, the price of each of the r erasers reduced by $(30 - 28) = 2$ cents resulting in a total decrease of $2 \times r = 2r$ cents.

The increase of $2f$ cents came at the expense of the reduction of $2r$ cents, implying:

$2r = 2f$

$=> r = f$

But, we have

$f + r = 20$

$=> f = r = \left(\frac{1}{1+1} \times 20\right) = 10$

Thus, the number of erasors returned is 10.

72. We know that the student's average score on four tests is 78.

Thus, his total score on the four tests = $4 \times 78 = 312$.

Let the score on the 5^{th} test be n.

Thus, his total score on the five tests = $(312 + n)$.

Thus, his average on the 5 tests = $\left(\frac{312 + n}{5}\right)$.

We know that

The final average increases from the average on 4 tests by an integer

This is possible only when the average of the 5 tests is also an integer.

Again, the student's average (an integer value) on the 5 tests = $\frac{312 + n}{5} = 62 + \frac{(2 + n)}{5}$

Thus, $(n + 2)$ must be divisible by 5.

Working with the options, we see that only Option D, i.e. $n = 93$ satisfies since $(n + 2)$ is divisible by 5.

The correct answer is Option D.

73. We know that the ratio of the numbers of candidates in groups P, Q and R was 3 : 5 : 4, respectively.

Let the number of candidates in groups P, Q and R be $3x, 5x$ and $4x$, respectively, where x is a constant of proportionality.

We also know that the average scores for the groups P, Q and R were 64, 84, and 72, respectively.

Thus, the average score for the three groups combined

$$= \left(\frac{64 \times 3x + 84 \times 5x + 72 \times 4x}{3x + 5x + 4x}\right)$$

$$= \left(\frac{192x + 420x + 288x}{12x}\right)$$

$$= \left(\frac{900x}{12x}\right)$$

$$= 75$$

The correct answer is Option B.

Alternate approach:

Let us solve the problem using the concept of assumed mean (deviation method).

We know that the ratio of the numbers of candidates in the groups P, Q and R was 3 : 5 : 4, respectively.

Let the number of candidates in groups P, Q and R be $3x, 5x$ and $4x$, respectively, where x is a constant of proportionality.

We know that the average scores for the groups P, Q and R were 64, 84, and 72, respectively.

Let the assumed mean score for the three groups combined = 64.

Thus, the effective scores are: $(64 - 64) = 0$, $(84 - 64) = 20$ and $(72 - 64) = 8$

Thus, we have

Average = $\dfrac{0 \times 3x + 20 \times 5x + 8 \times 4x}{3x + 5x + 4x}$

$= \dfrac{132x}{12x}$

$= 11$

Thus, the actual average = 11 + 64 = 75.

Note: This approach leads to lesser calculations than that in the previous approach.

74. We know that there are 50 male and 20 female members.

Thus, the total number of members = 50 + 20 = 70.

As the average of all 70 members is 23 years, sum of their ages = $70 \times 23 = 1,610$

As the average of 50 male members is 20 years, sum of their ages = $50 \times 20 = 1,000$

Thus, the sum of the ages of 20 female members = $1,610 - 1,000 = 610$

Thus, the average age of these 20 female members = $\dfrac{610}{20} = 30.50$

The correct answer is Option A.

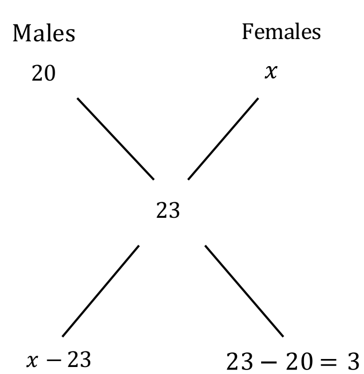
Alternate approach 1:

Here we know that the average age of 70 members = 23 years.

The average age of 50 male members = 20

Let us consider the average age of the remaining 20 female members = x years.

By the method of alligation:



Thus, we have

$\frac{x-23}{3} = \frac{50}{20} = \frac{5}{2}$

=> $2(x-23) = 5 \times 3$

=> $2x - 46 = 15$

=> $2x = 61$

$x = 30.50$ years.

Alternate approach 2:

According to the data, we have

Average age of 50 male members is 20 years and the average age of all 70 members is 23 years.

Let us reduce the above averages by 20.

Thus, the modified data is:

Average age of 50 male members is 0 years and the average age of all 70 members is 3 years.

Let, in the above situation, the average age of the 20 female members be a years.

Thus, we have

$\frac{50 \times 0 + 20a}{70} = 3$

=> $210 = 20a$

=> $a = 10.5$

To get the actual average age of the females, we must add 20 (which we had subtracted initially).

Thus, the actual average age of the females = 10.5 + 20 = 30.5

Although practically, above approach is not preferred one, for the sake of understanding, you must learn it.

75. This question is crafted to acknowledge the importance of Alternate approach 2 discussed in the previous question. In this question, while other approaches will certainly consume more time, Alternate approach 2 would excel.

According to the data, we have

Average age of 50 male members is 20.89 years and the average age of all 50 + 20 = 70 members is 23.89 years.

Let us reduce the above averages by 20.89.

Thus, the modified data is:

Average age of 50 male members is 20.89 – 20.89 = 0 years and the average age of all 70 members is 23.89 – 20.89 = 3 years.

Let, in the above situation, the average age of the 20 female members be a years.

Thus, we have

$$\frac{50 \times 0 + 20a}{70} = 3$$

=> $20a = 210$

=> $a = 10.50$

To get the actual average age of the females, we must add 23.89 (which we had subtracted initially).

Thus, the actual average age of the females = 10.50 + 23.89 = 34.39 years

The correct answer is Option C.

5.5 Ratio & Proportion

76. Fixed cost = \$25,000.

The total cost for 50,000 bearings = \$100,000.

Thus, the variable component of the total cost for 50,000 bearings = $\$\,(100,000 - 25,000) = \$75,000$.

Thus, variable cost per bearing = $\$\left(\frac{75,000}{50,000}\right) = \$1.50$.

Thus, the variable component of the total cost for 100,000 bearings = $\$\,(100,000 \times 1.50) = \$150,000$.

Thus, the total cost for 100,000 bearings = $\$\,(25,000 + 150,000) = \$175,000$.

The correct answer is Option C.

77. We know that the beaker was filled with 40 liters of water and liquid chemical with the components in the ratio 3 : 5, respectively.

Initial quantity of water = $\left(\frac{3}{3+5}\right) \times 40 = 15$ liters.

Initial quantity of liquid chemical = $\left(\frac{5}{3+5}\right) \times 40 = 25$ liters.

Amount of water evaporated per day = 2% of 15= 0.3 liters.

Thus, total amount of water evaporated in 10 days = $0.3 \times 10 = 3$ liters.

Amount of liquid chemical evaporated per day = 5% of 25 = 1.25 liters.

Thus, total amount of liquid chemical evaporated in 10 days = $1.25 \times 10 = 12.5$ liters.

Thus, total amount of mixture evaporated in 10 days = 3 + 12.5 = 15.5 liters.

Thus, the percent of the original amount of mixture evaporated

$= \frac{15.5}{40} \times 100$

= 38.75%.

The correct answer is Option C.

78. Fraction of total dolls that are Barbie dolls = $\frac{3}{5}$ . . . (i)

Thus, fraction of total dolls that are non-Barbie dolls = $1 - \frac{3}{5} = \frac{2}{5}$ . . . (ii)

Fraction of Barbies purchased before the age of 10 = $\frac{4}{7}$

Thus, fraction of Barbies purchased at the age of 10 or later = $1 - \frac{4}{7} = \frac{3}{7}$ . . . (iii)

Thus, from (i) and (iii), we have

Fraction of total dolls that are Barbies and purchased at the age of 10 or later

$= \frac{3}{5} \times \frac{3}{7} = \frac{9}{35}$

Thus, we have

$\frac{9}{35}$ of the total dolls = 90

=> Total dolls = $90 \times \frac{35}{9} = 10 \times 35 = 350$

Thus, from (ii):

Number of non-Barbie dolls = $350 \times \frac{2}{5} = 140$

The correct answer is Option C.

79. We know that, for a ratio $0 < \frac{x}{y} < 1$:

- $0 < \frac{x}{y} < \left(\frac{x+k}{y+k}\right) < 1$ ... (i), if k is a positive number
- $0 < \left(\frac{x-k}{y-k}\right) < \frac{x}{y} < 1$ ... (ii)

Also, for a ratio $\frac{x}{y} > 1$:

- $1 < \left(\frac{x+k}{y+k}\right) < \frac{x}{y}$ ... (iii), if k is a positive number
- $1 < \frac{x}{y} < \left(\frac{x-k}{y-k}\right)$ ... (iv)

In the above problem, we have

The given ratio of ages of John and Suzy = $\frac{5}{6}$ $(< 1) = \approx 0.83$

Thus, after 10 years, ages of both would increase by 10.

Hence, the final ratio must be greater than $\frac{5}{6}(= 0.83)$ (from relation (i) above).

Working with the options, we have

Option A: $\frac{2}{3} = 0.67 \ngtr 0.83$ – Does not satisfy

Option B: $\frac{13}{20} = 0.65 \ngtr 0.83$ – Does not satisfy

Option C: $\frac{11}{15} = 0.73 \ngtr 0.83$ – Does not satisfy

Option D: $\frac{4}{5} = 0.8 \ngtr 0.83$ – Does not satisfy

Option E: $\frac{9}{10} = 0.90 > 0.83$ – Satisfies

The correct answer is Option E.

80. Since the problem asks us to find a fraction value, we can assume any suitable value of the total number of phones and the time taken to produce a feature phone since the initial value does not affect the final answer.

Let the total number of phones be 5.

Thus, the number of feature phones = $\frac{2}{5} \times 5 = 2$.

Number of smartphones = $5 - 2 = 3$.

Let the time taken to produce a feature phone = 5 hours.

Thus, the time taken to produce a smartphone = $\frac{8}{5} \times 5 = 8$ hours.

Thus, total time taken to produce smartphones = $3 \times 8 = 24$ hours.

Total time taken to produce feature phones = $2 \times 5 = 10$ hours.

Thus, total time taken to produce all the phones = $24 + 10 = 34$ hours.

Thus, the required fraction = $\frac{24}{34} = \frac{12}{17}$

The correct answer is Option C.

81. We have

$$\frac{\text{Number of shirts}}{\text{Number of trousers}} = \frac{4}{5} \dots \text{(i)}$$

$$\frac{\text{Number of jackets}}{\text{Number of shirts}} = \frac{3}{8} \dots \text{(ii)}$$

$$\frac{\text{Number of sweaters}}{\text{Number of trousers}} = \frac{6}{5}$$

Taking reciprocal on both the sides:

$$=> \frac{\text{Number of trousers}}{\text{Number of sweaters}} = \frac{5}{6} \dots \text{(iii)}$$

Thus, from the above three equations, we have

$$\frac{\text{Number of jackets}}{\text{Number of sweaters}}$$

$$= \left(\frac{\text{Number of jackets}}{\text{Number of shirts}}\right) \times \left(\frac{\text{Number of shirts}}{\text{Number of trousers}}\right) \times \left(\frac{\text{Number of trousers}}{\text{Number of sweaters}}\right)$$

$$= \frac{3}{8} \times \frac{4}{5} \times \frac{5}{6}$$

$$= \frac{1}{4}$$

The correct answer is Option C.

82. Since the question asks for a fraction value, we can choose any suitable initial value of the total number for members for ease of calculation as the initial value will not affect the final answer.

Let the number of members be 100.

Thus, the number of male members = $\frac{3}{5} \times 100 = 60$.

Number of female members = $100 - 60 = 40$.

Fraction of male members who attended the prayer = $\frac{3}{5}$

Thus, the fraction of male members who did not attend the prayer = $\left(1 - \frac{3}{5}\right) = \frac{2}{5}$

Thus, the number of male members who did not attend the prayer = $\frac{2}{5} \times 60 = 24$.

Fraction of female members who attended the prayer = $\frac{7}{10}$

Thus, the fraction of female members who did not attend the prayer = $\left(1 - \frac{7}{10}\right) = \frac{3}{10}$

Thus, the number of female members who did not attend the prayer = $\frac{3}{10} \times 40 = 12$.

Thus, total number of members who did not attend the prayer = 24 + 12 = 36.

Thus, the required fraction = $\frac{\text{Number of male members who did not attend the prayer}}{\text{Total number of members who did not attend the prayer}}$

$= \frac{24}{36} = \frac{2}{3}$

The correct answer is Option C.

83. Total amount to be paid = \$100.

Amount paid by Suzy = \$20.

Thus, the amount paid by John and David = \$ (100 − 20) = \$80.

We know that John paid $\left(\frac{5}{3}\right)^{\text{th}}$ of what David paid.

Thus, ratio of the amounts paid by John and David = 5 : 3.

Thus, we need to divide \$80 in the ratio 5 : 3.

Thus, amount paid by David

$= \$ \left(\frac{3}{5+3}\right) \times 80 = 30$

Thus, the fraction of the total amount paid by David

$= \frac{30}{100} = \frac{3}{10}$

The correct answer is Option D.

84. Total number of shirts and trousers = X.

We know that the ratio of the number of trousers to the number of shirts = 1 : 5.

Thus, the number of shirts

$= \left(\frac{5}{5+1}\right) \times X$

$= \frac{5X}{6}$

Thus, the number of cotton shirts = $\left(\frac{1}{5}\right)^{\text{th}}$ of the number of shirts

$= \frac{1}{5} \times \frac{5X}{6}$

$= \frac{X}{6}$

The correct answer is Option E.

85. Total weight of the rod = 20 pounds.

We know that the weight (w) of each piece is directly proportional to the square of its length (l).

Weight of the first piece (w_1), which is 36 feet long (l_1) = 16 pounds.

Thus, weight of the other piece (w_2) = 20 − 16 = 4 pounds.

Thus, we have

$w \propto l^2$

$=> \frac{w_1}{w_2} = \frac{(l_1)^2}{(l_2)^2}$

$=> \frac{16}{4} = \frac{36^2}{(l_2)^2}$

$=> (l_2)^2 = 36^2 \times \left(\frac{4}{16}\right)$

$=> (l_2)^2 = \frac{36^2}{4}$

$=> (l_2)^2 = \left(\frac{36}{2}\right)^2$

$=> (l_2)^2 = 18^2$

$=> (l_2)^2 = 18$

Thus, the length of the second piece = 18 feet.

The correct answer is Option C.

86. We know that the ratio of coins of John to that of Suzy = 3 : 4

Let John's and Suzy's coins be $3x$ and $4x$, respectively, where x is a constant of proportionality.

Thus, the total number of coins = $3x + 4x = 7x$.

Since John's share exceeds $\frac{2}{7}$ of the total number of coins by 100, we have

$3x = \frac{2}{7} \times 7x + 25$

$=> x = 25$

Thus, Suzy's coins

$= 4x = 4 \times 25 = 100.$

The correct answer is Option B.

87. Say Material cost, Labour cost, Factory overhead cost, and Office overhead cost are a, b, c, and d.

Since we have to deal with fractions, $\frac{3}{7}$, $\frac{4}{7}$, and $\frac{1}{2}$, let us assume that the total cost = \$1,400.

Thus, we have...

$a + b = \frac{3}{7}$ of 1,400 = 600 ...(1)

$b + c = \frac{1}{2}$ of 1,400 = 700 ...(2)

$c + d = \frac{4}{7}$ of 1,400 = 800 ...(3)

$a + d = \frac{1}{2}$ of 1,400 = 700 ...(4)

Subtracting equation (2) from (1), we get

$c - a = 100 => c > a$; a is not the highest.

Subtracting equation (2) from (3), we get

$d - b = 100 => d > b$; b is not the highest.

We cannot establish whether $c >=< d$. Factory overhead cost or Office overhead cost can be highest.

The correct answer is Option E.

88. Let the number of points for the 1^{st} question = x.

We know that each question is worth 2 points more than the preceding question.

Thus, the worth of each question in points for the 20 questions forms an arithmetic progression with the first term as x and a constant difference between consecutive terms of 2.

The n^{th} term in arithmetic progression = $a + (n - 1) \times d$; (a is the first term, and d is the constant difference between consecutive terms)

Thus, the number of points for the 20^{th} question = $x + (20 - 1) \times 2 = (x + 38)$.

Since the points for the above questions have a constant difference, the average points per question

$= \left(\frac{\text{First term} + \text{Last term}}{2}\right)$

$= \frac{x + (x + 38)}{2}$

$= (x + 19)$

Thus, the total points for all 20 questions = $20 \times (x + 19)$.

Thus, we have

$20\,(x + 19) = 400$

$=> x = 1$

Thus, the number of points for the 4th question = $x + (4 - 1) \times 2 = 1 + 6 = 7$.

The correct answer is Option B.

89. Let the number of students in the school = x.

Thus, number of students taking the science course = $\left(80 + \frac{x}{3}\right)$.

Thus, the number of students taking chemistry = $\frac{1}{3}\left(80 + \frac{x}{3}\right)$.

Since $\left(\frac{1}{6}\right)^{\text{th}}$ of the students are taking chemistry, we have

$\frac{1}{3}\left(80 + \frac{x}{3}\right) = \frac{x}{6}$

$=> 80 + \frac{x}{3} = \frac{x}{2}$

$=> \frac{x}{2} - \frac{x}{3} = 80$

$=> \frac{x}{6} = 80$

$=> x = 480$

The correct answer is Option C.

90. Let the number of males = x.

Thus, the number of females = $(50 - x)$.

Thus, the number of employees who eat company breakfast

$$= \frac{x}{4} + \frac{50 - x}{5}$$

$$= \frac{5x + 4\,(50 - x)}{20}$$

$$= \frac{x + 200}{20}$$

$$= \frac{x}{20} + 10$$

Thus, to maximize the above value, we must have the largest possible value of x.

Also, since $\frac{x}{20}$ must be an integer, we have to choose $x = 40$.

Thus, the required maximum value = $\frac{40}{20} + 10 = 12$

The correct answer is Option D.

91. Let T, F and M be the total number of students, the number of female and the number of male, respectively.

We have

$$\frac{1}{8} \times F = \frac{1}{12} \times T$$

$$=> F = \frac{8}{12} \times T$$

$$=> F = \frac{2}{3} \times T$$

$$=> M = \left(1 - \frac{2}{3}\right) \times T$$

$$=> M = \frac{1}{3} \times T$$

$$=> \frac{M}{F} = \frac{\frac{1}{3} \times T}{\frac{2}{3} \times T}$$

$$=> \frac{M}{F} = \frac{\frac{1}{3}}{\frac{2}{3}} = \frac{1}{2}$$

Thus, the required ratio = $\frac{1}{2}$

The correct answer is Option C.

92. The incorrect total of the score of the class = $40 \times 32 = 1,280$.

The correct total of the score of the class = $1,280 - 30 + 40 = 1,290$.

The correct average (arithmetic mean) score of the class = $\frac{1,290}{40} = 32.25$.

The information that the average (arithmetic mean) score of the girls is 30 and that of boys is 40 is redundant.

The correct answer is Option C.

Alternate approach:

Since the correct score (40) is greater than the incorrect score (30), the average score would increase by $\frac{(40 - 30)}{40} = 0.25$.

Thus the correct average (arithmetic mean) score of the class = $32 + 0.25 = 32.25$.

93. We have 120 liters of 25% Chemical A solution.

Thus, amount of Chemical A = 25% of 120

$= \frac{25}{100} \times 120$

= 30 liters

Let x liters of Chemical A be added.

Thus, the final amount of Chemical A = $(x + 30)$ liters.

Total volume of the solution = $(x + 120)$ liters.

Since the final concentration of Chemical A is 40%, we have

$\left(\frac{x + 30}{x + 120}\right) \times 100 = 40$

$=> \left(\frac{x + 30}{x + 120}\right) = \frac{40}{100} = \frac{2}{5}$

$=> 5x + 150 = 2x + 240$

$=> x = 30$

The correct answer is Option E.

Alternate approach:

Amount of water in the initial solution = (100 − 25) % of 120 = 75% of 120 = 90 liters.

Let x liters of Chemical A be added.

Total volume of the solution = $(x + 120)$ liters.

Final concentration of water = (100 − 40) % = 60%

Since water is not added, the quantity of water remains the same, i.e. 90 liters.

Thus, we have

$$\left(\frac{90}{x + 120}\right) \times 100 = 60$$

$$=> \frac{90}{x + 120} = \frac{60}{100} = \frac{3}{5}$$

$$=> 3x + 360 = 450$$

$$=> x = 30$$

94. Increase in the number of chickens from the first month (144) to the second month (c) $= (c - 144)$

Thus, fractional increase

$$= \frac{\text{Increase}}{\text{Original value}}$$

$$= \left(\frac{c - 144}{144}\right)$$

Increase in the number of chickens from the second month (c) to the third month (256) $= (256 - c)$

Thus, fractional increase

$$= \frac{\text{Increase}}{\text{Original value}}$$

$$= \left(\frac{256 - c}{c}\right)$$

Since the fractional increases are the same, we have

$$\frac{c - 144}{144} = \frac{256 - c}{c}$$

$$=> \frac{c}{144} - 1 = \frac{256}{c} - 1$$

$$=> \frac{c}{144} = \frac{256}{c}$$

$$=> c^2 = 144 \times 256$$

$$=> c = 12 \times 16$$

$$=> c = 192$$

The correct answer is Option A.

Alternate approach 1:

Since the number of chickens increased by the same fraction during each of the two periods, we can say that the ratio of the number of chickens in consecutive intervals would be equal.

Thus we have

$$\frac{144}{c} = \frac{c}{256}$$

$$=> c^2 = 144 \times 256$$

$$=> c = 12 \times 16$$

$$=> c = 192$$

Alternate approach 2:

Since the fractional increase in each period is the same, we can conclude that the percent change in each period is also the same.

Let the percent change be r.

Thus, using the concept of compound interest, we have

$$256 = 144 \times \left(1 + \frac{r}{100}\right)^2$$

$$=> \left(1 + \frac{r}{100}\right)^2 = \left(\frac{16}{12}\right)^2$$

$$=> 1 + \frac{r}{100} = \frac{16}{12}$$

$$=> 1 + \frac{r}{100} = \frac{4}{3}$$

$$=> \frac{r}{100} = \frac{1}{3}$$

$=> r = \frac{100}{3}\%$

$=>$The number of chickens by second month, $c = 144 \times \left(1 + \frac{100/3}{100}\right)^1 = 144 \times \left(\frac{4}{3}\right) = 192$

5.6 Speed, Time & Distance

95. Let the the average speed for the trip be S.

T_1 = Time required to travel 900 miles with speed $S = \frac{900}{S}$ hours

S is increased by 10 miles; so new speed = $(S + 10)$ mph

T_2 = Time required to travel 900 miles with speed $(S + 10) = \frac{900}{S + 10}$ hours

Given that the difference between $T_1$and T_2 is 1 hour

$=> \frac{900}{S} - \frac{900}{S + 10} = 1$

$=> 900\left(\frac{1}{S} - \frac{1}{S + 10}\right) = 1$

$=> \frac{S + 10 - S}{S(S + 10)} = \frac{1}{900}$

$=> 10 \times 900 = S^2 + 10S$

$=> S^2 + 10S - 9,000 = 0$

Roots of above quadratic equations are '90' and '−100'.

Since speed cannot be negative, '−100' is ignored, so $S = 90$ mph.

The correct answer is Option E.

96. The truck traveled 4 miles less per gallon on the state highway compared to on the national highway.

Let's consider if the truck travels x miles per gallon on the national highway then the truck travels $(x - 4)$ miles per gallon on the state highway.

Capacity of the full tank of diesel on the national highway = $\frac{336}{x}$ gallons

Capacity of the full tank of diesel on the state highway = $\frac{224}{x - 4}$ gallons

Since the above fractions must be equal, we have

$\frac{336}{x} = \frac{224}{x - 4}$

$=> \frac{3}{x} = \frac{2}{x - 4}$

$=> 3x - 12 = 2x$

$=> x = 12$

As the truck travels $(x - 4)$ miles per gallon on the state highway, required answer is $12 - 4 = 8$.

The correct answer is Option B.

97. Time required to travel 10 miles at speed 60 miles per hour

$= \frac{10}{60}$ hours $= \frac{10}{60} \times 60$ minutes $= 10$ minutes

Now new time required $= 10 + 5 = 15$ minutes $= \frac{15}{60} = \frac{1}{4}$ hours.

Speed $= \frac{\text{Distance}}{\text{Time}}$

$= \frac{10 \text{ miles}}{15 \text{ Minutes}} = \frac{10}{\frac{1}{4}} = 40$ miles per hour

The correct answer is Option B.

98. Speed for first 10-minutes interval = 30 miles per hour

Speed for second 10-minutes interval = 40 miles per hour

Speed for third 10-minute interval = 50 miles per hour

Speed for fourth 10-minute interval = 60 miles per hour

Distance travelled in the fourth 10-minute interval $= \frac{60}{60} \times 10 = 10$ miles

The correct answer is Option D.

99. Time taken for the onward journey $= \frac{600}{500} = \frac{6}{5}$ hours.

Time taken for the return journey $= \frac{600}{400} = \frac{3}{2}$ hours.

Thus, total time taken for the round trip $= \frac{6}{5} + \frac{3}{2} = \frac{27}{10}$ hours.

Total distance travelled $= 2 \times 600 = 1200$ miles.

Thus, average speed $= \frac{\text{Total distance}}{\text{Total time}} = \frac{1,200}{\frac{27}{10}} = 1200 \times \frac{10}{27} = 1,000 \times \frac{4}{9} = \approx 444$ miles/hr.

The correct answer is Option B.

Alternate approach:

Since the distance travelled for the onward and the return journey is the same, we have

Average speed = $\frac{2 \times \text{Speed}_1 \times \text{Speed}_2}{\text{Speed}_1 + \text{Speed}_2} = \frac{2 \times 500 \times 400}{500 + 400} = \frac{2 \times 500 \times 400}{900} = \frac{4,000}{9} =\approx 444$ mph

100. Average speed of the truck for 1/2 of 800 miles (= 400 miles) = 40 miles per hour

Thus, time taken to cover the above distance (400 miles) = $\frac{400}{40}$ = 10 hours

Average speed of the truck or the entire 800 miles = 50 miles per hour

Thus, time taken to cover the total distance = $\frac{800}{50}$ = 16 hours

Thus, time taken by the truck to cover the remaining miles 400 miles = 16 – 10 = 6 hours

Thus, average speed of the truck for the remaining miles 400 miles = $\frac{400}{6}$ = 66.66 =≈ 67 miles per hour.

The correct answer is Option D.

101. Let the marathoner's speed on the first day be x miles per hour.

Thus, the his speed on the second day was $(x + 3)$ miles per hour.

Let the time for which the marathoner ran on the first day be t hours.

Thus, the time for which he ran on the second day = $(8 - t)$ hours.

Distance covered by him on the first day = $(x \times t)$ miles.

Distance covered by him on the second day = $((x + 3) \times (8 - t))$ miles.

Thus, total distance covered in two days = $[xt + (x + 3)\ (8 - t)]$ miles.

Thus, we have

$xt + (x + 3)\ (8 - t) = 36$

$=> xt + 8x - xt + 24 - 3t = 36$

$=> 8x = 3t + 12$

Since this is a single linear equation with two variables, we cannot get the unique value of x; however, we can get consistent values of x.

Working with the options one at a time:

Option A: $x = 0.5 \Rightarrow t = -4$ – Not possible, since t cannot be negative

We can deduce that since this is a 'Could be value' type of question, and we see that the smallest option value of x yields negative value for t, thus we should first try the largest value of x among the options.

Option E: $x = 2 \Rightarrow t = 4/3$ – Possible

Since this is a 'Could be value' type of question, and only one option is correct, Option E is the correct answer. There is no need to check other options since two or more options cannot be simultaneously correct.

Thus, we have $x = 2$

The correct answer is Option E.

Alternate approach:

Average speed of the marathoner for the two days $= \left(\frac{\text{Total distance}}{\text{Total time}}\right) = \frac{36}{8} = 4.5$ miles per hour.

If the average speed on the first day be x miles per hour, the average speed on the second day should be $(x + 3)$ miles per hour.

Thus, the average speed of 4.5 miles per hour must lie between the values of the speeds on the two days.

Thus, we have

$x < 4.5 < x + 3$

Among the options, only $x = 2$ satisfies.

102. On seeing this question, one would immediately calculate the time taken to meet using the data given.

From there on, one would try to find the distance between the trains 2 hours before they meet.

However, such calculations are not necessary.

The question simply asks us, "If two trains traveling at 50 miles per hour and 60 miles per hour need 2 hours to meet, how far away are they from one another."

Since both the trains travel for 2 hours before they meet, one train travels $50 \times 2 = 100$ miles and the other train travels $60 \times 2 = 120$ miles.

Thus, together the trains travel (100 + 120) = 220 miles before they meet.

Thus, distance between the trains 2 hours before they meet = 220 miles.

The correct answer is Option E.

103. Length of section = 10 miles.

Original speed limit = 50 miles per hour.

Thus, time taken to cover this distance = $\frac{10}{50} = \frac{1}{5}$ hours

New speed limit = 40 miles per hour.

Thus, time taken to cover this distance = $\frac{10}{40} = \frac{1}{4}$ hours

Thus, the required difference between the time durations is given = $\left(\frac{1}{4} - \frac{1}{5}\right)$ hours

$= \frac{1}{20}$ hours

$= \frac{1}{20} \times 60 = 3$ minutes

The correct answer is Option A.

104. We know that

Speed of Train B = 25% more than the speed of Train A

=> Speed of Train B = (100 + 25)% of the speed of Train A

=> Speed of Train B = 125% of the speed of Train A

=> Speed of Train B = $\frac{125}{100} \times$ (Speed of Train A)

=> Speed of Train B = $\frac{5}{4} \times$ (Speed of Train A)

=> $\frac{\text{Speed of Train B}}{\text{Speed of Train A}} = \frac{5}{4}$

Since time is inversely proportional to speed for a constant distance, we have

$$\frac{\text{Time taken by Train B to cover a distance}}{\text{Time taken by Train A to cover the same distance}} = \frac{1}{\frac{5}{4}} = \frac{4}{5}$$

We know that Train A took 4 hours to cover the distance.

Thus, we have

=> Time taken by Train B to cover a distance = $4 \times \frac{4}{5} = \frac{16}{5} = 3\frac{1}{5}$ hours

The correct answer is Option C.

Alternate approach:

Train A took 4 hours to travel 100 miles.

Thus, the average speed of Train A = 25 miles per hour.

Since the average speed of Train B is 25% more than that of Train A, we have

Average speed of Train B = 25 + 25% of 25 = $\frac{125}{4}$ miles per hour.

Thus, time required to travel 100 miles by Train B

$= \frac{\text{Distance}}{\text{Speed}} = \frac{100}{\frac{125}{4}} = \frac{16}{5} = 3\frac{1}{5}$ hours

105. Jeff's speed = 40 miles per hour.

Thus, distance covered by Jeff in 60 minutes = 40 miles.

Thus, distance covered by Jeff in 36 minutes = $\frac{40}{60} \times 36 = 24$ miles.

This distance of 24 miles is 3 times of what Amy drives in 30 minutes.

Thus, distance covered by Amy in 30 minutes = $\frac{24}{3} = 8$ miles.

Thus, distance covered by Amy in 60 minutes = $\frac{60}{30} \times 8 = 16$ miles.

Thus, Amy's speed = 16 miles per hour.

The correct answer is Option C.

106. Time taken for the first bus to cover the distance between the two depots A & B = 5 hours.

Time taken for the second bus to cover the distance between the two depots A & B = 3 hours.

Since we need to find the time when the two buses pass one another, the actual length of the distance is not required.

So, we can assume a suitable value of the distance for ease of calculations.

Let the distance between the depots = least common multiple of 5 and 3 = 15 miles.

Thus, speed of the first bus = $\frac{15}{5}$ = 3 miles/hour.

Speed of the second bus = $\frac{15}{3}$ = 5 miles/hour.

We know that the first bus started one hour earlier than when the second bus started.

Thus, in 1 hour, the distance covered by the first bus = 3×1 = 3 miles.

Thus, at 8:00 am, the distance between the two buses = $(15 - 3)$ = 12 miles.

At 8:00 am, both buses approach one another at speeds 3 miles/hour and 5 miles/hour.

Thus, when the buses pass one another, the ratio of the distances covered by the trains would be equal to the ratio of their respective speeds = 3 : 5

Thus, distance covered by the first bus = $\left(\frac{3}{3+5}\right) \times 12$ = 4.5 miles.

Time taken by the first bus to cover 4.5 miles = $\frac{4.5}{3}$ = 1.5 hours = 1 hour 30 minutes.

The buses will meet at 8:00 am + 1 hour 30 minutes = 9:30 am.

Alternately, we can use the concept of relative speed:

Since the buses travel in opposite directions, their relative speed = $(3 + 5)$ = 8 miles/hour.

Thus, time taken to cover 12 miles = $\frac{12}{8}$ = 1.5 hours = 1 hour 30 minutes.

Thus, the time when the two buses pass one another = 1 hour 30 minutes past 8:00 am

The correct answer is Option C.

5.7 Time & Work

107. Number of copies made per hour by the first machine = 1,500.

Thus, number of copies made per hour by the second machine = $2 \times 1,500 = 3,000$
(Since it is twice as efficient as the first machine)

Since the second machine works 12 hours a day, number of copies made in a day

$= 3,000 \times 12 =$ 36,000

Thus, number of copies made in 20 days = $36,000 \times 20 =$ 720,000

The correct answer is Option E.

108. According to the given data, the pump filled $\left(\frac{5}{6} - \frac{1}{2}\right) = \frac{1}{3}$ part of the pool in $2\frac{1}{3}\left(= \frac{7}{3}\right)$ hours

Thus, time taken by the pump to fill the entire pool = $\frac{\left(\frac{7}{3}\right)}{\left(\frac{1}{3}\right)} = \frac{7}{3} \times \frac{3}{1} = 7$ hours

The correct answer is Option C.

109. Let the volume of the pool = LCM (10, 15) = 30 liters

The first pump can fill the pool in 10 hours.
Thus, the rate of the first pump = $\frac{30}{10} = 3$ liters per hour.

The second pump can fill the pool in 15 hours.
Thus, the rate of the second pump = $\frac{30}{15} = 2$ liters per hour.

The first pump was on for the entire 7 hours in which it filled = $7 \times 3 = 21$ liters.

Thus, the remaining $(30 - 21) = 9$ liters were filled by the second pump.

Time taken for the second pump to fill 9 liters = $\frac{9}{2} = 4.50$ hours.

Thus, of the total 7 hours, the second pump was on for 4.50 hours.

Thus, the first pump alone was on for $(7 - 4.50) = 2.50$ hours.

Thus, $h = 2.50$

The correct answer is Option B.

110. The emptying pipe can empty the pool which is $\left(\frac{3}{4}\right)^{\text{th}}$ full in 9 hours.

Thus, time taken to empty the entire pool = $9 \times \frac{4}{3}$ = 12 hours.

It is given that capacity of swimming pool is 5,760 gallons.

Thus, the rate at which the emptying pipe removes water
= $\frac{5,760}{12}$ = 480 gallons per hour.

The rate at which the pool can be filled
= 12 gallons per minute

= 12×60 = 720 gallons per hour.

Thus, the effective filling rate when both filling and emptying occur simultaneously
= 720 − 480 = 240 gallons per hour.

Since we need to fill only half the pool, the volume required to be filled
= $\frac{5,760}{2}$ = 2,880 gallons.

Thus, time required = $\frac{2,880}{240}$ = 12 hours.

The correct answer is Option B.

111. We know that lathe machine B manufactures 300 X-type bearings in 60 days.

Since lathe machine A manufactures bearings thrice as fast as machine B does, time taken by lathe machine A to manufacturer 300 X-type bearings
= $\frac{60}{3}$ = 20 days

Since each Y-type bearing takes 2.5 times the time taken to manufacturer each X-type bearing, the time taken by lathe machine A to manufacturer 300 Y-type bearings
= 20×2.5 = 50 days

Thus, the number of Y-type bearings manufactured by lathe machine A in 50 days = 300.

Thus, the number of bearings manufactured by lathe machine A in 10 days

= $\frac{10}{50} \times 300 = 60$

The correct answer is Option D.

112. Numbers of copies made by Photocopier A in 1 hour = $\frac{1,200}{3}$ = 400

Numbers of copies made by Photocopier B in 1 hour = $\frac{1,200}{2}$ = 600

Numbers of copies made by Photocopier C in 1 hour = $\frac{1,200}{6}$ = 200

Thus, when all the three photocopiers work together, total numbers of copies made in 1 hour

= 400 + 600 + 200 = 1,200 copies

Thus, time taken to make 3,600 copies = $\frac{3,600}{1,200}$ = 3 hours.

The correct answer is Option D.

113. Cost of food consumed by 5 men in 4 days = \$150

=> Cost of food consumed by 1 man in 4 days = $\$\left(\frac{150}{5}\right) = \$30$

=> Cost of food consumed by 1 man in 1 day = $\$\left(\frac{30}{4}\right) = \$\left(\frac{15}{2}\right)$

We know that one woman consumes three-fourth the amount of food consumed by a man.

Thus, 2 women consume food equivalent to $2 \times \left(\frac{3}{4}\right) = \frac{3}{2}$ men.

Thus, 4 men and 2 women are equivalent to $\left(4 + \frac{3}{2}\right) = \frac{11}{2}$ men.

Thus, cost of food consumed by $\frac{11}{2}$ men in 1 day = $\$\left(\frac{15}{2} \times \frac{11}{2}\right) = \$\left(\frac{165}{4}\right)$

=> Cost of food consumed by $\frac{11}{2}$ men in 8 days = $\$\left(\frac{165}{4} \times 8\right) = \$330$

The correct answer is Option B.

114. Let the time taken by Mark and Kate working together = x hours

Thus, time taken by Mark, working alone = $(x + 12)$ hours

Time taken by Kate, working alone = $(x + 27)$ hours

Let us assume the total work to be 1 unit.

Part of work done by Mark and Kate, working together, in 1 hour = $\left(\frac{1}{x}\right)$

Part of work done by Mark in 1 hour = $\left(\frac{1}{x + 12}\right)$

Part of work done by Kate in 1 hour = $\left(\frac{1}{x+27}\right)$

Thus, we have

$$\frac{1}{x} = \frac{1}{x+12} + \frac{1}{x+27}$$

$$=> \frac{1}{x} = \frac{(x+27)+(x+12)}{(x+12)(x+27)}$$

$$=> (x+12)(x+27) = x(2x+39)$$

$$=> x^2 + 39x + 324 = 2x^2 + 39x$$

$$=> x^2 = 324$$

Since x is positive, we have

$$x = \sqrt{324} = 18$$

The correct answer is Option C.

Alternate approach:

Work done by Mark and Kate in x hours = Work done by Mark in $(x + 12)$ hours

Cancelling work done by Mark in x hours from both sides:

Work done by Kate in x hours = Work done by Mark in 12 hours

=> Work done by Kate in 1 hour = Work done by Mark in $\left(\frac{12}{x}\right)$ hours . . . (i)

Again, we have

Work done by Mark and Kate in x hours = Work done by Kate in $(x + 27)$ hours

Cancelling work done by Kate in x hours from both sides:

Work done by Mark in x hours = Work done by Kate in 27 hours

=> Work done by Kate in 27 hours = Work done by Mark in x hours

=> Work done by Kate in 1 hour = Work done by Mark in $\left(\frac{x}{27}\right)$ hours . . . (ii)

Thus, from (i) and (ii), we have

$$\frac{12}{x} = \frac{x}{27}$$

=> $x^2 = 324$

=> $x = 18$

5.8 Computational

115. Amount of chemical evaporated in y minutes = x liters.

Thus, the amount of chemical evaporated in 1 minute = $\frac{x}{y}$ liters.

Thus, the amount of chemical evaporated in z minutes = $\frac{xz}{y}$ liters.

Cost of 1 liter of the chemical = \$25.

Thus, cost of the chemical evaporated in z minutes = $\$\left(25 \times \frac{xz}{y}\right) = \$\left(\frac{25xz}{y}\right)$.

The correct answer is Option D.

116. We know that the total cost of producing 25,000 pens is \$37,500 and the total cost of producing 35,000 pens is \$47,500.

Since it is given that total cost of producing pens is governed by a linear function, total cost must have a fixed cost component and a variable complement.

Note that fixed cost component is same, irrespective of how many pens Company X makes.

Thus, incremental cost (variable complement) of producing additional 10,000 pens (= 35,000 − 25,000) pens = \$47,500 − \$37,500 = \$10,000.

=> Thus, incremental cost (variable complement) of producing additional 1 pen = $\frac{10,000}{10,000} = \$1$

Thus, incremental cost (variable complement) of producing additional 15,000 pens (= 50,000 − 35,000) pens = $1 \times 15,000 = \$15,000$

=> Thus, total cost of producing 50,000 pen = total cost of producing 35,000 pen + incremental cost (variable complement) of producing additional 15,000 pens = \$47,500 + \$15,000 = \$62,500

The correct answer is Option C.

117. The cost of four pencils = $\$\,(1.35 \times 4) = \$5.40$

The cost of two erasers = $\$\,(0.30 \times 2) = \$0.60$

Thus, total cost = $\$(5.40 + 0.60) = \$6.00$

Thus, Suzy has one-third of the above amount = $\$\left(\frac{6}{3}\right) = \$2$

The correct answer is Option B.

118. Total increase in population = 378 − 360 = 18 million

Increase in population per month = 30,000

Thus, increase in population per year = $30,000 \times 12$ = 360,000 = 0.36 million

Thus, number of years required for the increase = $\frac{18}{0.36}$ = 50 years

Thus, the population would be 378 million in the year $(2012 + 50) = 2062$

The correct answer is Option C.

119. The restaurant uses $\frac{1}{2}$ cup milk-cream in each serving of its ice-cream.

Since each carton has $2\frac{1}{2} = \frac{5}{2}$ cups of milk-cream, number of servings of ice-cream possible using one carton = $\frac{\left(\frac{5}{2}\right)}{\left(\frac{1}{2}\right)} = 5$

Thus, number of cartons required for 98 servings of the ice-cream = $\frac{98}{5} =\approx 19.3$

However, the number of cartons must be an integer.

Thus, the minimum number of cans required is 20.

The correct answer is Option C.

120. We need to minimize the total number of coins such that each box has at least 2 coins.

We know that at the most 3 boxes can have the same number of coins.

Since we need to minimize the total number of coins, we must have as many boxes having the same number (minimum possible number, i.e. 2 coins) of coins as possible.

Thus, for each of the 3 boxes containing an equal number of coins, we have ‘2’ coins.

Thus, number of coins in the 3 boxes = $2 \times 3 = 6$.

Since each of the remaining 4 boxes have a different number of coins, let us put in 3, 4, 5, and 6 coins in those boxes.

Thus, the total number of coins = 6 + (3 + 4 + 5 + 6) = 24.

The correct answer is Option C.

121. Distance covered by the lava in 1 hour = $\frac{15}{4}$ feet

$= \frac{\frac{15}{4}}{5,280}$ miles $= \frac{15}{4 \times 5,280}$ miles

Hours needed to cover $\frac{3}{2}$ miles $= \frac{\frac{3}{2}}{\frac{15}{4\times 5,280}}$

$= \frac{3 \times 4 \times 5,280}{2 \times 15} = 2,112$ hours

Days needed to cover $\frac{3}{2}$ miles $= \frac{2,112}{24} = 88$ days

The correct answer is Option E.

122. Cross-sectional area of the bar = 4 square feet

Rate at which the bar moves through the conveyor

= 360 feet per hour

$= \frac{360}{60 \times 60}$ feet per second

= 0.1 feet per second

Thus, volume of the bar that moves through the conveyor per second

$= 0.1 \times 4$ cubic feet

= 0.4 cubic feet

Thus, time taken to move 0.4 cubic feet of bar through the conveyor = 1 second.

Thus, time taken to move 8.4 cubic feet of bar through the conveyor $= \frac{8.4}{0.4} = 21$ seconds.

The correct answer is Option A.

123. We know that for a salary grade G, the hourly wage W, in dollars, is given by:

$W = 1,140 + 45(G - 1)$

Thus, for a salary grade $G = 1$, the corresponding hourly wage W

$= \$\,(1,140 + 45\,(1 - 1))$

$= \$1,140$

Again, for a salary grade $G = 7$, the corresponding hourly wage W

$= \$\,(1,140 + 45\,(7 - 1))$

$= \$(1,140 + 270)$

$= \$1,410$

Thus, the required difference = $\$\,(1,410 - 1,140) = \$270$.

The correct answer is Option B.

Alternate approach:

We have wage equation: $W = 1,140 + 45(G - 1)$

$=> W = 1,140 - 45 + 45G$

We see that in the above equation, $45G$ is variable and '$1,140 - 45$' is a constant for the workers of all the grades.

Thus, the difference between the remuneration would result because of $45G$.

Thus, difference in remuneration of grade-7 and grade-1 worker = $45 \times 7 - 45 \times 1 = \$270$.

124. Considering the radios sold:

We know that the price of the certain radio was the 15^{th} highest price as well as the 20^{th} lowest price among the prices of the radios sold.

Thus, the number of radios sold at a price greater than the price of the particular radio $= 15 - 1 = 14$

Also, the number of radios sold at a price lower than the price of the particular radio $= 20 - 1 = 19$

Thus, total number of radios sold = 14 + 19 + 1 (including that particular radio) = 34

Considering all the items sold:

We know that the price of the certain DVD player was the 29^{th} highest price as well as the 37^{th} lowest price among the prices of all the items sold.

Thus, the number of items sold at a price greater than the price of the particular item (i.e. DVD player) $= 29 - 1 = 28$

Also, the number of items sold at a price lower than the price of the particular item (i.e. DVD player) = 37 − 1 = 36.

Thus, total number of items sold = 28 + 36 + 1 (including that particular radio) = 65

Thus, the number of DVD players = Total number of items − number of radios = 65 − 34 = 31

The correct answer is Option B.

125. Commission received on the first 150 orders at the rate of $25 per order

$= \$\,(25 \times 150) = \$3,750$

Total commission received received = $5,000.

Thus, commission received on the additional orders (above 150) at $12.50 per order

$= \$(5,000 - 3,750) = \$1,250$

Thus, number of additional order made= $\frac{1,250}{12.5}$

= 100

Thus, total number of order = Initial 100 orders + Additional 100 orders

= 200 orders

The correct answer is Option D.

126. The loss would be minimum if fewer number of $50 checks were lost as compared to $20 checks.

Thus, the traveler should have cashed a greater number of $50 checks than $20 checks.

We know that the number of $20 checks cashed was 2 more or 2 less than the number of $50 checks cashed.

Thus, from the above reasoning, we can conclude that the number of $20 checks was 2 less than the number of $50 checks.

Since the total number of checks cashed was 10, from the above information, we have

Number of $50 checks cashed = 6
Number of $20 checks cashed = 4

Alternately:

Let the number of $50 checks cashed = x

Thus, the number of \$20 checks cashed = $(x - 2)$

Since the total number of checks cashed is 10, we have

$x + (x - 2) = 10$

$=> x = 6$

Thus, the total value of \$20 checks cashed = \$ $(4 \times 20) = \$80$.

The total value of \$50 checks cashed = \$ $(6 \times 50) = \$300$.

Thus, the total value of all the checks cashed = \$ $(80 + 300) = \$380$.

We know that the total value of all the checks with him was \$2,000.

Thus, the total value of all the checks lost = \$ $(2,000 - 380) = \$1,620$.

The correct answer is Option D.

127. Let's list down per kg prices realized upon buying three pack-sizes.

1. 5-kg pack for \$16 => $\frac{16}{5}$ = \$3.20 per kg.
2. 10-kg pack for \$26 => $\frac{26}{10}$ = \$2.60 per kg.
3. 25-kg pack for \$55 => $\frac{55}{25}$ = \$2.20 per kg.

From the above calculation, it is obvious that larger the pack size, smaller the per kg amount a customer has to pay.

Let's take few options the customer can take to buy 40 kg dog food.

1. Buy 50 kg.: 2 packs of 25 kg

Cost = $2 \times 55 = \$110$; though the quantity of food (50 kg) is more than the minimum required (40 kg), we must take this option into consideration since the per kg price of the food is least for a 25 kg pack.

2. Buy 45 kg.: 1 pack of 25 kg and 2 packs of 10 kg

Cost = $55 + 2 \times 26 = \$107$

3. Buy 40 kg.: 1 pack of 25 kg, 1 pack of 10 kg, and 1 pack of 5 kg

Cost = $55 + 26 + 16 = \$97$

From the above, it is clear that the customer must buy 40 kg (1 pack of 25 kg, 1 pack of 10 kg, and 1 pack of 5 kg), paying the minimum price of \$97.

The correct answer is Option C.

5.9 Interest

128. Amount after 4 years = \$3,200
Amount after 6 years = \$3,800

Thus, interest accumulated in 2 (= 6 – 4) years = $\$ \left(3,800 - 2,200\right) = \$600$

Thus, interest accumulated per year = $\$ \left(\frac{600}{2}\right) = \$300$ (since under simple interest, interest accumulated every year is constant)

Thus, interest accumulated in the first 4 years = $\$ \left(300 \times 4\right) = \$1,200$

Thus, principal amount invested = $\$ \left(3,200 - 1,200\right) = \$2,000$

Thus, on \$2,000 invested, interest accumulated is \$300 every year.

Thus, rate of interest = $\frac{300}{2,000} \times 100 = 15\%$

The correct answer is Option C.

129. Simple interest accumulated after 2 years = \$600

Thus, simple interest per year = $\$ \left(\frac{600}{2}\right) = \$300$ (since under simple interest, interest accumulated every year is constant)

Thus, compound interest accumulated after the first year = \$300 (equal to the simple interest accumulated after one year)

Thus, compound interest accumulated in the second year = $\$ \left(300 + 63\right) = \$363$ (since the total compound interest accumulated in 2 years is \$63 more than that under simple interest)

The higher interest in the second year is due to the additional interest on the interest accumulated after one year.

Thus, we can say that interest on \$300 in one year = \$63

Thus rate of interest = $\frac{63}{300} \times 100 = 21\%$

The correct answer is Option D.

130. Let the sums borrowed at 10% and 8% rate of interest be $\$x$ each.

Let the time after which Suzy repays the second sum be t years.

Thus, the time after which she repays the first sum is $(t - 1)$ years.

Since the amount to be repaid in either case is the same, the interest accumulated is also equal.

Simple Interest $= \left(\frac{PRT}{100}\right)$, where P =Principal, R = Rate of Interest, and T = Time Interval

Hence, we have

$$\frac{10 \times x \times (t-1)}{100} = \frac{8 \times x \times t}{100}$$

$=> 5(t-1) = 4t$

$=> t = 5$ years

Thus, the time for which she borrowed the first sum of money = $t - 1 = 4$ years

The correct answer is Option D.

131. Total amount invested = \$100,000.

Let $\$x$ be invested at 3% and $\$(100,000 - x)$ be invested at 4%

Thus, at the end of 1 year, interest on $\$x$

$$= \frac{x \times 3 \times 1}{100} = \frac{3x}{100}$$

Also, at the end of 1 year, interest on $\$(100,000 - x)$

$$= \frac{(100,000 - x) \times 4 \times 1}{100} = \frac{4\,(100,000 - x)}{100}$$

Since the total interest is \$3,600, we have

$$\frac{3x}{100} + \frac{4\,(100,000 - x)}{100} = 3,600$$

$=> 400,000 - x = 360,000$

$=> x = 40,000$

$=> 100,000 - x = 60,000$

Thus, the fraction of the total invested at 4% $= \frac{60,000}{100,000} = \frac{3}{5}$

The correct answer is Option D.

Alternate approach:

We can use the method of alligation:

Let the amounts invested at 3% and 4% be $\$x$ and $\$y$, respectively.

The total interest on \$100,000 is \$3,600.

Thus, the effective rate of interest as a whole $= \frac{3,600}{100,000} \times 100 = 3.6\%$.

Thus, we have

$\$x$ $\$y$

3% 4%

3.6%

$4 - 3.6 = 0.4$ $3.6 - 3 = 0.6$

Hence, we have

$$\frac{x}{y} = \frac{0.4}{0.6} = \frac{2}{3}$$

Hence, the required fraction $= \frac{3}{2+3} = \frac{3}{5}$

132. Let the sum of money invested at 4% rate of interest be $\$x$.

Thus, the sum of money invested at 7% rate of interest $= \$\left(18,000 - x\right)$

Thus, interest on $\$x$ at 4% rate of interest in 2 years

$$= \$\left(\frac{x \times 2 \times 4}{100}\right) = \$\left(\frac{8x}{100}\right)$$

Also, interest on $\$\left(18,000 - x\right)$ at 7% rate of interest in 2 years

$$= \$\left(\frac{(18,000 - x) \times 2 \times 7}{100}\right) = \$\left(\frac{14\left(18,000 - x\right)}{100}\right)$$

Since total interest is \$2,100, we have

$$\frac{8x}{100} + \frac{14\left(18,000 - x\right)}{100} = 2,100$$

$=> 14 \times 18,000 - 6x = 210,000$

$=> 6x = 252,000 - 210,000$

$=> x = 7,000$

The correct answer is Option C.

133. Let the sums of money invested at 10% and 20% rates of interest be $\$x$ each.

Since the difference between the interests earned after three years is between \$120 and \$140, we have

$$120 < \left(\frac{x \times 20 \times 2}{100}\right) - \left(\frac{x \times 10 \times 2}{100}\right) < 140$$

$$=> 120 < \frac{20x}{100} < 140$$

$=> 600 < x < 700$

We need to find the difference between the amounts earned after 2 years at compound interest at the same rates as above.

Thus, the required difference

$$= x\left(1 + \frac{20}{100}\right)^2 - x\left(1 + \frac{10}{100}\right)^2 = x\left\{\left(1 + \frac{20}{100}\right)^2 - \left(1 + \frac{10}{100}\right)^2\right\}$$

$$= x\left\{\left(1 + \frac{20}{100}\right) - \left(1 + \frac{10}{100}\right)\right\}\left\{\left(1 + \frac{20}{100}\right) + \left(1 + \frac{10}{100}\right)\right\}$$

$$= x\left(\frac{10}{100}\right)\left(2 + \frac{30}{100}\right) = x\,(0.1 \times 2.3) = x \times 0.23$$

We know that $600 < x < 700$

Thus, the required difference ($x \times 0.23$) is

$600 \times 0.23 < x \times 0.23 < 700 \times 0.23$

$=> 138 <$ Required difference < 161

Thus, the required difference lies between \$138 and \$161.

Only Option D lies in the above range.

The correct answer is Option D.

134. Population at the start of the experiment = x

Increase in population at the end of the 1st month = $2x$

Thus here we can say that, rate of increase = $\left(\frac{2x}{x}\right) \times 100 = 200\%$

This 200% increase remains same for each of the next 4 months.

Thus, applying the concept of compounding, we have

$$x\left(1 + \frac{200}{100}\right)^5 > 1,000$$

$$=> x > \frac{1,000}{(3)^5}$$

$$=> x > \frac{1,000}{243}$$

$$=> x > \left[\frac{1,000}{=\approx 250} =\approx 4\right]$$

Since we 250 > 243, thus $\frac{1,000}{243} > 4 => x > 4$

Since x must be an integer value (it represents the number of organisms), the minimum possible value of $x = 5$.

The correct answer is Option D.

Alternate approach:

Population at the start of the experiment = x.

Increase in population at the end of the 1st month = $2x$.

Thus, population size at the end of the 1st month = $x + 2x = 3x$.

Increase in population after the 2nd month = $2 \times 3x = 6x$.

Thus, population size at the end of the 2nd month = $3x + 6x = 9x$.

Thus, we observe that the population size triples after every month.

Thus, the population size at the end of the 5th month

= $3 \times$ (The population size at the end of the 4th month)

= $3 \times 3 \times$ (The population size at the end of the 3rd month)

$= 3 \times 3 \times 3 \times$ (The population size at the end of the 2nd month) $= 3^3 \times 9x$

$= 243x$

Thus, we have

$243x > 1,000$

$=> x > \frac{1,000}{243}$

$=> x > 4.1$

Since x must be an integer value (it represents the number of organisms), the minimum possible value of $x = 5$.

135. The description about the calculation of interest is basically follows the concept of compound interest.

Since interest is calculated after every two-month period, in a year, it will be calculated 6 times. Also the the rate on interest given is 12% per annum, thus, the rate of interest per period would be 12/6 = 2% per two-month period.

The amount (A) under compound interest on a sum of money (P) invested at $(r\%)$ rate of interest for n periods is given by:

$A = P\left(1 + \frac{r}{100}\right)^n$

We have to find out the value of $\left(\frac{A}{P}\right)$.

We know that $n = 6$ two-month periods and $r = 2\%$ per two-month period

Thus, $\frac{A}{P} = \left(1 + \frac{2}{100}\right)^6$

$\frac{A}{P} = (1.02)^6$

The correct answer is Option C.

136. The first $\$x$ deposited in the account earned interest for 2 years, while the additional $\$x$ earned interest for only 1 year.

The amount A under compound interest on a sum of money P invested at $r\%$ rate of interest for t years is given by:

$A = P\left(1 + \frac{r}{100}\right)^t$

Thus, the final value after 2 years for the first $\$x$ deposited

$= \$x\left(1 + \dfrac{4}{100}\right)^2$

$= \$(x \times 1.04^2)$

The final value after 1 year of the additional $\$x$ deposited

$= \$x\left(1 + \dfrac{4}{100}\right)^1$

$= \$1.04x$

Thus, total value of the money present in the account (y)

$= \$ \left\{\left(x \times 1.04^2\right) + (x \times 1.04)\right\}$

$= \$ \left(x \left(1.04^2 + 1.04\right)\right)$

Thus, we have

$y = x \left(1.04^2 + 1.04\right)$

$x = \dfrac{y}{\left(1.04^2 + 1.04\right)}$

$x = \dfrac{y}{1.04\,(1.04 + 1)}$

$x = \dfrac{y}{1.04 \times 2.04}$

The correct answer is Option D.

137. Let us understand the concept of the interest in the n^{th} year with an example:

Let \$100 be invested at 10% rate of interest.

Interest accumulated after one year (or in the **first year**)

= \$ (10% of 100) = \$10

Thus, amount after one year = \$ (100 + 10) = \$110

Thus, interest in the **second year**

= \$ (10% of 110) = \$11 (= 110% of interest in the first year)

Thus, total interest accumulated in two years

= (Interest in the first year + Interest in the second year)

= \$ (10 + 11) = \$21

Thus, amount after two years = \$ (100 + 21) = \$121

Thus, interest in the **third year**

\$ (10% of 121) = \$12.10 (= 110% of interest in the second year)

If we observe the values of the interest in the 1st, 2nd and 3rd years, we observe that:

The interest in the n^{th} year = $(100 + r)$ % of (The interest in the $(n-1)^{th}$ year)

Using the above relation in our problem:

Interest in the 5th year = \$4,800

Interest in the 6th year = \$5,520

Thus, we have

$5,520 = (100 + r)$ % of 4,800

$$=> 5,520 = \left(\frac{100 + r}{100}\right) \times 4,800$$

$$=> 5,520 = 48 \times (100 + r)$$

$$=> 115 = 100 + r$$

$$=> r = 15\%$$

The correct answer is Option D.

5.10 Functions

138. We have

$$f(p) = p^2 + \frac{1}{p^2}$$

$$=> f\left(-\frac{1}{\sqrt{p}}\right) = \left(-\frac{1}{\sqrt{p}}\right)^2 + \frac{1}{\left(-\frac{1}{\sqrt{p}}\right)^2} = \frac{1}{p} + p$$

$$= \left(f\left(-\frac{1}{\sqrt{p}}\right)\right)^2 = \left(\frac{1}{p} + p\right)^2$$

$$= \frac{1}{p^2} + p^2 + 2 \times \frac{1}{p} \times p$$

$= p^2 + \frac{1}{p^2} + 2 = f(p) + 2$; by replacing the value of $p^2 + \frac{1}{p^2} = f(p)$

The correct answer is Option A.

139. $f(x) = -\frac{1}{x}$

$$=> f(a) = -\frac{1}{a} = -\frac{1}{2}$$

$$=> a = 2$$

Also, we have

$$f(ab) = -\frac{1}{ab} = \frac{1}{6}$$

$$=> ab = -6$$

$$=> b = -\frac{6}{a} = -\frac{6}{2}$$

$$=> b = -3$$

The correct answer is Option D.

140. $f(x) = \sqrt{x} - 20$

$$=> f(q) = \sqrt{q} - 20$$

Since $p = f(q)$, we have

$$p = \sqrt{q} - 20$$

=> $\sqrt{q} = p + 20$

Squaring both sides, we have

=> $q = (p + 20)^2$

The correct answer is Option A.

141. Let d, e and f be the hundreds, tens and units digits of K, respectively and g, h and i be the hundreds, tens and units digits of R, respectively.

Thus, we have

$f(K) = 2^d 3^e 5^f$

$f(R) = 2^g 3^h 5^i$

Since $f(K) = 18f(R)$, we have

$2^d 3^e 5^f = 18 \times 2^g 3^h 5^i$

=> $2^d 3^e 5^f = 2^{(g+1)} 3^{(h+2)} 5^i$

Since d, e, f, g, h, i are integers, comparing coefficients of 2, 3 and 5:

$d = g + 1;\ e = h + 2$ and $f = i$

Thus, we have

The three-digit number $R \equiv ghi$, where g is the digit in the hundreds place, h is the digit in the tens place and i is the digit in the tens place
=> $R = 100g + 10h + i$

The three-digit number $K \equiv def \equiv (g + 1)(h + 2)i$, where $(g + 1)$ is the digit in the hundreds place, $(h + 2)$ is the digit in the tens place and i is the digit in the tens place

=> $K = 100(g + 1) + 10(h + 2) + i$

=> $K = (100d + 10h + i) + 120$

=> $K = R + 120$

=> $K - R = 120$

The correct answer is Option E.

142. Working with the options one at a time:

Option A: $f(x) = 1 + x$
$=> f(1-x) = 1 + (1-x) = 2 - x \neq f(x)$ – Incorrect

Option B: $f(x) = 1 + x^2$
$=> f(1-x) = 1 + (1-x)^2 = 1 + \left(1 - 2x + x^2\right) = 2 - 2x + x^2 \neq f(x)$ – Incorrect

Option C: $f(x) = x^2 - (1-x)^2$
$=> f(1-x) = (1-x)^2 - (1-(1-x))^2 = (1-x)^2 - x^2 \neq f(x)$ – Incorrect

Option D: $f(x) = x^2(1-x)^2$
$=> f(1-x) = (1-x)^2(1-(1-x))^2 = (1-x)^2x^2 = f(x)$ – Correct

Since we already have the answer, we need not check Option E.

Verifying Option E, we would have had:

Option E: $f(x) = \dfrac{x^2}{1-x}$

$=> f(1-x) = \dfrac{(1-x)^2}{1-(1-x)} = \dfrac{(1-x)^2}{x} \neq f(x)$

The correct answer is Option D.

143. $f(x) = \dfrac{1}{x}$

$g(x) = \dfrac{x}{x^2+1}$

$=> f(g(x)) = \dfrac{1}{g(x)} = \dfrac{1}{\left(\frac{x}{x^2+1}\right)}$

$= \dfrac{x^2+1}{x}$

$= \dfrac{(x-1)^2 + 2x}{x}$

$= \dfrac{(x-1)^2}{x} + 2$

Since $x > 0$, the minimum value of the above expression will occur when the square term becomes zero (since a square term is always non-negative, the minimum possible value occurs when it is zero).

$=> (x-1)^2 = 0 => x = 1$

Thus, the minimum value of $f(g(x)) = 0 + 2 = 2$

The correct answer is Option E.

144. $f(x) = \dfrac{10x}{1-x}$

$=> f(3) = \dfrac{10 \times 3}{1-3} = -15$

Thus, we have

$f(x) = \dfrac{1}{2} \times -15 = \dfrac{-15}{2}$

$=> \dfrac{10x}{1-x} = \dfrac{-15}{2}$

$=> 20x = -15 + 15x$

$=> 5x = -15$

$=> x = -3$

The correct answer is Option D.

145. We have

$3f(x) + 2f(-x) = 5x - 10 \ldots$(i)

Substituting $x = 1$ in equation (i):

$3f(1) + 2f(-1) = 5 - 10$

$=> 3f(1) + 2f(-1) = -5 \ldots$(ii)

Substituting $x = -1$ in equation (i):

$3f(-1) + 2f(1) = -5 - 10$

$=> 3f(-1) + 2f(1) = -15 \ldots$(iii)

Equation (ii) $\times$ 3 − Equation (iii) $\times$ 2:

$5f(1) = -15 - (-30) = 15$

$=> f(1) = 3$

The correct answer is Option D.

146. We know that

$D(t) = -10(t-7)^2 + 100$, where $0 \le t \le 12$

We need to find the value of t so that the value of $D(t)$ is maximum.

In the expression for $D(t)$, we have a negative term: $-10(t-7)^2$

We know that $(t-7)^2 \ge 0$ for all values of t (since it is a perfect square).

Thus, we have

$-10(t-7)^2 \le 0$ for all values of t (multiplying with a negative reverses the inequality).

Thus, in order that $D(t)$ attains a maximum value, the term $-10(t-7)^2$ must be 0.

Thus, we have

$-10(t-7)^2 = 0$

$=> t = 7$

Thus, $D(t)$ attains a maximum value at $t = 7$ i.e. 7 hours past 12:00 am i.e. 7:00 am.

The correct answer is Option B.

5.11 Permutation & Combination & Probability

147. Since $C_3^5 = C_r^5$, $r = 3$, but there is no option as $r = 3$.

We know that $C_q^p = C_{p-q}^p$

=> $C_3^5 = C_r^5 = C_{5-r}^5$

=> $3 = 5 - r$

=> $r = 2$

The correct answer is Option C.

148. This is a question on permutation with indistinguishable or identical objects.

We know that if there are n objects, out of which p objects are indistinguishable, then

Total number of way of arranging them = $\frac{n!}{p!}$

In this question, let's first assume that we use two BLACK and one RED dot, thus,

Total number of way of arranging them = $\frac{3!}{2!} = 3$.

Similarly, let's now assume that we use two RED and one BLACK dot, thus,

Total number of way of arranging them = $\frac{3!}{2!} = 3$.

There can be two more cases where we use all three BLACK or all three RED.
(Note: the question does not say that both colors must be used)

Total number of codes = 3 + 3 + 2 = 8.

The codes would be: RRB, RBY, RBB, BBR, BRB, BRR, BBB, & RRR.

The correct answer is Option D.

149. There are two different sizes and four different colors of mugs.

Packages having the same size and same color of mugs:

Number of ways in which a size can be chosen = $C_1^2 = \frac{2!}{(2-1)! \times 1!} = 2$ ways

Number of ways in which a color can be chosen = $C_1^4 = \frac{4!}{(4-1)! \times 1!} = 4$ ways

Thus, total number of such packages = $2 \times 4 = 8$.

Packages having the same size and different colors of mugs:

Number of ways in which a size can be chosen = $C_1^2 = \frac{2!}{(2-1)! \times 1!} = 2$ ways

Number of ways in which three different colors can be chosen = $C_3^4 = \frac{4!}{(4-3)! \times 3!} = 4$ ways

Thus, total number of such packages = $2 \times 4 = 8$

Thus, total number of different packages = $8 + 8 = 16$

The correct answer is Option C.

150. We know that there are six kinds of toppings and two kinds of breads for pizzas.

Since each pizza contains at least two kinds of toppings but not all kinds of toppings, the number of topping would be between 2 to 5.

Number of ways of selecting two kinds of toppings = $C_2^6 = \frac{6!}{4!2!} = 15$.

Number of ways of selecting three kinds of toppings = $C_3^6 = \frac{6!}{3!3!} = 20$.

Number of ways of selecting four kinds of toppings = $C_4^6 = C_2^6 = \frac{6!}{4!2!} = 15$.

Number of ways of selecting five kinds of toppings = $C_5^6 = C_1^6 = 6$.

Thus, number of possible sections of toppings = $15 + 20 + 15 + 6 = 56$.

Number of ways of selecting one kind of bread = $C_1^2 = 2$.

Thus, number of pizzas possible = $56 \times 2 = 112$.

The correct answer is Option E.

151. **Number of one-letter codes:**

The botanist can uniquely designate 26 plants (since there are a total of 26 letters).

Number of two-letter codes:

The first position can be assigned in 26 ways.

The second position can also be assigned in 26 ways (since the letters may be repeated).

Thus, total two-letter codes possible = $26 \times 26 = 676$.

Thus, using two-letter codes, the botanist can uniquely designate 676 plants.

Number of three-letter codes:

Each of the three positions can be assigned in 26 ways.

Thus, total three-letter codes possible = $26 \times 26 \times 26 = 17{,}576$.

Thus, using three-letter codes, the botanist can uniquely designate 17,576 plants.

Thus, total number of unique designations possible using one-, two- or three-letter codes = 26 + 676 + 17,576 = 18,278.

The correct answer is Option E.

Alternate approach:

There is a cheeky method for this question.

Number of one-letter codes: $26 \equiv$ units digit is 6.

Number of two-letter codes: $26 \times 26 \equiv$ units digit is 6.

Number of three-letter codes: $26 \times 26 \times 26 \equiv$ units digit is 6.

Thus, the units digit of the sum = $6 + 6 + 6 \equiv 8$.

Only Option E has the units digit as 8.

Note: This is not a holistic method and not to be used when two or more options are with same units digit.

152. We know that no subject is common in both the groups.

Here events “Selection of one out of eight optional subjects from group one” and “Selection of two out of ten optional subjects from group two” are mutually exclusive or disjoint events; thus the total number of ways would be multiplied.

Number of ways of selecting one optional subject from eight subjects = $C_1^8 = 8$

Number of ways of selecting two optional subjects from ten subjects = $C_2^{10} = \frac{10 \times 9}{2 \times 1} = 45$.

Thus, total number of ways of selecting three subjects = $8 \times 45 = 360$.

The correct answer is Option D.

153. We need to form a four-digit code using the digits 1, 2, 3, 4, 5, 6, 7, 8, and 9 i.e. 9 possible digits.

Also, it is known that repetition of digits is not allowed.

The thousands position of the code can be filled using any of the nine digits in 9 ways.

The hundreds position of the code can be filled using any of the eight digits in 8 ways.

The tens position of the code can be filled using any of the remaining seven digits in 7 ways.

The units position of the code can be filled using any of the remaining six digits in 6 ways.

Thus, the number of distinct codes possible = $9 \times 8 \times 7 \times 6 = 3{,}024$.

The correct answer is Option C.

154. We need to form a four-digit code using the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 i.e. 10 possible digits.

Also, it is known that repetition of digits is allowed, the code has to be an odd number, and the thousands' position of the code can't be 0.

The thousands' position of the code can be filled using any of the 9 digits (except 0) in 9 ways.

The hundreds position of the code can be filled using any of the 10 digits (since 0 can now be used and repetition is allowed) in 10 ways.

The tens position of the code can be filled using any of the 10 digits (since 0 can now be used and repetition is allowed) in 10 ways.

The units position of the code can be filled using any of the 5 odd digits 1, 3, 5, 7, or 9 in 5 ways.

Thus, the number of distinct codes possible = $9 \times 10 \times 10 \times 5 = 4{,}500$.

The correct answer is Option D.

155. Number of ways of selecting 4 sites out of 6

= (Number of ways in which any 4 of the 6 sites are selected without consideration to any constraint) – (Number of ways considering both A and B sites are selected)

Number of ways in which any 4 of the 6 sites may be selected without paying consideration to any restriction = C_4^6

$$= C_{(6-4)}^6 = C_2^6 = \frac{6 \times 5}{2 \times 1}$$

$= 15$

Number of ways in which 4 of the 6 sites may be selected so that both the sites A and B are selected (i.e. two more sites to be selected from the remaining four) $= C_{(4-2)}^{(6-2)}$

$= C_2^4 = \dfrac{4 \times 3}{2 \times 1}$

$= 6$; the above 6 ways do not satisfy the given restriction

Thus, the number of ways in which 4 of the 6 sites can be selected so that both A and B sites are not selected simultaneously $= 15 - 6 = 9$

The correct answer is Option D.

156. Imran has 4 Math, 5 Physics, and 6 Chemistry books.

To select: 4 books such that the selection has at least one book of each subject.

The selections can be done in following ways.

(1) 2 Math, 1 Physics and 1 Chemistry books:
\# of ways $= C_2^4 \times 5 \times 6 = \left(\dfrac{4 \times 3}{1 \times 2}\right) \times 5 \times 6 = 180$

(2) 1 Math, 2 Physics and 1 Chemistry books:
\# of ways $= 4 \times C_2^5 \times 6 = 4 \times \left(\dfrac{5 \times 4}{1 \times 2}\right) \times 6 = 240$

(3) 1 Math, 1 Physics and 2 Chemistry books:
\# of ways $= 4 \times 5 \times C_2^6 = 4 \times 5 \times \left(\dfrac{6 \times 5}{1 \times 2}\right) = 300$

Total number of possible selections $= 180 + 240 + 300 = 720$

The correct answer is Option B.

157. Let the number of letters to be used be n.

The number of plants that can be identified using a single letter $= C_1^n = n$.

The number of plants that can be identified using two distinct letters $= C_2^n = \dfrac{n(n-1)}{2}$ (since the letters are to kept in alphabetic order, we must <u>not</u> order them or apply P_2^n.)

Thus, total number of plants that can be identified if we attempt to have all the 15 codes that are either one-letter code or two-letter codes

$= \left(n + \dfrac{n(n-1)}{2}\right)$

Since we need to have at least 15 identifications, we have

$n + \frac{n(n-1)}{2} \geq 15$

$=> \frac{2n + n(n-1)}{2} \geq 15$

$=> \frac{n(2 + (n-1))}{2} \geq 15$

$=> \frac{n(n+1)}{2} \geq 15$

$=> n(n+1) \geq 30$

Working with the options and starting with the least value of n, we see that $n = 5$ satisfies the above inequality.

The correct answer is Option C.

158. We have to select 1 student each from classes A, B, and C each having 30 students and 2 students from Class D having 20 students.

Number of ways of selecting 1 student from Class A = $C_1^{30} = 30$.

Number of ways of selecting 1 student from Class B = $C_1^{30} = 30$.

Number of ways of selecting 1 student from Class C = $C_1^{30} = 30$.

Number of ways of selecting 2 student from Class D = $C_2^{20} = \frac{20 \times 19}{2 \times 1} = 190$.

As all four events are independent of each other, the number of ways of forming the team = $30 \times 30 \times 30 \times 190$

= 5,130,000

The correct answer is Option E.

159. Total number of stocks available: 4 Information Technology, 5 Retail, and 3 e-commerce stocks

Number of stocks to be selected: 2 Information Technology, 4 Retail, and 2 e-commerce stocks

Number of ways of selecting 2 out of 4 Information Technology stocks = $C_2^4 = \frac{4 \times 3}{2 \times 1} = 6$

Number of ways of selecting 4 out of 5 Retail stocks = $C_4^5 = C_{(5-4)}^5 = C_1^5 = 5$

Number of ways of selecting 2 out of 3 e-commerce stocks = $C_2^3 = C_{(3-2)}^3 = C_1^3 = 3$

Thus, the total number of ways of selecting the required number of stocks

$= 6 \times 5 \times 3$ (we multiply since the above selections are independent of one another)

$= 90$

The correct answer is Option D.

160. Total number of people present $= 3 \times 8 = 24$.

Number of handshakes if the delegates shook hands with every person other than those from his or her own company

= (Number of handshakes without any constraint) – (Number of handshakes with people from their own company)

Number of handshakes without any constraint $= C_2^{24} = \frac{24 \times 23}{2 \times 1} = 276$

(Since a handshake requires two people, we need to **select** any 2 people from the 24 for a handshake)

Number of handshakes with people from their own company $= 8 \times C_2^3 = 8 \times \frac{3 \times 2}{2 \times 1} = 24$

(We need to select any 2 delegates from 3 delegates of the same company, for each of the 8 companies)

Thus, the number of handshakes if the delegates shook hands with every person other than those from his or her own company

$= 276 - 24$

$= 252$

The correct answer is Option C.

Alternate approach:

Let us calculate how many handshake a particular person does.

There are a total of $3 \times 8 = 24$ delegates.

A particular person would have to handshake $24 - 3 = 21$ times. This excludes the person itself and his company's two collegaues.

Thus, all the delegates would do $\frac{21 \times 24}{2} = 252$ handshakes.

We divided the total number of handshakes by '2' because one handshake involving two delegates should be counted as one handshake and not two.

161. We need to select three digits for the code.

The digits to be used are from 0 to 9, thus there are 10 possible digits.

Since the first digit cannot be 0 or 9, number of possibilities for the first digit $= (10 - 2) = 8$.

Since the second digit can only be 0 or 9, number of possibilities for the second digit = 2.

Let us ignore the restriction for the third digit.

Thus, number of possibilities for the third digit = 10.

Thus, total number of codes possible (ignoring the condition for the third digit)
$= 8 \times 2 \times 10 = 160$

In the above codes, there are a few codes that are unacceptable since they violate the condition for the third digit.

The codes which violate the condition for the third digit are of the form $(a99)$, where a is the first digit and both second and third digits are simultaneously 9.

The number of such codes equals the number of possibilities for the first digit, i.e. 8.

Thus, the number of codes possible without violating any of the given conditions
$= 160 - 8 = 152$

The correct answer is Option A.

162. There are total 30 marbles, out of which 15 are yellow.

Probability that both the marbles are yellow $= \dfrac{\text{Number of ways of drawing two yellow marbles}}{\text{Number of ways of drawing any two marbles}}$

$$=> \frac{C_2^{15}}{C_2^{30}} = \frac{\frac{15\times14}{1\times2}}{\frac{30\times29}{1\times2}} = \frac{15 \times 14}{30 \times 29} = \frac{7}{29}$$

The correct answer is Option B.

163. In a basket, out of 12 balls, seven are red and five are green.

Number of ways we can select three balls from 12 balls $= C_3^{12} = \dfrac{12 \times 11 \times 10}{3 \times 2 \times 1} = 220$

Number of ways of selecting two red balls and one green ball

$$= C_2^7 \times C_1^5 = \frac{7 \times 6}{1 \times 2} \times 5 = 21 \times 5 = 105$$

So, the required probability = $\dfrac{C_2^7 \times C_1^5}{C_3^{12}} = \dfrac{105}{220} = \dfrac{21}{44}$

The correct answer is Option D.

164. The number of 6−member committees that can be formed from the 21 members = C_6^{21}

$= \dfrac{21 \times 20 \times 19 \times 18 \times 17 \times 16}{6 \times 5 \times 4 \times 3 \times 2 \times 1}$

The number of 5−member committees that can be formed from the 21 members = C_5^{21}

$= \dfrac{21 \times 20 \times 19 \times 18 \times 17}{5 \times 4 \times 3 \times 2 \times 1}$

Thus, the required ratio

$$= \frac{\left(\dfrac{21 \times 20 \times 19 \times 18 \times 17 \times 16}{6 \times 5 \times 4 \times 3 \times 2 \times 1}\right)}{\left(\dfrac{21 \times 20 \times 19 \times 18 \times 17}{5 \times 4 \times 3 \times 2 \times 1}\right)}$$

$= \dfrac{16}{6} = \dfrac{8}{3} = 8$ to 3

The correct answer is Option C.

165. There are two offices to which the four employees need to be assigned.

Thus, the number of offices for each employee to choose = 2 (since each employee can be assigned to any of the two offices)

Thus, the total number of ways of assigning the four employees = $2 \times 2 \times 2 \times 2 = 2^4 = 16$.

Note: For n objects, each with r options, the total number of options = r^n

The correct answer is Option E.

166. We need to select three male officers from five male officers.

The number of ways of achieving it = $C_3^5 = \left(\dfrac{5 \times 4 \times 3}{3 \times 2 \times 1}\right) = 10$.

We also need to select two female officer from three female officers.

The number of ways of achieving it = $C_2^3 = C_1^3 = 3$.

Thus, the number of ways in which three male officers and two female officer can be selected = $10 \times 3 = 30$.

The correct answer is Option D.

167. Given that,

Probability that Stock X increases in value = P(A) = 0.4;

Probability that Stock Y increases in value = P(B) = 0.6

Exactly one of the stocks would increase in value if:

Stock A increases AND Stock Y does not

OR

Stock B increases AND Stock X does not

Probability that Stock X does not increase in value = $P(\overline{A}) = 1 - 0.4 = 0.6$
Probability that Stock Y does not increase in value = $P(\overline{B}) = 1 - 0.6 = 0.4$

Thus, the required probability = $P(A) \times P\left(\overline{B}\right) + P(B) \times P\left(\overline{A}\right)$

$= 0.4 \times 0.4 + 0.6 \times 0.6$

$= 0.16 + 0.36 = 0.52$

The correct answer is Option C.

168. Since probability of landing on heads or tails is the same, each must be $\frac{1}{2}$ => $P(H) = P(T) = \frac{1}{2}$

Probability that the coin will land on heads at least once on two tosses

= 1− Probability that it will not land on heads at all

= 1− Probability that it will land on tails on both occasions

= 1− (Probability that the first toss will show tails AND the second toss will show tails)

$= 1 - P(T) \times P(T)$

$= 1 - \frac{1}{2} \times \frac{1}{2}$

$= 1 - \frac{1}{4}$

$= \frac{3}{4}$

The correct answer is Option E.

169. Each question has two options of which only one is correct.

Thus, the probability of randomly guessing an answer and getting it correct = $\frac{1}{2}$.

Thus, the probability of randomly guessing answers to all X questions and getting them correct

$= \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \ldots X$ times

$= \left(\frac{1}{2}\right)^X$

Thus, we have

$\left(\frac{1}{2}\right)^X < \frac{1}{500}$

$=> 2^X > 500$

We observe from the options that $2^9 = 512$, which just exceeds 500.

Thus, the least value of $n = 9$.

The correct answer is Option B.

170. We know that the first three balls were black.

Thus, there are $(20 - 3) = 17$ balls left.

Of these, number of black balls $= 10 - 3 = 7$

We need the next two balls to be black.

Thus, we need to select 2 black balls from the remaining 7 black balls.

Number of ways in which the above case can be achieved (favorable cases) $= C_2^7$

$= \frac{7 \times 6}{2 \times 1} = 21$

Number of ways in which two balls can be selected from the remaining 17 balls (total cases) $= C_2^{17} = \frac{17 \times 16}{2 \times 1} = 136$

Thus, required probability $= \frac{\text{Favorable cases}}{\text{Total cases}}$

$= \frac{21}{136}$

The correct answer is Option A.

171. We need to select two balls one at a time.

On drawing 2 balls, one white and one blue can be obtained if:

The first ball is white AND the second ball is blue

OR

The first ball is blue AND the second ball is white

Since the balls are not replaced after drawing, after the first draw, the total number of balls would be 1 less than what was present initially, i.e. $(16 - 1) = 15$.

Thus, the required probability =

p(The first ball is white AND the second ball is blue)

OR

p(The first ball is blue AND the second ball is white)

$= \{p(1^{\text{st}} \text{ ball white}) \times p(2^{\text{nd}} \text{ ball blue})\} + \{p(1^{\text{st}} \text{ ball blue}) \times p(2^{\text{nd}} \text{ ball white})\}$

$$= \left\{\frac{4}{16} \times \frac{3}{15}\right\} + \left\{\frac{3}{16} \times \frac{4}{15}\right\}$$

$$= \frac{1}{20} + \frac{1}{20}$$

$$= \frac{1}{10}$$

The correct answer is Option C.

172. Probability that at least one refrigerator is single-door

= 1 − Probability that none is single-door refrigerator

Probability of selecting two refrigerators such that none is single-door refrigerator

= Probability of selecting two double-door refrigerators

$$= \left(\frac{\text{Number of ways of selecting 2 doubledoor from 6 sets}}{\text{Number of ways of selecting 2 refrigerators from 8 sets}}\right)$$

$$= \frac{C_2^6}{C_2^8}$$

$$= \frac{\left(\frac{6 \times 5}{2 \times 1}\right)}{\left(\frac{8 \times 7}{2 \times 1}\right)}$$

$= \frac{15}{28}$

Thus, the required probability $= 1 - \frac{15}{28} = \frac{13}{28}$.

The correct answer is Option D.

173. Let the number of red balls $= r$

Number of white balls = 9

Thus, total number of balls $= (r + 9)$

Thus, probability that both balls would be white

$$= \left(\frac{\text{Number of ways of selecting 2 white balls form 9 white balls}}{\text{Number of ways of selecting 2 balls from } (r+9) \text{ balls}}\right)$$

$$= \frac{C_2^9}{C_2^{(r+9)}}$$

$$= \frac{\frac{9 \times 8}{2 \times 1}}{\frac{(r+9) \times (r+9-1)}{2 \times 1}}$$

$$= \frac{72}{(r+9) \times (r+8)}$$

Thus, we have

$$\frac{72}{(r+9) \times (r+8)} = \frac{6}{11}$$

$=> (r + 9) \times (r + 8) = 12 \times 11$

We see that the LHS and the RHS are product of two consecutive numbers, thus $(r + 9) = 12 => r = 3$

Thus, the total number of balls = 3 + 9 = 12

The correct answer is Option C.

174. The probability that a card falls $= P(F) = 0.05$

Thus, the probability that a card does not fall $= P\left(\overline{F}\right) = 1 - 0.05 = 0.95$

Thus, the probability that none of the 12 card falls $= 0.95^{12}$

For the pyramid to collapse, at least one card needs to fall.

Thus, the probability that at least one card falls $= 1 - 0.95^{12}$

The correct answer is Option C.

175. Total number of candies = 12

Number of orange flavored candies = 4

Thus, the number of non-orange flavored candies = 12 – 4 = 8

Thus, the kid has to pick 2 candies out of the 8 non-orange flavored candies.

Thus, number of ways (favorable cases)

$= C_2^8 = \frac{8 \times 7}{2 \times 1} = 28$

Number of ways in which the kid can pick 2 candies from the 12 candies (total cases)

$= C_2^{12} = \frac{12 \times 11}{2 \times 1} = 66$

Thus, the required probability

$= \frac{\text{Favorable cases}}{\text{Total no. of cases}} = \frac{28}{66} = \frac{14}{33}$

The correct answer is Option C.

176. If Suzy returns at the end of the day 3, she would have stayed for 3 days.

Since it is given that she would return home at the end of the first day it rained, it must not have rained on day 1 and day 2 but rained on day 3.

Probability of rain on each day = $P(R) = 0.25$

=> Probability that there is no rain on a particular day

$= P\left(\overline{R}\right) = 1 - P(R)$

$= 1 - 0.25$

$= 0.75$

Thus, probability that she return at the end of day on day 3

= Probability that there is no rain on day 1 AND no rain on day 2 AND rain on day 3

$= P\left(\overline{R}\right) \times P\left(\overline{R}\right) \times P(R)$

$= 0.75 \times 0.75 \times 0.25 = \frac{9}{64}$

The correct answer is Option B.

5.12 Sets

177. Number of students on the committee G1 = 10.

As no member of G1 is in either of the other two groups, the above 10 students belong to only G1.

However, there may be an overlap with the students of G2 and G3.

Number of students in G2 = 10.
Number of students in G3 = 6.

We would get the greatest number of students who would not be in any of the groups if there is maximum overlap between the students of G2 and G3.

The maximum overlap between the students of G2 and G3 would be the minimum of the number of students in the two groups i.e. minimum of 6 and 10 = 6.

Thus, we have

$G2 \cap G3 = 6$

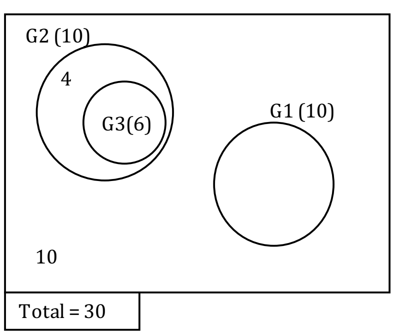
Thus, the number of students in G2 or G3 = $G2 + G3 - G2 \cap G3 = 10 + 6 - 6 = 10$

Thus, total number of students belonging to one of more groups

= G1 + G2 or G3 = 10 + 10 = 20.

Thus, maximum number of students who don't belong to any group = 30 − 20 = 10.

The above information can be represented in a Venn-diagram as shown below:



The correct answer is Option D.

178. Total number of dresses = 1,000

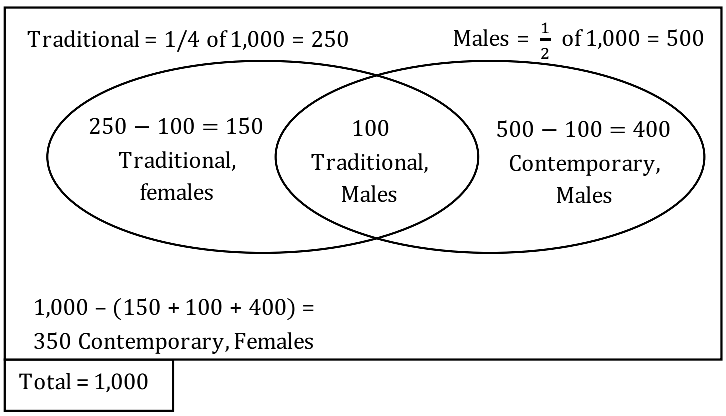
Number of traditional dresses = 250

Number of contemporary dresses = 750

Number of dresses for males = Number of dresses for females = $\frac{100}{2}$ = 500

Number of traditional dresses for males = 100

Let us represent the above information using a Venn-diagram, as shown below:



Thus, from the above Venn-diagram, we have

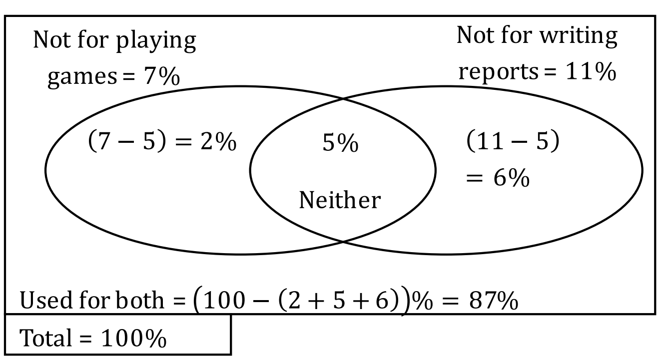
Number of contemporary dresses for females = 350

The correct answer is Option D.

179. We know that 95 percent students used a computer to play games or to write reports.

Thus, (100 – 95) = 5% students did not use a computer for either of these purposes.

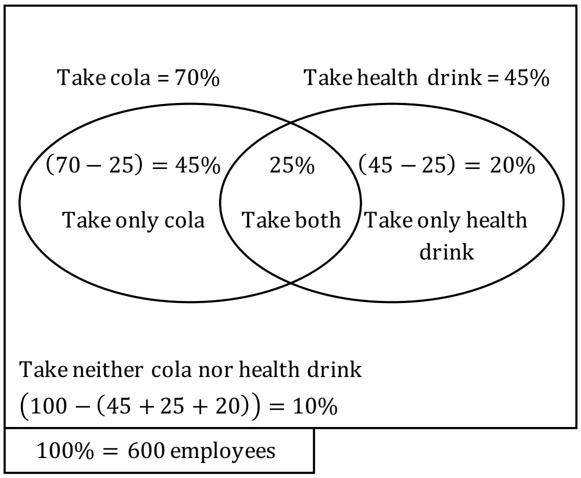
Let us represent the above information using a Venn-diagram, as shown below:



Thus, the percent of students who did use a computer both to play games and to write reports = 87%.

The correct answer is Option D.

180. Let us represent the given information using a Venn-diagram, as shown below:



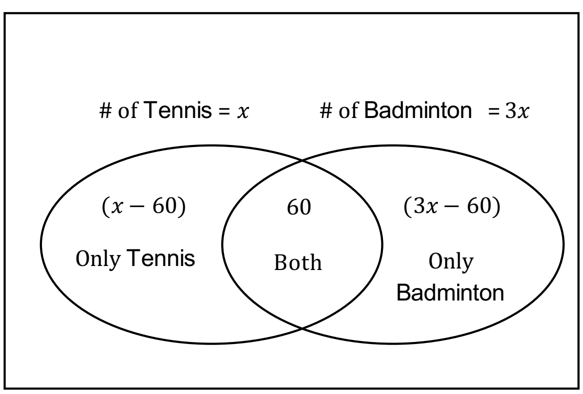
Thus, the number of employees who take neither cola nor health drink

= 10% of 600

= 60

The correct answer is Option B.

181. Let us represent the given information using a Venn-diagram, as shown below:



We know that the number of students who play both the sports is thrice the number of students who play only Tennis.

Thus, we have

$60 = 3\,(x - 60)$

$=> x = 80$

Thus, the number of students play only Badminton = $3x - 60$

= 180

The correct answer is Option C.

5.13 Statistics & Data Interpretation

182. We know that the median is the middle-most value of any series/data set, but we do not know the value of x, so we cannot calculate exact value of Median; however we can surely find its range.

- Case 1:
  If x is smallest, the series would be x, 15, 20, 25 and median = average of 15 & 20 = 17.5–smallest median value.
- Case 2:
  If x is largest, the series would be 15, 20, 25, x and median = average of 20 & 25 = 22.5–largest median value.

Thus, the median would lie between 17.5 & 22.5, inclusive. Since the values in only Statements I & II are in the range, Option C is correct.

The correct answer is Option C.

183. The question asks the number of scores > (Mean + SD)?

$$\text{Mean} = \frac{44 + 52 + 56 + 65 + 73 + 75 + 77 + 95 + 96 + 97}{10} = 73$$

Mean + SD = 73 + 20.50 = 93.50.

It is clear that three scores (95, 96, and 97) are greater than 93.50.

The correct answer is Option D.

184. Let the sum of the 19 numbers other than n be s.

Thus, we have

$$n = 4 \times \left(\frac{s}{19}\right)$$

$$=> s = \frac{19n}{4}$$

Thus, the sum of all the 20 numbers in the list $= s + n = \frac{19n}{4} + n = \frac{23n}{4}$

Thus, the required fraction $= \frac{n}{\frac{23n}{4}} = \frac{4}{23}$

The correct answer is Option B.

185. We have

$$w \le \frac{3 + 8 + w}{3} \le 3w$$

=> $3w \le 11 + w \le 9w$

=> $2w \le 11 \le 8w$

=> $2w \le 11$ and $8w \ge 11$

=> $w \le \frac{11}{2} = 5\frac{1}{2}$

and

=> $w \ge \frac{11}{8} = 1\frac{3}{8}$

Since w is an integer, possible values of w are: 2, 3, 4 or 5,

Thus, there are four possible values of w.

The correct answer is Option B.

186. Let the seven distinct positive integers be p, q, v, w, x, y and z such that $p > q > v > w > x > y > z$.

Thus, we need to find the least possible value of the largest among the seven, i.e. p.

Let's assume that w, the middle-most number = average of the seven numbers = 14.

Now to maintain the average equals to 14, increase v, q, & p by 1, 2, & 3, respectively and decrease x, y, & z by 1, 2, & 3, respectively.

Thus, $p = 14 + 3 = 17$ – the least possible value of the greatest of the seven numbers

The correct answer is Option B.

187. We have

$$\frac{x + y + 10}{3} = \frac{x + y + 10 + 20}{4}$$

=> $4x + 4y + 40 = 3x + 3y + 90$

=> $x + y = 50$

The correct answer is Option B.

188. If the 13 different integers are arranged in order, the median is the $\left(\frac{13+1}{2}\right)^{th} = 7^{th}$ integer.

Thus, the 7^{th} integer is 20.

Since we need to find the maximum possible integer (given a range of 20), we need to have the maximum value of the least integer as well.

Since the integers are distinct, we can have the first 7 integers as:

$(20-6) = 14$, $(20-5) = 15$, $(20-4) = 16$, $(20-3) = 17$, $(20-2) = 18$, $(20-1) = 19$, and 20

Thus, the maximum possible value of the smallest integer = 14.

Since the range is 20, the value of the greatest integer = 14 + 20 = 34.

The correct answer is Option D.

189. We have Mean = $\left(\frac{\text{Sum of the terms}}{\text{Total number of terms}}\right)$

$$=> \frac{1+2+3+4+5+6+x}{7} = \frac{\sqrt{7x}}{2}$$

$$=> \frac{21+x}{7} = \frac{\sqrt{7x}}{2}$$

Finding out the value of x by applying the traditional method will consume time. The optimum approach is to plug-in the option values.

You will find that $x = 28$ – Option E satisfies the above equation; thus it is the correct answer.

The correct answer is Option E.

190. We know that there are x employees.

Since the median salary is the 22^{nd} salary, no two salaries are the same, and the 22^{nd} salary is there in the list, there would be 21 salaries that are less than the 22^{nd} salary and 21 salaries that are greater than the 22^{nd} salary.

This implies that there are 21 + 1 + 21 = 43 salaries in the list or there are a total of 43 employees.

Thus, the average salary of the 43 employees

$$= \frac{\text{Total salary}}{\text{Number of employees}}$$

$$= \$\left(\frac{860,000}{43}\right)$$

$= \$20,000$

The correct answer is Option B.

191. We can calculate the total number of watts of electricity consumed as shown below:

Appliance	**Number of hours in use**	**Number of watts of electricity used per hour**	**Total number of watts of electricity used**
Computer	4	105	$4 \times 105 = 420$
Music system	2	90	$2 \times 90 = 180$
Refrigerator	2	235	$2 \times 235 = 470$
LED TV	2	150	$2 \times 150 = 300$
Total	4 + 2 + 2 + 2 = 10 hours		420 + 180 + 470 + 300 = 1,370 watts

Thus, the average number of watts of electricity used per hour per appliance

$= \frac{1,379}{10} = 137$ watts per hour.

The correct answer is Option C.

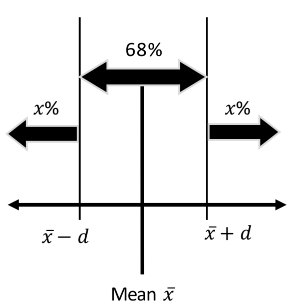
192. We know that the distribution is symmetric about the mean.

Thus, the percent of the distribution equidistant from the mean on either side of it is the same.

Let the percent of the distribution less than $(\bar{x} + d)$ be $x\%$.

Thus, the percent of the distribution more than $(\bar{x} - d)$ is also $x\%$.

The situation is shown in the diagram below.



Thus, we have

$x\% + 68\% + x\% = 100\%$

=> $x = 16\%$

Thus, the percent of the distribution greater than $(\bar{x} - d) = x + 68 = 16 + 68 = 84\%$.

The correct answer is Option D.

5.14 Linear Equations

193. Let us recall the property of two-digit number:

"Difference between a particular two digit number and the number obtained by interchanging the digits of the same two digit number is always 9 times the difference between the digits."

Thus, the difference between actual amount and reversed amount = 63

= 9 × difference between the digits

=> Difference between the digits = $\frac{63}{9} = 7$

The difference between the digits of the number 7 is satisfied only by Option E.

The correct answer is Option E.

Alternate approach 1:

If we consider correct amount as $[xy] = 10x + y$, then interchanged amount becomes $[yx] = 10y + x$.

According to the given condition, difference between the new amount and the original amount is 63 cents.

=> $(10x + y) - (10y + x) = 63$

=> $10x - x - 10y + y = 63$

=> $9x - 9y = 63$

On dividing by 9, we have

$x - y = 7$.

Thus, the difference between the digits is 7, which is satisfied only by Option E.

Alternate approach 2:

Since the cash register contained 63 cents more than it should have as a result of this error, this implies that the tens digit of the correct amount must be greater than its units digit.

Only two options can qualify. Let us analyze them:

(C) 73: $73 - 37 = 36 \neq 63$
(E) 92: $92 - 29 = 63$; correct answer

194. Let the number of screwdrivers and spanners purchased be a and b, respectively.

Thus, total cost of the items = $\$(11a + 3b)$

Thus, we have

$11a + 3b = 109$

$b = \frac{109 - 11a}{3} = \frac{108 + 1 - 11a}{3} = \frac{108}{3} + \frac{1 - 11a}{3} = 36 + \frac{1 - 11a}{3}$

It is clear that a and b are positive integers. Thus, $(1 - 11a)$ must be a multiple of 3.

There can be a few possible values of a, two such values are $a = 2$, 5 and 8.

For $a = 3$, we have $b = 36 + \frac{1 - 11 \times 2}{3} = 36 - 7 = 29$. Thus, $a + b = 2 + 29 = 31$.

Since 31 is not one of the options, we must try with $a = 5$.

For $a = 5$, we have $b = 36 + \frac{1 - 11 \times 5}{3} = 36 - 18 = 18$. Thus, $a + b = 5 + 18 = 23$.

Since 23 is not one of the options, we must try with $a = 8$.

For $a = 8$, we have $b = 36 + \frac{1 - 11 \times 8}{3} = 36 - 29 = 7$. Thus, $a + b = 8 + 7 = 15$.

Thus, the total number of items purchased could be $8 + 7 = 15$.

The correct answer is Option C.

195. We have

$x + y + z = 2 \ldots$(i)
$x + 2y + 3z = 6 \ldots$(ii)

Since z has no role to play, let's eliminate it.

Multiplying (i) by 3 and subtracting (ii) from the result:

$3 \times (x + y + z) - (x + 2y + 3z) = 3 \times 2 - 6$

$=> 2x + y = 0$

$=> 2x = -y$

$=> \frac{x}{y} = -\frac{1}{2}$

The correct answer is Option A.

196. Let the number of notebooks sold last month be n.

Since the number of books sold was 2 more than the notebooks, the number of books sold = $(n+2)$.

Selling price of each book = \$25.

Selling price of each notebook = \$15.

Thus, total sales revenue = $\$(15n + 25(n+2))$.

Thus, we have
$15n + 25(n+2) = 490$

$40n = 490 - 50$

$=> n = \frac{440}{40} = 11$

Thus, the number of notebooks sold = 11.

Thus, the number of books sold = 11 + 2 = 13.

Thus, the total number of books and notebooks sold = 11 + 13 = 24.

The correct answer is Option C.

Alternate approach:

We know that the number of books sold is 2 more than the number of notebooks sold.

The price of 2 books = $\$(25 \times 2) = \$50$.

Removing this from the total, i.e. \$490, we are left with $\$(490 - 50) = \$440$.

This amount was obtained by selling equal numbers of books and notebooks.

Total price of one book and one notebook = $\$(25 + 15) = \$40$.

Thus, number of items sold for \$440

$= \frac{440}{40} \times 2 = 22$

Thus, total number of books and notebooks sold = 2 + 22 = 24.

5.15 Quadratic Equations & Polynomials

197. We have

$a = \sqrt{8ab - 16b^2}$

Squaring both the sides:

$a^2 = 8ab - 16b^2$

$=> a^2 - 8ab + 16b^2 = 0$

$=> (a - 4b)^2 = 0$

$=> a - 4b = 0$

$=> a = 4b$

The correct answer is Option D.

198. Given that,

$(x - 2)^2 = 9$

$=> x - 2 = \pm 3$

$=> x = 2 \pm 3$

$=> x = 5 \text{ OR } -1$

Given that,

$(y - 3)^2 = 25$

$=> y - 3 = \pm 5$

$=> y = 3 \pm 5$

$=> y = 8 \text{ OR } -2$

The minimum value of $\left(\frac{x}{y}\right)$ will be that value with the greatest magnitude of x, least magnitude of y and exactly one between of x and y being negative in sign.

Thus, we have

$x = 5, y = -2 => \dfrac{x}{y} = -\dfrac{5}{2}$

The maximum value of $\left(\frac{x}{y}\right)$ will be that value with the greatest magnitude of x, least magnitude of y and both x and y being simultaneously positive or negative in sign.

Thus, we have

$x = 5, y = 8 => \frac{x}{y} = \frac{5}{8}$

OR

$x = -1, y = -2 => \frac{x}{y} = \frac{1}{2}$

Between $\frac{5}{8}$ and $\frac{1}{2}$, the fraction $\frac{5}{8}$ is greater.

Thus, the required difference

$= \frac{5}{8} - \left(-\frac{5}{2}\right)$

$= \frac{5}{8} + \frac{5}{2}$

$= \frac{25}{8}$

The correct answer is Option E.

199. Given that,

$2x + 3y + xy = 12$

$=> 2x + 3y + xy + 6 = 12 + 6 = 18$; (adding the product of the coefficients of x and y to both sides)

$=> (2x + 6) + (xy + 3y) = 18$

$=> 2(x + 3) + y(x + 3) = 18$

$=> (x + 3)(y + 2) = 18$

Since x and y are positive integers, we must have:

$x + 3 > 3$, and

$y + 2 > 2$

Possible ways of getting 18 are: $1 \times 18, 2 \times 9$, and 3×6

Thus, the only possible solution is:

$x + 3 = 6 \Rightarrow x = 3$, and
$y + 2 = 3 \Rightarrow y = 1$

Thus, we have $x + y = 3 + 1 = 4$.

The correct answer is Option B.

Alternate approach:

Given that both x and y are positive integers, we can solve this question by hit and trial approach, too. Let's plug-in few probable positive integer values for x in the equation $2x + 3y + xy = 12$ and see which value renders a positive integer value for y.

We see that for $x = 1$ & 2, we get non-integer values for y; and for $x = 3$, we get $y = 1$, a positive integer value. Thus, $x + y = 3 + 1 = 4$

200. We know that

$h = -3(t - 10)^2 + 250 \ldots$(i)

We need to first find the value of t such that the value of h is maximum.

In the expression for h, we have a term $-3(t - 10)^2$

We know that $(t - 10)^2 \geq 0$ for all values of t (since it is a perfect square).

Thus, we have

$-3(t - 10)^2 \leq 0$ for all values of t (multiplying with a negative reverses the inequality).

Thus, in order that h attains a maximum value, the term $-3(t - 10)^2$ must be 0.

Thus, we have $-3(t - 10)^2 = 0$

$\Rightarrow t = 10$

Thus, h attains a maximum value at $t = 10$ seconds

Thus, 7 seconds after the maximum height is attained, i.e. at $t = 10 + 7 = 17$, we have the corresponding value of h (in feet) as:

$h = -3(t - 10)^2 + 250$

$= -3 \times 49 + 250$; substituting the value of $t = 17$ and solving

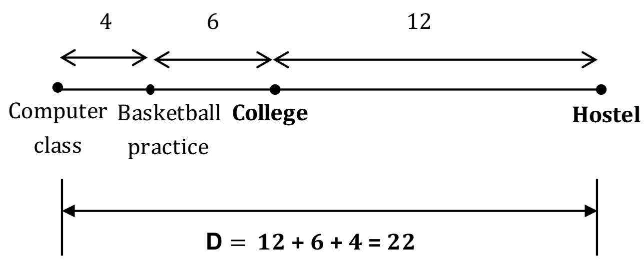
$= 103$ feet

The correct answer is Option B.

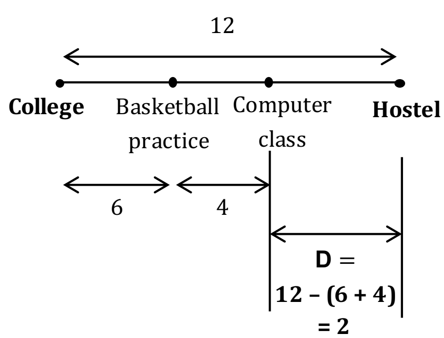
5.16 Inequalities

201. The possible extreme scenarios are shown in the diagrams below:

(1) Maximum distance away from hostel:



(2) Minimum distance away from hostel:



Thus, the maximum value of D is 22 and minimum value of D is 2

$=> 2 \leq D \leq 22$

The correct answer is Option D.

202. As per given inequality: $|b| \leq 12$, value of 'b' ranges from '-12' to '$+12$'. So, by putting these values in first equation: $2a + b = 12$, we can form a table of consistent values of a & b.

a	b
0	12
1	10
2	8
3	6
4	4
5	2
6	0

a	b
Cont...	
7	-2
8	-4
9	-6
10	-8
11	-10
12	-12

So a total of 13 ordered pairs are possible.

The correct answer is Option E.

Alternate approach:

We see that the value of b ranges from -12 to $+12$; this follows that b can have 25 number of integer values.

Now let us see how many integer values a can have.

$2a + b = 12 => a = \frac{12 - b}{2};$

$=> a = 6 - \frac{b}{2}$

We see that for a to be an integer, $\frac{b}{2}$ must be an integer; this follows that b must be an even number.

Out of 25 possible values of b, 13 are even (including 0); so for a to be an integer, the set of arrangement can only have 13 ordered pairs.

203. Let the cost of an pencil be $\$x$ and the cost of a pen be $\$y$.

Thus, we need to find the range within which $(5x + 7y)$ lies.

We have

$3.60 < 15x < 4.80$

$=> \frac{3.60}{3} < \frac{15x}{3} < \frac{4.80}{3}$

$=> 1.20 < 5x < 1.60 \ldots$(i)

Also, we have

$33.30 < 21y < 42.90$

$=> \frac{33.30}{3} < \frac{21y}{3} < \frac{42.90}{3}$

$=> 11.10 < 7y < 14.30 \ldots$(ii)

Adding (i) and (ii):

$12.30 < 5x + 7y < 15.90$

Thus, the correct answer is Option D.

204. Working with the options one at a time:

Comparing options A and B:

$(xy)^2 = x^2y^2 < x^2$ (since $0 < y < 1 \Rightarrow y^2$ is a fraction between 0 and 1)

Thus, Option B cannot have the greatest value.

Comparing options A and C:

$\left(\frac{x}{y}\right)^2 = \frac{x^2}{y^2} = x^2 \times \left(\frac{1}{y^2}\right) > x^2$ (since $0 < y < 1 \Rightarrow 0 < y^2 < 1 \Rightarrow \frac{1}{y^2} > 1$)

Thus, Option A cannot have the greatest value.

Comparing options C and D:

$\frac{x^2}{y} = \frac{x^2}{y^2} \times y = \left[\left(\frac{x}{y}\right)^2 \times y\right] < \left(\frac{x}{y}\right)^2$ (since $0 < y < 1 \Rightarrow y$ is a fraction between 0 and 1)

Thus, Option D cannot have the greatest value.

Comparing options C and E:

$x^2y = \frac{x^2}{y^2} \times y^3 = \left(\frac{x}{y}\right)^2 \times y^3 < \left(\frac{x}{y}\right)^2$ (since $0 < y < 1 \Rightarrow y^3$ is a fraction between 0 and 1)

Thus, Option E cannot have the greatest value.

The correct answer is Option C.

Alternate approach:

Since $x < 0$ and $0 < y < 1$ must be true for all the values of x & y; let us assume convenient, smart values of x & y.

Say $x = -1$ & $y = \frac{1}{2}$

Let us calculate the values of each option.

(A) $x^2 = (-1)^2 = 1$

(B) $(xy)^2 = \left(-1 \times \frac{1}{2}\right)^2 = \frac{1}{4}$

(C) $\left(\frac{x}{y}\right)^2 = \left(\frac{-1}{\frac{1}{2}}\right)^2 = 4$: Maximum

(D) $\frac{x^2}{y} = \frac{(-1)^2}{\frac{1}{2}} = 2$

(E) $x^2y = (-1)^2 \times \frac{1}{2} = \frac{1}{2}$

205. Let the distance between the cities A and B be d miles.

Range of speeds of David = 20 miles per hour to 30 miles per hour.

Time taken by David to cover the distance = 5 hours.

So, the range of distance between cities A and B
= [20 × 5 miles] to [30 × 5 miles]

= 100 miles to 150 miles

$=> 100 < d < 150 \ldots$(i)

Range of speeds of Mark = 40 miles per hour to 60 miles per hour.

Time taken by Mark to cover the distance = 3 hours.

So, the range of distance between cities A and B
= [40 × 3 miles] to [60× 3 miles]

= 120 miles to 180 miles

$=> 120 < d < 180 \ldots$(ii)

Thus, from (i) and (ii), we have

Range of distance between cities A and B

= (Higher of the two minimum values) to (Lower of the two maximum values)

= (Higher of 100 and 120) to (Lower of 150 and 180)

= 120 miles to 150 miles

$=> 120 < d < 150$

The only option that satisfies above is 135 miles.

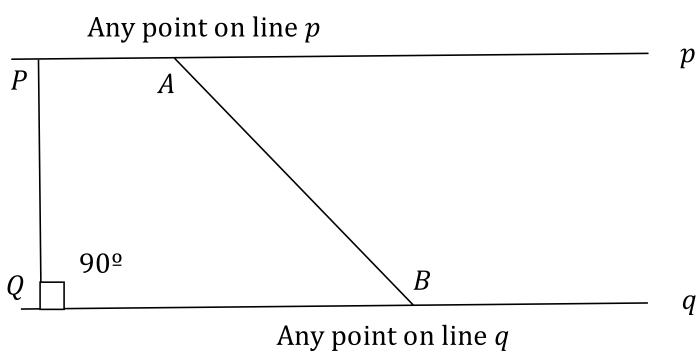
The correct answer is Option B.

5.17 Geometry: Lines & Triangles

206. Working with the statements:

Statement I:

We can have a situation as shown below:



Note that the statement talks about any points on the two lines; here, they can be A and B or P and Q. Note that AB > PQ or in other way AB ≠ PQ.

Thus, statement I is incorrect.

Statement II:

Perpendicular distance between the two lines is given by PQ; it is the shortest distance between the two lines.

Thus, statement II is correct.

Statement III:

This is a corollary of Statement 1. We see that PQ ≠ AB.

Thus, statement III is incorrect.

The correct answer is Option B.

207. We know that

$AB = \frac{1}{3}CD$

$=> CD = 3AB \ldots (i)$

BD = 2AC ... (ii)

BC = 36 ... (iii)

From (ii):

=> BC + CD = 2(AB + BC)

Using (i) and (iii):

=> 36 + 3AB = 2(AB + 36)

=> 36 + 3AB = 2AB + 72

=> AB = 36

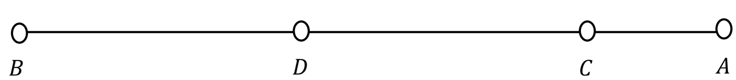
=> CD = 3 × 36 = 108

The correct answer is Option D.

208. Since the length of AB (20) > the length of AC (6), A must be closer to C than to B.

Also, since the sum of the lengths of AB (20) and AC (6) is greater than the length of BC (14), A must lie beyond the line segment BC (14).

The sequence of the points A, B, C and D is shown in the diagram below:



Since D is the midpoint of BC, we have

$BD = CD = \frac{BC}{2}$

$= \frac{14}{2}$

$= 7$

AD = AC + CD

= 6 + 7

= 13

The correct answer is Option D.

209. Here we know that gym and school are equidistant from Mike's home and distance between gym and school is constant that is 10 miles. So if we join all these three places, we get an isosceles triangle.

So, here the property about lengths of sides of triangle, "Sum of any two sides is always greater than third side and positive difference between any two sides is always less than third side." is applicable.

- Statement 1:

Isosceles triangle is of sides: 4, 4, 10. Here $4 + 4 = 8 \ngtr 10$; so such a triangle does not exist. This is NOT the possible case.

- Statement 2:

Isosceles triangle is of sides: 12, 12, and 10. This triangle follows the above mentioned property. So this is a possible case.

- Statement 3:

Isosceles triangle is of sides: 15, 15, and 10. This triangle follows the above mentioned property. So this is a possible case.

The correct answer is Option E.

Alternate approach:

The shortest required distance is when the Mike's home lies midway on the line joining gym and school, i.e., $\frac{10}{2} = 5$ miles from either places. Thus, any value greater than or equal to 5 miles is possible.

210. Given

$a < b < c$

Since c is the longest side in the right triangle, it must be the hypotenuse.

Also, a and b are the perpendicular legs of this right angled triangle.

Here let us recall formula to find the area of right angled triangle:

$= \frac{1}{2} \times$ Product of two legs

Thus, area of the triangle:

$= \frac{1}{2} \times a \times b = 2$

=> $ab = 4$

If we assume that $a = b$, we have

$a = b = \sqrt{4} = 2$

However, it is known that $a < b$, we can conclude that $a < 2$ and $b > 2$.

=> $a < 2$

The correct answer is Option A.

211. Since z is the longest side in the right triangle, it must be the hypotenuse.

Thus, we have

$x^2 + y^2 = z^2 \ldots$(i)

Also, x and y are the perpendicular legs of the triangle.

Thus, area of the triangle:

$= \frac{1}{2} \times x \times y = 2$

=> $xy = 4 \ldots$(ii)

From (i), we have
$z^2 = x^2 + y^2$
$= (x + y)^2 - 2xy$
$= (x + y)^2 - 8$ (since $xy = 4$, from (ii))

Given $xy = 4$, the minimum value of $(x + y)$ occurs if $x = y$.

Let us verify:

Say, $x \neq y$:

$x = 4, y = 1$ => $x + y = 5$

However, if $x = y$:

$x = y = 2$ => $x + y = 4 < 5$

However, the maximum value of $(x + y)$ is undefined and tends to infinity.

Say, we take $x = 100, y = 0.04$ => $x + y = 100.4$

Thus, the value of $(x + y)$ can be increased to any arbitrarily high value.

Thus, we can see that given $xy = 4$, $(x + y)$ has only a minimum value and this is 4.

Hence, we have

$z^2 = (x + y)^2 - 8$

=> The minimum value of z^2 occurs when $(x + y)^2$ is minimum i.e. $(x + y)$ is minimum

=> Minimum value of $z^2 = 4^2 - 8 = 8$

=> Minimum value of $z = \sqrt{8} = 2\sqrt{2}$

=> $z > 2\sqrt{2}$ (the equality does not hold since x and y cannot be equal since $x < y$)

The correct answer is Option A.

212. Since DA = DC, triangle DAC is isosceles

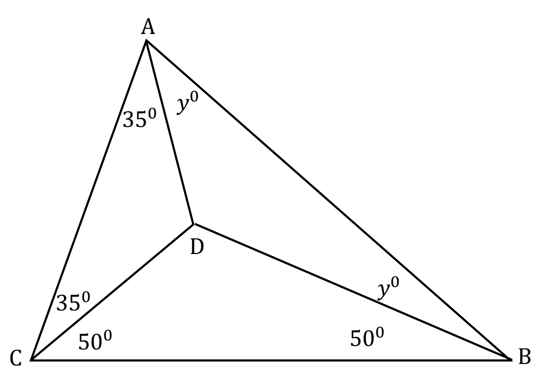
=> $\angle DAC = \angle DCA = 35^\circ$

Since DB = DC, triangle DBC is isosceles

=> $\angle DBC = \angle DCB = 50^\circ$

Since DA = DB, triangle DAB is isosceles

=> $\angle DBA = \angle DAB = y^\circ$



Since sum of the internal angles of the triangle ABC is 180°, we have

$(35 + y) + (y + 50) + (50 + 35) = 180$

=> $2y = 10$

=> $y^\circ = 5^\circ$

The correct answer is Option A.

Alternate approach:

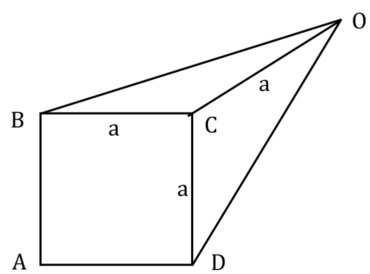
Since DA = DB = DC, D is the center of the circumcircle of triangle ABC.

Thus, $\angle ADB = 2 \times \angle ACB = 2 \times (35 + 50)^\circ = 170^\circ$

Since triangle ADB is an isosceles triangle, we have

$$y = \frac{(180^\circ - 170^\circ)}{2} = 5^\circ$$

213.



We observe that triangles BCO and DCO are isosceles.

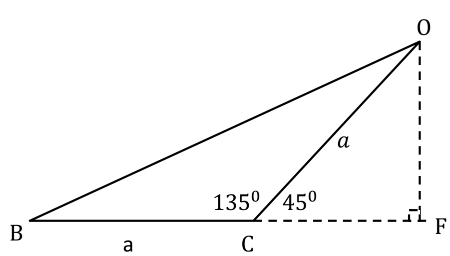
Also, triangle BCO $\cong$ triangle DCO

(Since CO is common, BC = CD and BO = DO)

Thus, $\angle BCO = \angle DCO$

$$= \frac{360^\circ - 90^\circ}{2} = 135^\circ$$

Considering triangle BCO alone, we have



In triangle COF:

$\angle OCF = 180^\circ - 135^\circ = 45^\circ$

$=> \angle COF = 180^\circ - (90^\circ + 45^\circ) = 45^\circ$

Thus, triangle COF is isosceles.

Let CF = OF = x

Thus, from Pythagoras' theorem in triangle COF:

$x^2 + x^2 = a^2$

$=> x = \frac{a}{\sqrt{2}}$

$=> OF = x = \frac{a}{\sqrt{2}} = \frac{a\sqrt{2}}{2}$

Thus, area of triangle BCO

$= \frac{1}{2} \times \text{Base} \times \text{Height}$

$= \frac{1}{2} \times BC \times OF$

$= \frac{1}{2} \times a \times \frac{a\sqrt{2}}{2}$

$= \frac{a^2\sqrt{2}}{4}$

The correct answer is Option B.

Alternate approach:

From symmetry, we can say that OC, when extended would pass through A.

$AC = \sqrt{AB^2 + BC^2} = \sqrt{a^2 + a^2} = a\sqrt{2}$

We know that if the height of two triangles is the same, the ratio of their area equals the ratio of their base.

Thus, we have

$\frac{\text{Area of triangle ABC}}{\text{Area of triangle BOC}} = \frac{\text{Base of triangle ABC}}{\text{Base of triangle BOC}}$

$= \frac{AC}{CO}$

$= \frac{a\sqrt{2}}{a} = \frac{\sqrt{2}}{1}$

Area of triangle ABC = $\frac{\text{Area of square ABCD}}{2}$

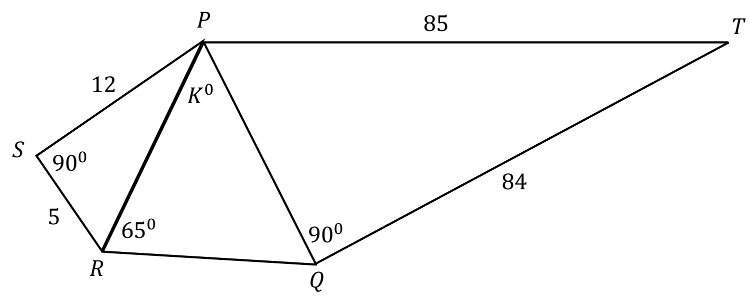
$\frac{a \times a}{2} = \frac{a^2}{2}$

Thus, we have

$$\frac{\left(\frac{a^2}{2}\right)}{\text{Area of triangle BOC}} = \frac{\sqrt{2}}{1}$$

=> Area of triangle BOC = $\frac{a^2}{2\sqrt{2}} = \frac{a^2\sqrt{2}}{4}$

214. Let us bring out the figure.



In the right angled triangle PSR, as per Pythagoras theorem, we have

$PR^2 = PS^2 + RS^2$

=> $PR^2 = 12^2 + 5^2 = 169$

=> PR = 13

In the right angled triangle PQT, as per Pythagoras theorem, we have

$PQ^2 = PT^2 - QT^2$

=> $PQ^2 = 85^2 - 84^2 = 169$

=> PQ = 13

Thus, we have

PQ = PR

In a triangle, if two sides are equal, angles opposite to them are also equal.

=> $\angle PQR = \angle PRQ = 65^\circ$

=> $\angle QPR = 180^\circ - (\angle PQR + \angle PRQ)$

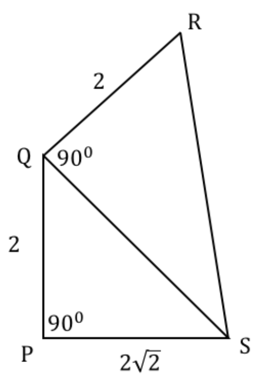
=> $\angle QPR = 180^\circ - (65^\circ + 65^\circ)$

=> $\angle QPR = 50^\circ$

=> $K^\circ = 50^\circ$

The correct answer is Option B.

215. Let us bring out the figure.



In right angled triangle PQR, as per Pythagoras theorem:

$QS^2 = PQ^2 + PS^2$

=> $QS^2 = 4 + 8 = 12$

=> $QS = 2\sqrt{3}$

In right angled triangle RQS, as per Pythagoras theorem:

$RS^2 = RQ^2 + QS^2$

=> $RS^2 = 4 + 12 = 16$

=> $RS = 4$

Thus, perimeter of triangle QRS

= QR + RS + QS

= $2 + 4 + 2\sqrt{3}$

$= 6 + 2\sqrt{3}$

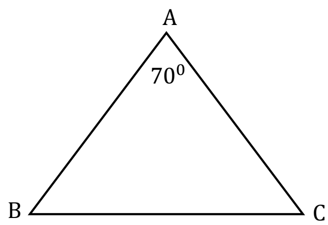
The correct answer is Option C.

216. Since the triangle ABC is isosceles, there can be three possible cases:

(1) AB = AC ≠ BC

=> $\angle ABC = \angle BCA$

We know that ∠BAC = 70°



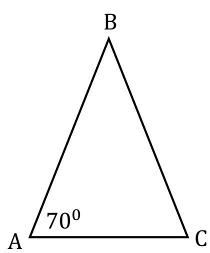
= >$\angle ABC$ + ∠BCA = 180° − 70° = 110°

=> ∠BCA = $\frac{110^\circ}{2}$ = 55°

(2) BP = BC ≠ AC

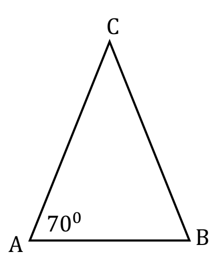
=> ∠BAC = ∠BCA

We know that ∠BAC = 70°



=> ∠BCA = 70°

(3) CB = CA ≠ BC



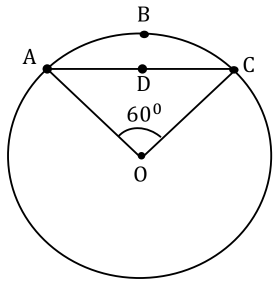
=> ∠CAB = ∠CBA = 70° (given)

$$=> \angle BCA = 180^\circ - (70^\circ + 70^\circ) = 40^\circ$$

The correct answer is Option E.

5.18 Geometry–Circles

217. Length of the arc ABC (which subtends 60° at the center) = $2\pi r \times \left(\frac{60}{360}\right)$, where r is the radius of the circle.



Thus, we have

$$2\pi r \times \left(\frac{60}{360}\right) = 24\pi$$

$=> r = 72$

In triangle COA, we have AO = CO = radius of the circle

Hence, we have

$$\angle OCA = \angle OAC = \frac{180^\circ - 60^\circ}{2} = 60^\circ$$

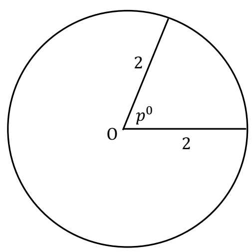
Thus, triangle COA is equilateral.

Thus, we have AC = CO = AO = radius of the circle = 72.

Thus, perimeter of the region ABCD = $(24\pi + 72) = 24(\pi + 3)$.

The correct answer is Option D.

218. Let us bring out the figure.



Area of a sector of a circle containing p° at the center is given by:

Area of the sector $= \pi \times (\text{radius})^2 \times \left(\frac{p}{360}\right)$

Thus, we have

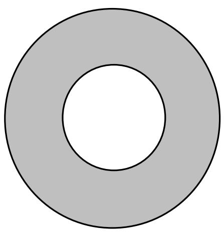
$\pi \times (2)^2 \times \left(\frac{p}{360}\right) = \frac{\pi}{2}$

$=> \; p = \frac{360}{8}$

$= 45°$

The correct answer is Option C.

219. The figure below demonstrate the two circles and the shaded region.



Let the radius of the outer circle be R and the radius of the inner circle be r.

Thus, area of the outer circle = πR^2

Area of the inner circle = πr^2

Thus, area of the shaded region = $(\pi R^2 - \pi r^2)$

Since the area of the shaded region is 3 times the area of the smaller circle, we have

$\pi R^2 - \pi r^2 = 3\pi r^2$

$=> \pi R^2 = 4\pi r^2$

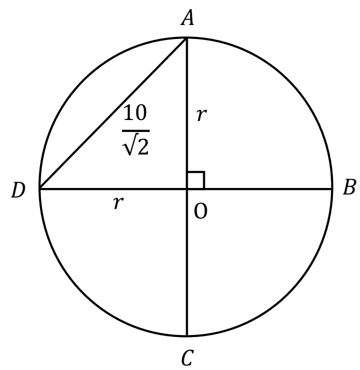
$=> R^2 = 4r^2$

$=> R = 2r$

$=> \frac{R}{r} = \frac{2}{1}$

The correct answer is Option C.

220.



In right angled triangle AOD, as per Pythagoras theorem, we have

=> $AD^2 = AO^2 + DO^2$

Since AD = $\frac{10}{\sqrt{2}}$ and AO = DO = radius = r, we have

=> $\left(\frac{10}{\sqrt{2}}\right)^2 = r^2 + r^2$

=> $2r^2 = 50$

=> $r = 5$

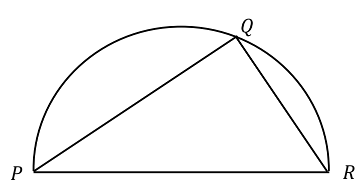
Thus, area of the circle

$= \pi r^2$

$= 25\pi$

The correct answer is Option C.

221. Let us bring out the figure.



Since the triangle PQR is inscribed in a **semicircle**, PR is the diameter of the semicircle.

Since the diameter subtends 90° at any point on the circumference, in triangle PQR, we have

$\angle PQR = 90°$

Thus, from Pythagoras' theorem, we have

$PR^2 = PQ^2 + QR^2$

=> $PR^2 = 5^2 + 12^2 = 169$ (it is given that PQ = 5 and PR = 12)

=> PR = 13

=> Radius of the semicircle = $\frac{13}{2}$

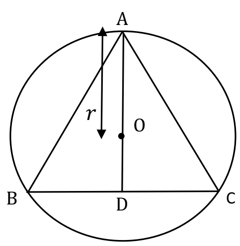
Thus, length of the arc PQR

$= \frac{\text{Circumference of the circle}}{2} = \frac{2\pi \times (\text{radius of the circle})}{2} = \pi \times (\text{radius of the circle})$

$= \frac{13\pi}{2}$

The correct answer is Option E.

222.



The area of an equilateral triangle = $\frac{\sqrt{3}}{4} \times (\text{side})^2 = \frac{\sqrt{3}}{4} \times (AB)^2$

Thus, we have

$\frac{\sqrt{3}}{4} \times (AB)^2 = 8\sqrt{3}$

=> $AB = 4\sqrt{2}$

Thus, the height (or, the median) of the equilateral triangle (AD)

$= \frac{\sqrt{3}}{2} \times (\text{side}) = \frac{\sqrt{3}}{2} \times (AB)$

$= \frac{\sqrt{3}}{2} \times 4\sqrt{2}$

$= 2\sqrt{6}$

In an equilateral triangle, the centre of the circumscribing circle is the centroid of the triangle.

Thus, the centre of the circle (O) is the centroid of the equilateral triangle ABC.

The centroid divides the median AD in the ratio 2 : 1.

Thus, we have

$$AO = \left(\frac{2}{2+1}\right) \times AD$$

$$= \frac{2}{3} \times 2\sqrt{6}$$

$$= \frac{4\sqrt{6}}{3}$$

Thus, the radius (r) of the circle = AO = $\frac{4\sqrt{6}}{3}$

Thus, the area of the circle

$$= \pi r^2$$

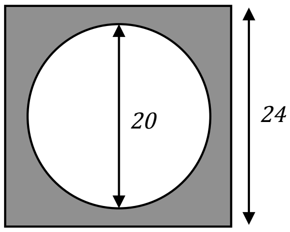
$$= \pi \times \left(\frac{4\sqrt{6}}{3}\right)^2$$

$$= \frac{32\pi}{3}$$

The correct answer is Option C.

5.19 Geometry–Polygon

223. The diagram corresponding to the data provided is shown below:



We need to find what fraction the shaded area represents of the area of square tabletop.

Side of square table top is 24 inches.

Area of the square tabletop = (Side)^2

=> $24^2 = 576$ square inches.

Diameter of circular cloth is 20 inches.

Area of the circular cloth = $\pi(r)^2$

=> $\pi \times \left(\frac{20}{2}\right)^2 = \approx 3.14 \times 100 = 314$ square inches.

Thus, area of the tabletop not covered by the cloth = 576 − 314 = 262 square inches.

Thus, the required fraction = $\frac{\text{Area of the tabletop not covered by the cloth}}{\text{Area of square tabletop}}$

=> $\frac{262}{576} = \frac{131}{288}$.

We can see that 131 is less than half of 288 (= 144)

So here Option A, B, and C are eliminated.

However, 131 is more than one-fourth of 288 (= 72)

So here Option D is eliminated.

Thus, the required fraction must be between 50% (half) and 25% (one-fourth).

The only option satisfying is E, which is $\frac{9}{20} \times 100 = 45\%$

The correct answer is Option E.

224. Let the length and breadth of the rectangular floor be x meters and y meters, where x and y are integers.

Since the perimeter of such floor is 16 meters, we have

$2(x + y) = 16$

$=> x + y = 8$

Thus, the possible cases are:

(1) $(x, y) = (7, 1)$
=> Area of the floor $= 1 \times 7 = 7$ square meters
=> Number of carpets required $= \left(\frac{7}{1 \times 1}\right) = 7$
=> Total cost of carpeting $= \$ (7 \times 6) = \$42$

(2) $(x, y) = (6, 2)$
=> Area of the floor $= 2 \times 6 = 12$ square meters
=> Number of carpets required $= \left(\frac{12}{1 \times 1}\right) = 12$
=> Total cost of carpeting $= \$ (12 \times 6) = \$72$

(3) $(x, y) = (5, 3)$
=> Area of the floor $= 3 \times 5 = 15$ square meters
=> Number of carpets required $= \left(\frac{15}{1 \times 1}\right) = 15$
=> Total cost of carpeting $= \$ (15 \times 6) = \$90$

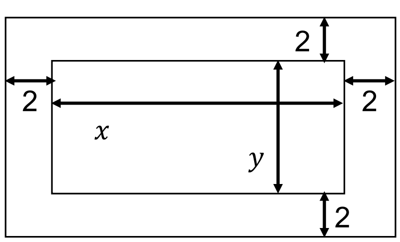
(4) $(x, y) = (4, 4)$
=> Area of the floor $= 4 \times 4 = 16$ square meters
=> Number of carpets required $= \left(\frac{16}{1 \times 1}\right) = 16$
=> Total cost of carpeting $= \$ (16 \times 6) = \$96$

Note: For a given perimeter, the area is the maximum if the length and breadth are equal.

The correct answer is Option D.

225. Let the length and width of the photograph be x centimeters and y centimeters respectively.

Thus, along with the border of 2 centimeters, the effective length becomes $(x + 4)$ centimeters and the effective width becomes $(y + 4)$ inches (since the border is along all sides) as shown in the figure below:



Thus, we have

$(x + 4)(y + 4) = a$

$=> xy + 4(x + y) = a - 16 \ldots$(i)

Again, along with the border of 4 centimeters, the effective length becomes $(x + 8)$ centimeters and the effective width becomes $(y + 8)$ centimeters.

Thus, we have

$(x + 8)(y + 8) = a + 100$

$=> xy + 8(x + y) = a + 100 - 64$

$=> xy + 8(x + y) = a + 36 \ldots$(ii)

Subtracting (ii) from (i):

$xy - xy + 8(x + y) - 4(x + y) = (a + 36) - (a - 16)$

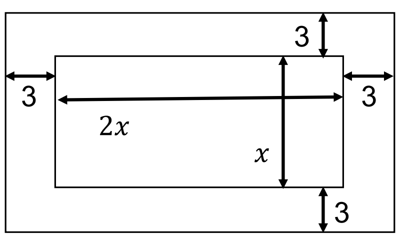
$=> 4(x + y) = 36 + 16 = 52$

$=> 2(x + y) = 26$

$=>$ Perimeter of the photograph = $2(x + y) = 26$ centimeters.

The correct answer is Option D.

226. Let the width of the photograph without the border be x centimeters.



Thus, the length of the photograph without the border is $2x$ centimeters.

Thus, area of the above rectangle without the border = $2x \times x = 2x^2$ square centimeters.

Including the border, the length and width are $(2x + 3 + 3) = (2x + 6)$ and $(x + 3 + 3) = (x + 6)$ centimeters respectively.

Thus, area of the above rectangle including the border = $(2x + 6) \times (x + 6)$ square centimeters.

Thus, the area of the border

= (Area of the outer rectangle) – (Area of the inner rectangle)

$= (2x + 6) \times (x + 6) - 2x^2$

$= 2x^2 + 18x + 36 - 2x^2$

$= 18x + 36$

Thus, we have

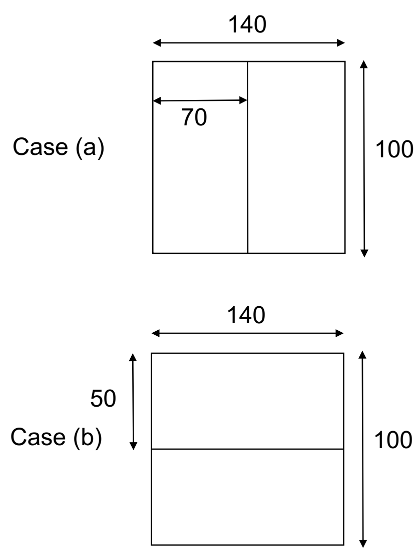
$18x + 36 = 216$

$=> x = 10$

Thus, the width of the photograph without the border = $x = 10$ centimeters.

The correct answer is Option A.

227. The two possible ways in which the field may be partitioned are shown below:



- Case a: Perimeter of one half of the field = $2 \times (70 + 100) = 340$ feet.
- Case b: Perimeter of one half of the field = $2 \times (50 + 140) = 380$ feet.

Thus, the perimeter is the minimum in the first case.

Thus, the minimum cost of fencing = $\$(340 \times 3) = \$1020$.

The correct answer is Option D.

228. We know that the perimeter of the rectangle is 480 feet.

Thus, the sum of the length and breadth is $\frac{480}{2} = 240$ feet.

Note that the area of the rectangle would be the maximum if the length and breadth are equal.

In that case, we would have:

Length = Breadth = $\frac{240}{2}$ = 120 feet

Thus, the maximum possible area would be = 120×120 = 14,400 square feet.

The correct answer is Option A.

229. Width of the strip = b inches

$= \left(\frac{b}{12}\right)$ feet

Length of the strip = c miles

$= 5,280 \times c$ feet

Thus, total area of the strip

$= \left(\frac{b}{12}\right) \times (5,280 \times c)$

$= \left(\frac{5,280 \times c \times b}{12}\right)$ square feet

Quantity of paint required to paint a square feet = 1 gallon.

Thus, quantity of paint required to paint 1 square foot = $\frac{1}{a}$ gallon.

Thus, quantity of paint required to paint $\left(\frac{5,280 \times c \times b}{12}\right)$ square feet

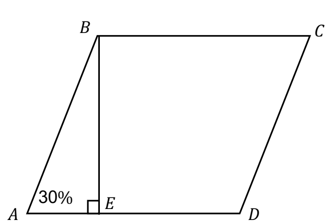
$= \left(\frac{1}{a}\right) \times \left(\frac{5,280 \times c \times b}{12}\right)$

$= \left(\frac{5,280 \times c \times b}{12 \times a}\right)$ gallons

$= \left(\frac{5,280bc}{31.5 \times 12a}\right)$ barrels

The correct answer is Option A.

230. Let us bring out the figure.

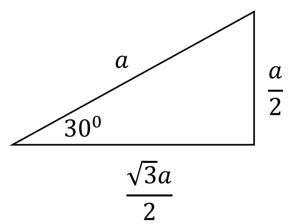


We know that the area of a parallelogram = Base × Height = AD × BE

In triangle ABE, we have

AB = 2, and $\angle$BAE = 30°

In a 30-60-90 triangle, the ratio of the sides of the triangle is shown below:



If the hypotenuse is of length a:

(1) The side opposite to 30° is $\frac{a}{2}$

(2) The side opposite to 60° is $\frac{\sqrt{3}a}{2}$

In the given problem, we have

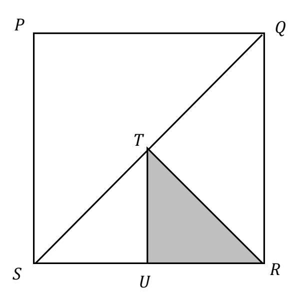
AB = Hypotenuse = 2

=> BE (side opposite to 30°) = $\frac{2}{2} = 1$

Thus, area of the parallelogram = BE $\times$ AD = BE $\times$ BC = $1 \times 3 = 3$.

The correct answer is Option A.

231. Let us bring out the figure.



We know that

T is the mid-point of QS, and

U is the mid-point of RS.

Thus, from intercept theorem, we have TU || QR.

Thus, triangle STU ≅ triangle SRQ

The ratio of the corresponding sides of the above two similar triangles

$$= \frac{ST}{SQ} = \frac{1}{2}$$

Thus, ratio of the area of similar triangles STU and SRQ

$$= (\text{Ratio of their corresponding sides})^2$$

$$= \left(\frac{1}{2}\right)^2 = \frac{1}{4}$$

Thus, we have

$$\frac{\text{Area of triangle STU}}{\text{Area of triangle SRQ}} = \frac{1}{4}$$

Since area of triangle SRQ is $\frac{1}{2}$ area of square PQRS, we have

$$=> \frac{\text{Area of triangle STU}}{\left(\frac{\text{Area of square PQRS}}{2}\right)} = \frac{1}{4}$$

$$=> 2 \times \frac{\text{Area of triangle STU}}{\text{Area of square PQRS}} = \frac{1}{4}$$

$$=> \frac{\text{Area of triangle STU}}{\text{Area of square PQRS}} = \frac{1}{8}$$

From the diagram, it is clear that triangles STU and TUR are congruent and hence, have equal area.

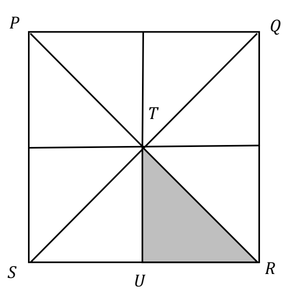
Thus, we have

$$\frac{\text{Area of triangle TUR}}{\text{Area of square PQRS}} = \frac{1}{8}$$

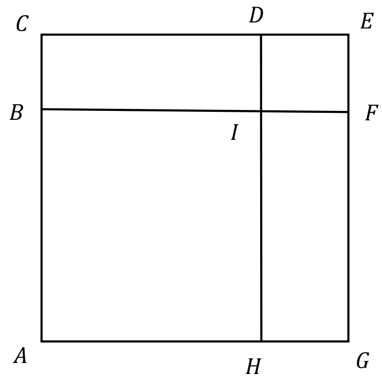
The correct answer is Option B.

Alternate approach:

Constructing a few lines (shown below as dotted lines) makes it clear that the shaded part i.e. triangle TUR is 1 out of 8 identical parts in which the square has been divided into.



232. Let us bring out the figure.



Area of square ACEG = 729

Thus, we have

$CE^2 = 729$

$=> CE = 27 \ldots (i)$

Ratio of the area of square region IDEF to the area of square region ABHI = 1 : 4

$=> DE^2 : BI^2 = 1 : 4$

$=> DE : BI = 1 : 2$

Since CDIB is a rectangle, CD = BI

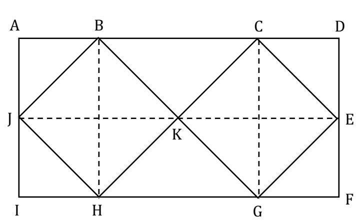
$=> DE : CD = 1 : 2 \ldots (ii)$

Thus, from (i) and (ii):

$$CD = \left(\frac{2}{1+2}\right) \times 27 = 18.$$

The correct answer is Option C.

233. Let us redraw the figure.



Since BJHK and CKGE are identical squares, we have

BH = CG = JK = KE (since diagonals of a square are equal)

Thus, we have

AD = JK + KE

= BH + CG

= AI + AI (since BH = CG = AI)

=> AD = 2× AI

Since, perimeter of the rectangle is $36\sqrt{2}$, we have

$2 \times (\text{AD} + \text{AI}) = 36\sqrt{2}$

=> $2 \times (2 \times \text{AI} + \text{AI}) = 36\sqrt{2}$

=> AI = $6\sqrt{2}$

=> Diagonal of each square = $6\sqrt{2}$

If the side of each square be x, then the length of the diagonal = $x\sqrt{2}$

Thus, we have

$x\sqrt{2} = 6\sqrt{2}$

=> $x = 6$

Thus, perimeter of each square

= $4x$

= 4×6

= 24

The correct answer is Option D.

234. Let the number of desks placed be d and the number of benches placed be b.

Given that each desk is 2.0 meters long, and each bench is 1.5 meters long, the total length covered by d desks and b benches = $(2d + 1.5b)$ meters.

Since we need to maximize the total number of desks and benches, and benches are shorter than desks, we must have more number of benches than desks, keeping at least one desk.

Thus, we have

$(2d + 1.5b) \leq 16.5$ (Where d and b are positive integers)

If we take the maximum value of b to be 10, we have $1.5b = 1.5 \times 10 = 15 < 16.5$

In the above situation, there is only $(16.5 - 15) = 1.5$ meter left, which is not sufficient to accommodate a desk.

Checking with the next possible value of $b = 9$, we have $1.5b = 1.5 \times 9 = 13.5 < 16.5$

The space left = $(16.5 - 13.5) = 3$ meters.

Thus, one desk (of length 2 meters) can be accommodated in this space.

Thus, space left after accommodating one desk = $(3 - 2) = 1$ meters.

Thus, the maximum number of desks and benches that can be placed along the corridor

$= 9 + 1 = 10$.

The correct answer is Option D.

235. We know that the radius of the circle formed is r.

Thus, circumference of the circle = $2\pi r$.

Thus, length of wire left to form the square = $(20 - 2\pi r)$.

Thus, length of each side of the square = $\frac{1}{4}(20 - 2\pi r) = \left(5 - \frac{1}{2}\pi r\right)$.

Thus, area of the square formed= $\left(5 - \frac{1}{2}\pi r\right)^2$

The correct answer is Option E.

5.20 Geometry–3 Dimensional

236. The volume of liquid is same in both the cylinders.

Volume of cylinder = $\pi \times r^2 \times h$

For first cylinder, we know that $d = 10$ => $r = 5$ inches and $h = 9$ inches.

Volume of liquid in the first cylinder = $v = \pi \times 5^2 \times 9 = 225\pi$ cubic inches.

Let the radius of the second cylinder be R inches and height be 4 inches.

Thus, volume of liquid in the second cylinder = $V = \pi \times R^2 \times 4 = 4R^2\pi$ cubic inches.

As per given data,

$v = V$

Thus, we have

$4R^2\pi = 225\pi$

=> $R^2 = \frac{225\ \pi}{4\ \pi}$

=> $R = \frac{15}{2} = 7.5$

Diameter of the second cylinder = $2 \times R = 2 \times 7.5 = 15$ inches

The correct answer is Option D.

237. Diameter of the smaller rim = 24 inches.

Circumference of the smaller rim = Distance covered by smaller ring in one rotation

=> $\pi \times 24 = 24\pi$ inch.

Number of rotations made per second by the smaller rim = r

D_1 = distance covered per minute by the smaller rim

= No. of revolutions per minute $\times$ Distance covered by smaller ring in one rotation

=> $24\pi r$ inch.

Diameter of the larger rim = 36 inch.

Circumference of the larger rim = Distance covered by larger ring in one rotation

=> $\pi \times 36 = 36\pi$ inch.

Let the number of rotations made per minute by the larger rim be R.

D_2 = distance covered per minute by larger rim

= No. of rotations per minute × Distance covered by larger ring in one rotation

=> $36\pi R$ inch.

Hence, we have

$D_1 = D_2$

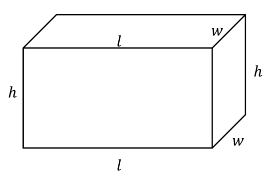
$24\pi r = 36\pi R$

=> $R = \dfrac{2r}{3}$

Thus, the number of rotations made per minute by the larger rim = $\dfrac{2r}{3}$

The correct answer is Option C.

238.



Let the dimensions of the length, width and height be l, w and h, respectively.

Since three faces shown have areas 12, 45, and 60, we have

Top face: $l \times w = 12 \ldots$(i)

Front face: $l \times h = 45 \ldots$(ii)

Right hand side face: $h \times w = 60 \ldots$(iii)

Multiplying the above three equations:

$l^2 \times w^2 \times h^2 = 12 \times 45 \times 60 = 3^4 \times 4^2 \times 5^2$

=> $l \times w \times h = \sqrt{3^4 \times 4^2 \times 5^2} = 3^2 \times 4 \times 5$

Since the volume of the solid is given by $l \times w \times h$, we have

Volume of the solid = 180.

The correct answer is Option A.

239. Since the ratio of length to width to height is 4 : 3 : 2, we can assume that:

- Length = $4k$
- Width = $3k$
- Height = $2k$

Thus, the volume of the cuboid

$= 4k \times 3k \times 2k$

$= 24k^3$

Thus, we have

$24k^3 = n$

$=> k^3 = \frac{n}{24}$

$=> k = \sqrt[3]{\frac{n}{24}}$

Thus, the length of the cuboid

$= 4k$

$= 4 \times \sqrt[3]{\frac{n}{24}}$

$= 4 \times \sqrt[3]{\frac{n}{2^3 \times 3}}$

$= \frac{4}{2} \times \sqrt[3]{\frac{n}{3}}$

$= 2\sqrt[3]{\frac{n}{3}}$

The correct answer is Option B.

240. Let the height and radius of cylinder A are h and r, respectively.

Thus, volume of cylinder A = $\pi r^2 h = 10$

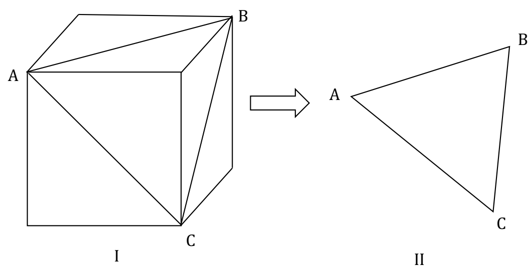
Height and radius of cylinder B = $2h$ and $2r$, respectively.

Thus, volume of cylinder B = $\pi(2r)^2(2h) = 8\pi r^2 h$

We see that the volume of cylinder B is 8 times the volume of cylinder A, thus, the volume of cylinder B = $8 \times 10 = 80$ barrels.

The correct answer is Option D.

241.



Let us join AB as shown in the figure (I) above.

Let us now remove the edges of the cube from the figure (I) so that only the triangle ABC is left behind as shown in figure (II).

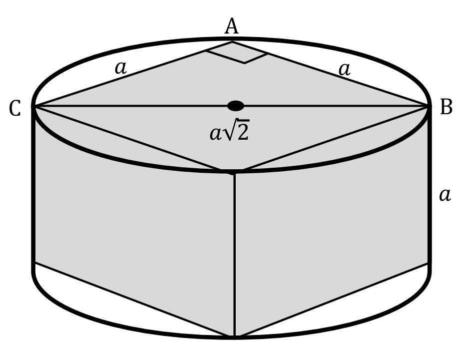
We can see that AC, BC and AB are the face diagonals of the cube and hence, are equal to one another.

Thus, triangle ABC is an equilateral triangle.

Thus, $\angle ABC = 60^\circ$

The correct answer is Option D.

242. Let us refer to the image below.



Let the edge of the cube be a.

Height of the cylinder = edge of the cube = a; given

In right angled triangle CAB:

$CB^2 = CA^2 + AB^2 = a^2 + a^2 = 2a^2$

=> $CB = a\sqrt{2}$

Thus, the diameter of the cylinder = $a\sqrt{2}$

=> Radius of the cylinder = $\frac{a\sqrt{2}}{2} = \frac{a}{\sqrt{2}}$

Thus, volume of the cylinder

$= \pi \times \text{radius}^2 \times \text{height}$

$= \pi \times \left(\frac{a}{\sqrt{2}}\right)^2 \times a$

$= \frac{\pi a^3}{2}$

$= \frac{3}{2}a^3$; it is given that $\pi = 3$

Volume of the cube = a^3

Ratio of the volume of the cube to the volume of the cylinder = $\frac{a^3}{\frac{3}{2}a^3} = \frac{2}{3}$

The correct answer is Option E.

5.21 Co-ordinate geometry

243. The length of the line segment between 2 points $(x_1, y_1) = (-3, -6)$ and $(x_2, y_2) = (5, 0)$ is given by:

$L = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

$= \sqrt{(5 - (-3))^2 + (0 - (-6))^2}$

$= \sqrt{8^2 + 6^2}$

$= 10$

Thus, the length of the diameter of the circle = 10.

Thus, the length of the radius of the circle = $\frac{10}{2} = 5$.

Thus, the area of the circle = $\pi \times 5^2 = 25\pi$.

The correct answer is Option C.

244. Equation of a line is: $y = mx + c$, where m is the slope and c is the Y-intercept.

Thus, we have the equation of the given line as:

$y = 3x + 4$

Let the required point on the above line be: $(a, 10)$.

Thus, we have

$10 = 3a + 4$

$=> a = 2$

Thus, the required X-coordinate of the point is 2.

The correct answer is Option A.

245. Equation of a line passing through a point (p, q) and slope m is given as:

$y - q = m(x - p)$

Thus, the equation of the line l that passes through the origin $(0, 0)$ and has slope 3 is:

$y - 0 = 3(x - 0)$

$=> y = 3x$

Since $(1, a)$ is a point on the line, we have

$a = 3 \times 1$

$=> a = 3 \ldots$(i)

Since $(b, 2)$ is a point on the line, we have

$2 = 3 \times b$

$=> b = \frac{2}{3} \ldots$(ii)

Thus, from (i) and (ii), we have

$\frac{a}{b} = \frac{3}{\left(\frac{2}{3}\right)} = \frac{9}{2}$

The correct answer is Option E.

246. The equation of a circle having center at (p, q) and radius r is:
$(x - p)^2 + (y - q)^2 = r^2$

Since the center of the circle is at $(3, 2)$, the equation of the circle is:
$(x - 3)^2 + (y - 2)^2 = r^2$

If a point (m, n) lies inside the circle $(x - p)^2 + (y - q)^2 = r^2$,
it must satisfy: $(m - p)^2 + (n - q)^2 < r^2$

Since $(-1,\ 2)$ lies inside the circle, it must satisfy:
$(-1 - 3)^2 + (2 - 2)^2 < r^2$

$=> r^2 > 16$

$=> r > 4 \ldots$(i)

If a point (m, n) lies outside the circle, it must satisfy:
$(m - p)^2 + (n - q)^2 > r^2$

Since $(3, -4)$ lies outside the circle, it must satisfy:
$(3 - 3)^2 + (-4 - 2)^2 > r^2$

$=> r^2 < 36$

=> $-6 < r < 6$

Since r must be positive, we have

$0 < r < 6 \ldots$(ii)

Thus, from (i) and (ii), we have

$4 < r < 6$

From the options, only $r = 5$ satisfies the above inequality.

The correct answer is Option A.

Alternate approach:

Since $(-1, 2)$ lies inside, the distance between $(-1, 2)$ and the center $(3, 2)$ is less than the radius.

Similarly, since $(3, -4)$ lies outside, the distance between $(3, -4)$ and the center $(3, 2)$ is greater than the radius. Thus, we have

$\sqrt{[(-1-3)^2 + (2-2)^2]} < r < \sqrt{[(3-3)^2 + (-4-2)^2]}$

=> $\sqrt{16} < r < \sqrt{36}$

=> $4 < r < 6$ => $r = 5$ (only value among the options)

247. The three vertices are: (a, b), $(a, -b)$ and $(-a, -b)$

We know that $a < 0$ and $b > 0$

=> $-a > 0$ and $-b < 0$

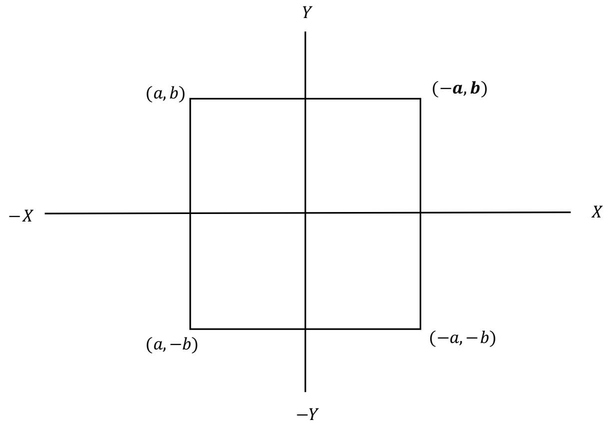
We can see that the distance of each of the vertices from the origin $(0, 0) = \sqrt{a^2 + b^2}$

Thus, the three vertices are equidistant from the origin.

Alternately, we can see that the midpoint of the diagonal joining (a, b) and $(-a, -b)$ is $(0, 0)$, i.e. the origin.

Thus, the centre of the square is at the origin.

Thus, the square would be positioned as shown in the diagram below:



Thus, the fourth vertex would be $(-a, b)$, which lies in the first quadrant.

Thus, the X-coordinate of the fourth vertex is positive and the Y-coordinate of the fourth vertex is also positive.

Thus, the only point which also lies in the same quadrant is $(6, 2)$.

The correct answer is Option E.

248. Distance between two points (x_1, y_1) and (x_2, y_2) is given by $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Distance between the points $(0, 0)$ and $(5, 5)$

$= \sqrt{(5 - 0)^2 + (5 - 0)^2}$

$= \sqrt{50}$

$= 5\sqrt{2}$

Distance between the points $(0, 0)$ and $(10, 0)$

$= \sqrt{(10 - 0)^2 + (0 - 0)^2}$

$= \sqrt{100}$

$= 10$

Note: The distance is obviously 10 since (10, 0) is a point on the X-axis at a distance of 10 to the right of the origin.

Distance between the points $(10, 0)$ and $(5, 5)$

$= \sqrt{(10 - 5)^2 + (0 - 5)^2}$

$= \sqrt{50}$

$= 5\sqrt{2}$

Thus, the perimeter

$= 5\sqrt{2} + 10 + 5\sqrt{2}$

$= 10 + 10\sqrt{2}$

The correct answer is Option E.

249. Since the points are collinear, their slopes must be equal.

Slope of the line joining two points (x_1, y_1) and (x_2, y_2) is given by: $\left(\frac{y_2 - y_1}{x_2 - x_1}\right)$.

Slope of the line joining the points $(a, 0)$ and $(0, b)$

$= \frac{b-0}{0-a}$

$= -\frac{b}{a}$

Slope of the line joining the points $(a, 0)$ and $(1,\ 1)$

$= \frac{1-0}{1-a}$

$= \frac{1}{1-a}$

Thus, we have

$-\frac{b}{a} = \frac{1}{1-a}$

$=> -b \times (1-a) = a$

$=> -b + ab = a$

$=> b + a = ab$

$=> b = ab - a$

$=> b = a(b-1)$

$=> a = \frac{b}{b-1}$

The correct answer is Option C.

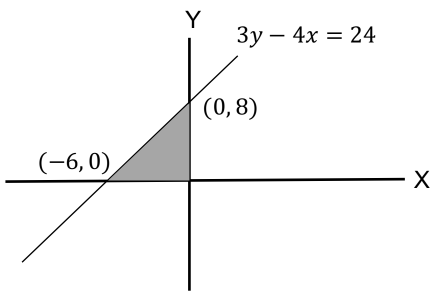
250. The area of the triangle formed by the line with the two axes

$= \frac{1}{2} \times$ (Length of X intercept) $\times$ (Length of Y intercept)

We have

$3y - 4x = 24 \ldots$(i)

The graph of the line and the area of the triangle formed by the line and the axes is shown in the diagram below:



To calculate the X-intercept:

Substituting $y = 0$ in (i):

$x = -\frac{24}{4} = -6$

Thus, the length of the X-intercept = 6.

To calculate the Y-intercept:

Substituting $x = 0$ in (i):

$y = \frac{24}{3} = 8$

Thus, the length of the Y-intercept = 8.

Thus, required area

$= \frac{1}{2} \times 6 \times 8 = 24$

The correct answer is Option C.

Chapter 6

Solutions – Data Sufficiency Questions

6.1 Numbers

251. From statement 1:

We have $M^\$ = M^2 - 2$.
$14 < M^\$ < 34$
$=> 14 < M^2 - 2 < 34$
$=> 16 < M^2 < 36$

Since M is a positive integer, M^2 must be a perfect square between 16 and 36.
Thus: $M^2 = 25$
$=> M = 5$ – Sufficient

From statement 2:

This statement is clearly not sufficient.

The correct answer is Option A.

252. Let the number of members in batches A and B be a and b, respectively.

Thus, we have

$a = 8x$
$b = 4y + 3$

We need to determine the value of $(a + b)$.

From statement 1:

We have $x = \frac{y - 1}{2}$

$=> y = 2x + 1$

Thus, we have

$a = 8x$

$b = 4y + 3 = 4(2x + 1) + 3 = 8x + 7$

However, there may be many values for x and y, thus correspondingly many values for $(a + b)$.
Thus, we cannot find the value of $(a + b)$. – Insufficient

From statement 2:

We have $b = a + 7$

Thus, we have

$4y + 3 = 8x + 7$

$=> y = 2x + 1$

There may be many values possible for x and y:

$x = 3$, $y = 7$; $x = 4$, $y = 9$, etc.

Thus, the values of x and y are not unique.

Hence, the values of $a = 8x$ and $b = 4y + 3$ are also not unique. – Insufficient

Thus, from statements 1 and 2 together:

From each statement, we have the same information: $y = 2x + 1$

Thus, even combining both the statements does not help. – Insufficient

The correct answer is Option E.

253. The index-3 of p is essentially the highest exponent of 3 that perfectly divided p.
For example, if $n = 162 = 3^4 \times 2$
The index-3 of 162 is 4 since the greatest exponent of 3 that divided 162 completely is 4.

From statement 1:

We have $q - r > 0 => q > r$.

We have have two cases.

Case 1: Say $q = 4$ & $r = 3$

We have the index-3 of $q = 4 = 3^0 \times 4$ is 0 and the index-3 of $r = 3 = 3^1$ is 1. The answer is No.

Case 2: Say $q = 9$ & $r = 3$

We have the index-3 of $q = 3^2$ is 2 and the index-3 of $r = 3 = 3^1$ is 1. The answer is Yes.

Hence, there is no definite answer. – Insufficient

From statement 2:

We have $\frac{q}{r}$ is a multiple of 3

=> $q = r \times 3^k$; where k is any positive integer

Thus, the index-3 of q will be k greater than that of r. – Sufficient

The correct answer is Option B.

254. The number of positive factors of a number N, expressed in its prime form as $N = p^x q^y$, where p and q are distinct primes, is given by $(x + 1)\ (y + 1)$.

For example: $24 = 2^3 \times 3^1$
The number of positive factors = $(3 + 1)\ (1 + 1) = 8$.
The factors of 24 are: 1, 2, 3, 4, 6, 8, 12, 24; i.e. 8 in number.

From statement 1:

$m = p^3 q^2$; where p and q are different prime numbers.
Thus, the number of positive factors = $(3 + 1)\ (2 + 1) = 12$. – Sufficient

From statement 2:

Here, m can take multiple possible values.
For example, $2 \times 3,\ 2^2 \times 3^3,\ 2^4 \times 3$, etc. all have 2 and 3 as the only two prime factors.
However, the number of factors of each of the above numbers is different. – Insufficient

The correct answer is Option A.

255. Since $\sqrt{m}$ is an integer, m must be a perfect square.

From statement 1:

We have $13 \leq m \leq 16$

The only perfect square between 13 and 16 is 16.

Thus, we have

$m = 16$.

=> $\sqrt{m} = 4$ ($\sqrt{m}$ only takes the positive square root of m). – Sufficient

From statement 2:

We have $3 \leq \sqrt{m} \leq 4$

The possible values of $\sqrt{m}$ are 3 or 4.

Thus, the value of $\sqrt{m}$ is not unique. – Insufficient

The correct answer is Option A.

256. We have
$xy^{\left(\frac{4}{3}\right)} = \sqrt[3]{432}$

Cubing both sides

$x^3y^4 = 432 = 3^3 \times 2^4$

We need to determine whether $x + y = 5$.

From statement 1:

Nothing is mentioned about x.
For example, two possible solutions are:

If $x = 3,\ y = 2 => x + y = 5$;

OR

if $x = \sqrt[3]{432},\ y = 1 => x + y \neq 5$ – Insufficient

From statement 2:

Nothing is mentioned about y.

For example, two possible solutions are:

If $x = 3,\ y = 2 => x + y = 5$;

OR

If $x = 1,\ y = \sqrt[4]{432} => x + y \neq 5$ – Insufficient

Thus, from statements 1 and 2 together:

Both x and y are integers and $y > 0$.

Thus, the only way in which $x^3y^4 = 432 = 3^3 \times 2^4$ is $x = 3,\ y = 2 => x + y = 5$ – Sufficient

The correct answer is Option C.

257. From statement 1:

The value of y is not known.

Hence, we cannot determine the value of $\left(\frac{5x}{y}\right)^2$ – Insufficient

From statement 2:

$5x - 2y = 0$
$\Rightarrow 5x = 2y$
$\Rightarrow \frac{x}{y} = \frac{2}{5}$
Thus, we have

$\left(\frac{5x}{y}\right)^2 = \frac{25 \times 4}{25} = 4$ – Sufficient

The correct answer is Option B.

258. $|x + 3| = 2$
$\Rightarrow x + 3 = \pm 2$
$\Rightarrow x = -3 \pm 2$
$\Rightarrow x = -1$ or -5.

From statement 1:

We have $x < 0$.

Thus, as per the information given in the question $x = -1$ or -5.
Thus, there is no unique value for x. – Insufficient

From statement 2:

$x^2 + 6x + 5 = 0$
$\Rightarrow (x + 1)(x + 5) = 0$
$\Rightarrow x = -1$ or -5.

Thus, both values of x are possible. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining both statements, we have
$x = -1$ or -5. – Insufficient

The correct answer is Option E.

259. $|x + 3| = 3$

=> $x + 3 = \pm 3$

=> $x = -3 \pm 3$

=> $n = 0$ or -6.

From statement 1:

We have $x^2 \neq 0$

=> $x \neq 0$

=> $x = -6$. – Sufficient

From statement 2:

$x^2 + 6x = 0$

=> $x\,(x + 6) = 0$

=> $x = 0$ or -6.

Thus, both values of x are possible, i.e. x is not unique. – Insufficient

The correct answer is Option A.

260. For any decimal number, say $[a \cdot bcd]$, where b, c, d are the digits after the decimal point, the tenths digit refers to the digit b, i.e. the digit just after the decimal point.

From statement 1:

$m + 0.01 < 3$

=> $m < 2.99$

=> $2 < m < 2.99$

Thus, the tenths digit of m may be 8 (if $m = 2.88$); less than 8 (for example, if $m = 2.58$) or 9 (if $m = 2.98$). – Insufficient

From statement 2:

$m + 0.05 > 3$

=> $m > 2.95$

=> $2.95 < m < 3$.

Thus, the tenths digit of m must always be 9, not 8. The answer is No. – Sufficient

The correct answer is Option B.

261. From statement 1:

$5a + 6b$ is even:

For any integer value of b, $6b$ is even, [since $(\text{even}) \times (\text{any integer}) = \text{even}$].

Thus, $5a$ must be even [since $(\text{even}) + (\text{even}) = \text{even}$].

Hence, a is even.

However, b may be even or odd. – Insufficient

From statement 2:

$5a + 3b$ is even:

Two odd numbers when added result in an even number OR two even numbers when added also result in an even number.

Thus, both $5a$ and $3b$ are odd i.e. both a and b are odd

OR

Both $5a$ and $3b$ are even i.e. both a and b are even

Thus, b may be even or odd. – Insufficient

Thus, from statements 1 and 2 together:

From statement 1: a is even.

Hence, from statement 2, b is even. – Sufficient

The correct answer is Option C.

262. From statement 1:

We know that x is a factor of y.
However, we have no information about the exponents p and q, which are likewise important.

For example:

2 is a factor of 6.
Also, 2^3 is a factor of 6^4.

However:

2^4 is not a factor of 6^3.

Thus, we need to know whether $p \leq q$. – Insufficient

From statement 2:

We know: $p < q + 1$.

However, there is no information on x and y. – Insufficient

Thus, from statements 1 and 2 together:

x is a factor of y;
$p < q + 1 => p \leq q$

Thus, x^p is a factor of y^q. – Sufficient

The correct answer is Option C.

263. From statement 1:

Since the product of the four numbers (10, −2, −8 and 0) is zero, it is immaterial what the fifth integer (X) be; for any value of the fifth integer, the product of five integers would still be '0.' – Insufficient

From statement 2:

The sum of the four integers = $10 - 2 - 8 + 0 = 0$.

Since '0' divided by any number (other than '0' itself) is '0', we can only conclude that the fifth integer (X) is not '0', as '0' divided by '0' is not defined; however we cannot determine the value of the fifth integer, X. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining both the statements, we cannot get the value of the fifth integer X.

The correct answer is Option E.

264. We know that P, Q and R lie on a straight line.

However, the order in which they are present is not known and whether they are positive or negative is also not known.

From statement 1:

The points P and Q are 20 units apart.

However, the distance between either R and P or between R and Q is not known; neither do we know the order in which the points are present is known. – Insufficient

From statement 2:

The points P and Q are 25 units apart.

However, the distance between neither Q and P nor between Q and R is known; neither do we know the order in which the points are present is known. – Insufficient

Thus, from statements 1 and 2 together:

The order in which the points are present is not known.

For example, if the points are as: P__ Q__ R, then the distance between Q and R is => $25-20 = 5$

However, if the points are as: Q__ P__ R, then the distance between Q and R is => $25 + 20 = 45$

Thus, the distance between Q and R cannot be determined. – Insufficient

The correct answer is Option E.

265. The remainder when a number is divided by 10 is the unit digit of the number.
For example: The remainder when 12 is divided by 10 is 2, which is the unit digit of 12.

The exponents of 2 follow a cycle for the last digit as shown below (p is a positive integer):

Exponent of 2	Unit digit
2^{4p+1}	2
2^{4p+2}	4
2^{4p+3}	8
2^{4p}	6

From statement 1:

Since m is divisible by 10, m may or may not be a multiple of 4.

For example, if $m = 20$: Unit digit of $2^m = 2^{20} = 2^{(4\times5)}$ => Remainder = 6.
Whereas, if $m = 30$: Unit digit of $2^m = 2^{30} = 2^{(4\times7)+2}$ => Remainder = 4.

Thus, we do not have a unique remainder. – Insufficient

From statement 2:

Thus, m is a multiple of 4; unit digit of $2^{(4p)}$ is always 6. – Sufficient

The correct answer is Option B.

266. From statement 1:

We know that: a and b are even and c is odd.

Thus, $(a - b - c)$ is
((Even – Even) – Odd) = (Even – Odd) = Odd. The answer is No. – Sufficient

From statement 2:

Since a, b and c are consecutive integers, there are two possibilities:

(1) a = Even, b = Odd, c = Even
=> $(a - b - c)$ is ((Even – Odd) – Even) = (Odd – Even) = Odd.

(2) a = Odd, b = Even, c = Odd
=> $(a - b - c)$ is ((Odd – Even) – Odd) = (Odd – Odd) = Even.

Hence, the nature of value of $(a - b - c)$ is not unique. – Insufficient

The correct answer is Option A.

267. From statement 1:

m is a multiple of 5
=> $m = 5u$; where u is an integer.

Thus, we have

$4m + 5n = p$

=> $20u + 5n = p$

=> $p = 5(4u + n)$

Thus, p is a multiple of 5.

Thus, p and 10 do have a common factor other than 1 and that is 5. – Sufficient

From statement 2:

n is a multiple of 5

=> $n = 5v$; where v is an integer.

Thus, we have

$4m + 5n = p$
$=> 4m + 25v = p$

We cannot definitely conclude that p is a multiple of at least one of the common multiples of 10 (2 and 5).

Thus, p and 10 may or may not have a common factor other than 1. – Insufficient

The correct answer is Option A.

268. From statement 1:

There is no information about whether p and q are positive.

Hence, there would be different combinations of values of p and q possible, leading to different values of $(p + q)$.

The possible integer values of p and q satisfying the equation $pq = 6$ are:

p	q	$p + q$
1	6	7
2	3	5
3	2	5
6	1	7
−1	−6	−7
−2	−3	−5
−3	−2	−5
−6	−1	−7

Thus, there is no unique value of $(p + q)$. – Insufficient

From statement 2:

$(p + q)^2 = 49$
$=> p + q = \pm 7$

Thus, there is no unique value of $(p + q)$. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining both statements, we have $(p + q) = \pm 7$

Thus, there is no unique value of $(p + q)$. – Insufficient

The correct answer is Option E.

269. $p = 13m + 25n$ is odd in one condition: If only one between $13m$ and $25n$ is odd, making the sum of EVEN + ODD = ODD.

From statement 1:

Since $p = 13m + 25n$ and one of m and n is odd, the condition above is met. Let's see how.

Say m is odd and n is even, then
$p = 13 \times \text{ODD} + 25 \times \text{EVEN} = \text{ODD} \times \text{ODD} + \text{ODD} \times \text{EVEN} = \text{ODD} + \text{EVEN} = \text{ODD}$

Same goes with considering n is odd and m is even.

The answer is Yes. – Sufficient

From statement 2:

Given $p = 13m + 25n$ and n is even, we have

1. If m is ODD: $p = 13 \times \text{ODD} + 25 \times \text{EVEN} = \text{ODD} \times \text{ODD} + \text{ODD} \times \text{EVEN} = \text{ODD} + \text{EVEN} = \text{ODD}$

2. If m is EVEN: $p = 13 \times \text{EVEN} + 25 \times \text{EVEN} = \text{ODD} \times \text{EVEN} + \text{ODD} \times \text{EVEN} = \text{EVEN} + \text{EVEN} = \text{EVEN}$

No unique answer. – Insufficient

The correct answer is Option A.

270. The product abc will be even if at least one among a, b and c is an even integer.

From statement 1:

$c - b = b - a$

$=> a + c = 2b$

Thus, we see that $(a + c)$ is twice of an integer and hence, $(a + c)$ is even.

However, a and c are both odd or both even.

Similarly, b may be odd or even.

For example:

$a = 3,\ c = 19,\ b = 11$: all are odd, the product abc is odd.

OR

$a = 3,\ c = 5,\ b = 4$: at least one of them is even, the product abc is even.

Thus, the product abc may be even or odd. – Insufficient

From statement 2:

$c - 16 = a \ \ => \ \ c - a = 16$

Since the difference of c and a is 16 (even), it may be that a and c are both odd or both even.

Also, there is no information on whether b is even.

Thus, the product abc may be even or odd. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining both statements, we can have all of $a,\ b$ and c as odd or at least one of them even.

Thus, the product abc may be even or odd. – Insufficient

The correct answer is Option E.

271. If $\frac{x}{3}$ an integer, x must be a multiple of '3.'

From statement 1:

If $x = 1$, the answer is no; however, if x is, say 3, the answer is yes. Thus, we cannot say whether x is a multiple of '3.' – Insufficient

From statement 2:

We have $\frac{x}{6}$ is an integer

=> x is a multiple of '6, which itself is a multiple of 3.'

=> x is a multiple of '3.' – Sufficient

The correct answer is Option B.

272. From statement 1:

We have no information on x. – Insufficient

From statement 2:

We have no information on y. – Insufficient

Thus, from statements 1 and 2 together:

x is divisible by 8

=> $x = 8p$, where p is an integer.

y is divisible by 4

=> $y = 4q$, where q is an integer.

Thus, we have

$$\frac{x}{y} = \frac{8p}{4q} = \frac{2p}{q} = 2 \times \frac{p}{q}$$

If $\frac{p}{q}$ is an integer, then $\frac{x}{y}$ is an even integer.

However, if $\frac{p}{q}$ is not an integer, then $\frac{x}{y}$ is not an even integer.

For example, if $\frac{p}{q} = \frac{1}{2}$ => $\frac{x}{y} = 1$; not an even integer.

Hence, the answer to the question may be 'Yes' or 'No.' – Insufficient

The correct answer is Option E.

273. From statement 1:

Say $n = k\,(k + 1)\,(k + 2)$; where k is a positive integer.

Possible values of k are 1, 2, 3 ...

For any other value of k, since n is the product of three consecutive positive integers, there is at least one even integer and one integer, which is a multiple of 3.

Thus, n is divisible by $3 \times 2 = 6$.

Hence, n is divisible by 6 for any positive integer value of k, thus $\frac{n}{6}$ an integer. – Sufficient

Alternatively:

Product of 'n' consecutive integers must be divisible by $n!$ thus, product of three consecutive integers must be divisible by 3! i.e. 6, thus $\frac{n}{6}$ an integer. – Sufficient

From statement 2:

With is information, $\frac{n}{6}$ may or may not be an integer.

If $n = 6$, $\frac{n}{6}$ an integer; however, if $n = 3$, $\frac{n}{6}$ is not an integer. – Insufficient

The correct answer is Option A.

274. From statement 1:

n is not a multiple of 2.

=> n is an odd number.

If $n = 5$:

Remainder (r) when $(n^2 - 1) = 24$ is divided by 24 is '0.'

If $n = 9$:

Remainder (r) when $(n^2 - 1) = 80$ is divided by 24 is '8.'

Thus, the value of remainder is not unique. – Insufficient

From statement 2:

n is not a multiple of 3.

If $n = 5$:

Remainder (r) when $(n^2 - 1) = 24$ is divided by 24 is '0.'

If $n = 8$:

Remainder (r) when $(n^2 - 1) = 63$ is divided by 24 is '15.'

Thus, the value of remainder is not unique. – Insufficient

Thus, from statements 1 and 2 together:

n is neither a multiple of 2 nor a multiple of 3.

=> n is not a multiple of 6.

Thus, n when divided by 6 will leave a remainder of either 1 or 5 since it cannot leave remainders 2, or 4 (since n is not a multiple of 2) or 3 (n is not a multiple of 3).

Thus, we have

$n = 6p + 1$ or $n = 6p - 1$, where p is a positive integer.

Thus, we have the following situations:

If $\boldsymbol{n = 6p + 1}$	If $\boldsymbol{n = 6p - 1}$
$(n^2 - 1)$ $= (n - 1)(n + 1)$ $= \{(6p + 1) - 1\}\{(6p + 1) + 1\}$ $= 6p \times (6p + 2)$	$(n^2 - 1)$ $= (n - 1)(n + 1)$ $= \{(6p - 1) - 1\}\{(6p - 1) + 1\}$ $= (6p - 2) \times 6p$

Thus, we observe that:

$(n - 1)(n + 1)$
$= 6p \times (6p \pm 2)$
$= 12p \times (3p \pm 1)$

Now, we have two situations depending on p as even AND as odd:

(1) If p is even:
=> $12p(3p \pm 1)$ is a multiple of 24.

(2) If p is odd:
=> $(3p \pm 1)$ is even
=> $12p(3p + 1)$ is a multiple of 24.

Thus, we see that $(n^2 - 1)$ is always divisible by 24.

Hence, the remainder (r) when $(n^2 - 1)$ is divided by 24 is '0.' – Sufficient

The correct answer is Option C.

275. From statement 1:

Say $n = 2k + 1$; where k is an integer

Any odd integer can be expressed as $n = 2k + 1$; where k is an integer.

Thus, we have

$= n(n - 1)(n + 1)$

$= (2k + 1)(2k)(2k + 2)$

$= 4k(2k + 1)(k + 1)$

$=> n(n - 1)(n + 1)$ is divisible by 4. – Sufficient

Alternatively:

Since n is an odd number, $(n - 1)$ and $(n + 1)$ must be even.

Thus, we have

$n(n - 1)(n + 1) = \text{odd} \times \text{even} \times \text{even}$, which must be divisible by 4. – Sufficient

From statement 2:

We have $n(n + 1)$ is divisible by 6.

If $n = 2$:

It satisfies $n(n + 1)$ divisible by 6.

However, $n(n - 1)(n + 1) = 6$, which is not divisible by 4.

Again, if $n = 3$:

It satisfies $n(n + 1)$ divisible by 6.

However, $n(n - 1)(n + 1) = 24$, which is divisible by 4.

Hence, we do not have a unique answer. – Insufficient

The correct answer is Option A.

276. From statement 1:

We know that $5x$ is odd.

Since x is an integer and '5' is odd, x must be an odd integer (since: odd $\times$ odd = odd). – Sufficient

From statement 2:

We know that $(x + 5)$ is odd.

Since '5' is odd, x must be odd (since: odd + odd = even). – Sufficient

The correct answer is Option D.

277. From statement 1:

Since x divided by 3 leaves the remainder 2, we have

$x = 3k + 2$, where k is a non-negative integer.

However, the value of x cannot be determined as k is unknown. – Insufficient

From statement 2:

We know that x^2 divided by 3 leaves the remainder 1.

We know that any number x divided by 3 leaves a remainder of 0 or 1 or 2.

Thus, x^2 when divided by 3 would leave a remainder $0^2 = 0$ or $1^2 = 1$ or $2^2 = 4 \equiv 1$ (since 4 is greater than 3, we divide 4 by 3 to get the actual remainder as 1).

Thus, x^2 when divided by 3 leaves remainder 0 or 1.

It is obvious that the remainder 0 occurs when the number x is a multiple of 3.

For all other values of x, remainder when x^2 divide by 3 would be 1.

Thus, there are infinitely many possible values of x, for example: 1, 2, 4, 5, 7, 8, 10 . . .

Thus, we cannot determine any unique value of x. – Insufficient

Thus, from statements 1 and 2 together:

From statement 1, we have

$x = 3k + 2$

$=> x^2 = 9k^2 + 12k + 4$

$=> x^2 = 3\left(3k^2 + 4k + 1\right) + 1$

$=> x^2 = 3q + 1$; q is quotient

Thus, x^2 when divided by 3 would leave a remainder 1.

However, this is exactly what statement 2 conveys.

Thus, statement 2 provides the same information as statement 1.

Since there is no additional information provided about x, the value of x cannot be determined. – Insufficient

The correct answer is Option E.

A few values of x would be 1, 2, 5, 8, 11, ...

Alternate approach:

It is clear that each statement itself in not sufficient, so let's combine them.

From statement 1, we have

$x = 3k + 2$; where k is non-negative integer

Few values of x would be 1, 2, 5, 8, 11, 14, 17,...

=> The relevant values of x^2 are: $2^2 = 4;\ 5^2 = 25;\ 8^2 = 64;\ 11^2 = 121;\ 14^2 = 196;\ 17^2 = 289; \ldots$

We see that each of the above values of x^2: 4, 25, 64, 121, 196, and 289 leave the remainder 1 when they are divided by 3; thus, statement 2 is, in fact, a rephrased version of statement 1.

278. From statement 1:

Since $x \geq 3$, the number of trailing zeroes in 30^x must be at least 'three.' Let's see with an example.

For $x = 3,\ 30^x = 30^3 = 27,000;$

For $x = 4,\ 30^x = 30^4 = 810,000;$

Thus, the hundreds digit of 30^x is '0.' – Sufficient

From statement 2:

We have $\frac{x}{3}$ is an integer

Thus, the possible values of x are 3, 6, 9 ...

If $x = 3$, we have

$30^x = 30^3 = 27,000.$

Thus, when $x = 3$ there are '3' trailing zeroes in 30^x.

For higher values of x, the number of trailing zeroes would be more.

Thus, the hundreds digit in 30^x is '0.' – Sufficient

The correct answer is Option D.

279. From statement 1:

x is a multiple of 36 such that its value is between 100 and 200.

Thus, possible multiples of 36 are: $36 \times 3 = 108$, $36 \times 4 = 144$, and $36 \times 5 = 180$.

Thus, the value of x is not unique. – Insufficient

From statement 2:

x is an even multiple of 45 such that its value is between 100 and 200.

Thus, possible multiples of 45 are: $45 \times 3 = 135$, and $45 \times 4 = 180$.

Since x is an even integer, the only possible value of x is $45 \times 4 = 180$.

Thus, the value of x is unique. – Sufficient

The correct answer is Option B.

280. From statement 1:

We have 15 is a multiple of x.

=> x is a factor of 15.

Factors of 15 are: 1, 3, 5, and 15.

Possible factors of 15 (lying between 2 and 6) are 3 and 5.

Thus, possible values of x are 3 or 5.

Thus, the value of x is not unique. – Insufficient

From statement 2:

We have 21 is a multiple of x.

=> x is a factor of 21.

Factors of 21 are: 1, 3, 7, and 21.

The only possible factor of 21 (lying between 2 and 6) is 3.

Thus, the only possible value of x is 3.– Sufficient

The correct answer is Option B.

281. We have

$=> x^m = \frac{1}{x^m}$

$=> x^m \times x^m = 1$

$=> x^{2m} = 1$

Thus, there are two possibilities:

(1) $x = \pm 1$ (here, m can be any number: since '1' raised to any exponent is always '1' and '-1' raised to any even exponent (i.e. 2) is always 1)

OR

(2) $m = 0$ (here, x can be any number: since any non-zero number raised to '0' is always '1')

Thus, we need to use the statements 1 and 2 to decide which of the above cases is possible.

From statement 1:

We only know that x is an integer.

We have no information whether m is '0.'

Thus, the value of x cannot be determined. – Insufficient

From statement 2:

Since $m \neq 0$, we must have:

$x = \pm 1$

However, we cannot uniquely determine the value of x. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining both statement, we still have $x = \pm 1$.

Thus, the value of x cannot be uniquely determined. – Insufficient

The correct answer is Option E.

282. From statement 1:

We know that the sum of the two digits of x is prime.

Thus, apart from $x = 11$ (sum of the digits is 2, the only even prime), for all other values of x, one digit of x must be even and the other digit of x must be odd (since the sum of an even and odd number is always odd and all prime numbers above 2 are odd).

Thus, possible values of x could be: 23 (sum of digits = 5, a prime number), 89 (sum of digits = 17, a prime number), etc.

Thus, x may be less than 85 or more than 85. – Insufficient

From statement 2:

We know that each of the two digits of x is prime.

In order that $x > 85$ (but less than equal to 99), we need to have a prime number greater than or equal to 8 but less than or equal to 9 in the tens position of x.

However, this is not possible.

Thus, all possible values of x would have a digit less than 8 in the tens position.

Possible such digits are: 7, 5, 3, or 2.

Hence, $x < 85$ – Sufficient

The correct answer is Option B.

283. $\frac{n}{13}$ will be an integer only if n is a multiple of 13.

From statement 1:

Since $\frac{5n}{13}$ is an integer, we can conclude that $5n$ is divisible by 13.

However, 5 and 13 have no common factors.

Thus, n must be divisible by 13.

Hence, $\frac{n}{13}$ must be an integer. – Sufficient

From statement 2:

Since $\frac{3n}{13}$ is an integer, we can conclude that $3n$ is divisible by 13.

However, 3 and 13 have no common factors.

Thus, n must be divisible by 13.

Hence, $\frac{n}{13}$ must be an integer. – Sufficient

The correct answer is Option D.

284. $10^x \le \frac{1}{1000}$

$=> 10^x \le \frac{1}{10^3}$

$=> 10^x \le 10^{-3}$

$=> x \le -3$

From statement 1:

Possible values of x are: $-2, -3, -4 \ldots$

Thus, we have
$x = -2\ (\nleq -3)$

OR

$x = -3, -4$, etc. (≤ -3).

Thus, we do not have a unique answer to the question. – Insufficient

From statement 2:

Possible values of x are: $-3, -2, -1 \ldots$

Thus, we have
$x = -3 (\le -3)$

OR

$x = -2,\ -1$, etc. $(\nleq -3)$

Thus, we do not have a unique answer to the question. – Insufficient

Thus, from statements 1 and 2 together:

We still have:
$n = -2\ (\nleq -3)$

OR

$x = -3 (\leq -3)$

Thus, we do not have a unique answer to the question. – Insufficient

The correct answer is Option E.

285. We need to verify whether:

$\frac{a}{b} = \frac{c}{d}$

From statement 1:

We have

$c = 5a \ldots$(i)

$d = 5b \ldots$(ii)

Dividing (i) by (ii)

$\frac{c}{d} = \frac{5a}{5b} = \frac{a}{b}$ – Sufficient

From statement 2:

We have

$5a = 4b$

$=> \frac{a}{b} = \frac{4}{5} \ldots$(iii)

$5c = 4d$

$=> \frac{c}{d} = \frac{4}{5} \ldots$(iv)

From, (iii) and (iv)

$\frac{a}{b} = \frac{c}{d}$ – Sufficient

The correct answer is Option D.

286. From statement 1:

Let us factorize 2,457:
$2,457 = 3^3 \times 7 \times 13.$

Thus, we have
$a^3bc = 3^3 \times 7 \times 13.$

Since $a,\ b$, and c are prime numbers, we have

$a = 3,\ b = 7, \&\ c = 13$

OR

$a = 3,\ b = 13, \&\ c = 7$

In either case, $a^3b^3c^3 = 3^3 \times 7^3 \times 13^3$. – Sufficient

From statement 2:

We have no information on a and c. – Insufficient

The correct answer is Option A.

287. We have

x is a multiple of 24

=> x^2 is a multiple of $24^2 = (8 \times 3)^2 = (2^3 \times 3)^2 = 2^6 \times 3^2$.

Also, y is a multiple of $21 = 3 \times 7$.

=> x^2y is a multiple of $2^6 \times 3^3 \times 7$

In order that x^2y is a multiple of 648 $(= 2^3 \times 3^4)$, we must ensure that there are three 2s and four 3s in x^2y. We see that there are sufficient 2s (six), but the number of 3s is deficient by one.

So, the question is limited to whether we get one more 3 as a multiple of x^2y.

From statement 1:

Given x is a multiple of 8 does not help. 8 provides three more 2s but none 3. – Insufficient

From statement 2:

Given x is a multiple of 18 helps. $18(= 2 \times 3^2)$ provides at least one 3. – Sufficient

The correct answer is Option B.

288. Since $n < 18$, the remainder (r) when 18 is divided by n can be any of the following:

$r = 0, 1, 2, 3 \ldots 16$ or 17.

From statement 1:

Since $n > 12$, possible values of n are: 13, 14, 15, 16, and 17.

Thus, the corresponding values of r are: 5, 4, 3, 2 and 1.

Thus, the value of r is not unique. – Insufficient

From statement 2:

Since $2 < (n = 2^m) < 18$, possible values of n are: $2^2 = 4,\ 2^3 = 8$ or $2^4 = 16$.

Thus, the values of the remainder (r) when 18 is divided by 4, 8 or 16 is '2' in each case.

Thus, the value of r is unique. – Sufficient

The correct answer is Option B.

289. We have $x > 0$

We need to determine whether $y > 0$ given $x > 0$.

From statement 1:

We have
$y \le x$:

If $y = x$:

$y > 0$

If $y < x$:

The value of y may be positive (but less than x), 0, or negative. – Insufficient

From statement 2:

We have $y \ge x$:

Since $x > 0$

$=> y \ge x > 0$

$y > 0$. – Sufficient

The correct answer is Option B.

290. From statement 1:

We have xy is divisible by 9.

There may be a possibility that both x and y are divisible by 3 and hence their product is divisible by 9.

However, there is another possibility that y is divisible by 9 and x is not divisible by 3.

Thus, there is no unique answer to the question. – Insufficient

From statement 2:

We have no information about x. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining both statements, we cannot determine whether x is divisible by 3. – Insufficient

The correct answer is Option E.

291. From statement 1:

$$\frac{(x-1)}{(y+1)(y-1)} = 1$$

$=> x - 1 = (y+1)(y-1)$

$=> x - 1 = y^2 - 1$

$=> x = y^2$

$=> \frac{x}{y} = y$ (which is given to be an integer). – Sufficient

From statement 2:

We have
$x - y = 2$

A few possible values of x and y are:

$x = 3,\ y = 1\ => \frac{x}{y} = \frac{3}{1} = 3$ (an integer)

$x = -1,\ y = -3 \ => \dfrac{x}{y} = \dfrac{-1}{-3} = \dfrac{1}{3}$ (not an integer)

Thus, there is no unique answer to the question. – Insufficient

The correct answer is Option A.

292. From statement 1:

We have $y^x = y$

$=> y^{x-1} = 1$

Possible situations are:

(1) $y = 1$ (here x can be any number)
(2) $y = -1$ (here $(x - 1)$ must be an even number)
(3) $x - 1 = 0 \ => \ x = 1$ (here y can be any number)

Thus, the value of y cannot be uniquely determined. – Insufficient

From statement 2:

We do not have any information about y. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining both statements, we have

(1) $y = 1$ (here x can be any number)
(2) $y = -1$ (here $(x - 1)$ must be an even number)

(Note: $x = 1$ is no longer applicable using the information from statement 2)

Thus, the value of y cannot be uniquely determined. – Insufficient

The correct answer is Option E.

293. From statement 1:

We have
$a_{n-1} + a_n = pn\,(n - 1)$

Substituting $n = 30 : a_{29} + a_{30} = p \times 30 \times 29 \ldots$(i)
Substituting $n = 31 : a_{30} + a_{31} = p \times 31 \times 30 \ldots$(ii)

Thus: (ii) − (i) (since $a_{31} - a_{29}$ is mentioned in the statement 1):

$a_{31} - a_{29} = 30 \times (p \times 31 - p \times 29) = 60p.$

Thus, we have $60p = 120$

=> $p = 2.$ – Sufficient

From statement 2:

We have
$a_{n-1} + a_n = pn(n-1)$

Substituting $n = 2 : a_1 + a_2 = p \times 2 \times 1 = 2p \ldots$(iii)

Since $a_2 = 6$, we have

$a_1 + 6 = 2p$

However, we have no information on the value of a_1, we cannot determine the value of p. – Insufficient

The correct answer is Option A.

294. We have find out whether $|P - R| \geq 13.$

From statement 1:

$|P - Q| = 65$

=> $P - Q = \pm 65 \ldots$(i)

However, we do not have any information about R. – Insufficient

From statement 2:

$|Q - R| = 52$

=> $Q - R = \pm 52 \ldots$(ii)

However we do not have any information about P. – Insufficient

Thus, from statements 1 and 2 together:

Adding (i) and (ii):

$(P - Q) + (Q - R) = (P - R) = \pm 65 \pm 52$

$= 65 + 52 = 117$

OR

$= 65 - 52 = 13$

OR

$= -65 + 52 = -13$

OR

$= -65 - 52 = -117$

$=> P - R = \pm 117$ OR ± 13

$=> |P - R| = 117$ OR 13

Thus, $|P - R| \geq 13$. – Sufficient

The correct answer is Option C.

295. Let the three positive integers are r, s, & t as first, second and third integer.

From statement 1:

We have no information about the third integer. – Insufficient

From statement 2:

We have no information about the first integer. – Insufficient

Thus, from statements 1 and 2 together:

$(r + s) + (s + t) =$ even + even = even

$=> r + 2s + t =$ [even]

$=> r + s + t =$ [even] $- s$

However, s may be even or odd.

Thus, we have

$r + s + t = \text{even} - \text{even} = \text{even}$

OR

$r + s + t = \text{even} - \text{odd} = \text{odd}$

Thus, we cannot determine the nature of $(r + s + t)$. – Insufficient

The correct answer is Option E.

296. $c = 10a + 12b$

$=> c = 12\,(a + b) - 2a$

$=> c = 12 - 2a$ (since $(a + b) = 1$).

We deliberately took $12(a + b)$ so that we could relate c and a.

We need to determine whether $c > 11$:

$=> 12 - 2a > 11$

$=> 2a < 1$

$=> a < \frac{1}{2}$

Thus, we need to see whether $a < \frac{1}{2}$.

From statement 1:

We have $a > \frac{1}{2}$

This is contrary to what we needed i.e. $a < \frac{1}{2}$

Thus, we have a unique answer 'No.' – Sufficient

From statement 2:

We had obtained: $a < \frac{1}{2}$

Since $a + b = 1$, we have

$b = 1 - a > 1 - \frac{1}{2}$

$=> b > \frac{1}{2}$

$=> b > a$

This is contrary to the information of statement 2 i.e. $a > b$

Thus, we have a unique answer 'No.' – Sufficient

The correct answer is Option D.

297. From statement 1:

We can have 14 consecutive integers including -5 in the following ways:

Set S: $\{-5, -4, -3, -2, \ldots 6, 7, 8\}$; ('7' is present in the set)

OR

Set S: $\{-7, -6, -5, -4, -3 \ldots 4, 5, 6\}$; ('7' is not present in the set), etc.

Thus, the integer '7' may be or may not be present in the set. – Insufficient

From statement 2:

We can have 14 consecutive integers including 6 in the following ways:

Set: $\{5,\ 6,\ 7, \ldots 17, 18\}$; ('7' is present in the set)

OR

Set: $\{-7, -6, -5, -4 \ldots 4, 5, 6\}$; ('7' is not present in the set).

Thus, the integer '7' may be or may not be present in the set. – Insufficient

Thus, from statements 1 and 2 together:

We can still have the following sets:

Set: $\{-7, -6, -5, -4, \ldots 4, 5, 6\}$; ('7' is not present in the set)

OR

Set: $\{-6, -5, -4, -3 \ldots 4, 5, 6, 7\}$; ('7' is present in the set)

Thus, the integer '7' may be or may not be present in the set. – Insufficient

The correct answer is Option E.

298. From statement 1:

We know that the 150^{th} term is 305.

However, the relation between the other terms of the sequence is not known.

Hence, the 200^{th} term cannot be determined. – Insufficient

From statement 2:

Same with Statement 2.– Insufficient

From statement 1 $ 2 together:

Since it is given that Sequence S is such that the difference between a term and its previous term is constant, the difference between 150^{th} term and 100^{th} term must be equal to the difference between 200^{th} term and 150^{th} term because the difference between 150 and 100 is 50 and the difference between 200 and 150 is also 50.

Thus, 200^{th} term = 150^{th} term + (150^{th} term − 100^{th} term)

$= 305 + (305 - (-95)) = 305 + (305 + 95) = 305 + 400 = 705$

The correct answer is Option C.

299. From statement 1:

$n < \frac{7}{20}$

$=> n < 0.35$

For all values of $h = 0,\ 1,\ 2,\ 3$ or 4, we have $n < 0.35$

Thus, the value of n rounded to the nearest tenth is:

(1) For $h = 0 : n = 0.307 =\approx 0.3$
(2) For $h = 1 : n = 0.317 =\approx 0.3$
(3) For $h = 2 : n = 0.327 =\approx 0.3$
(4) For $h = 3 : n = 0.337 =\approx 0.3$
(5) For $h = 4 : n = 0.347 =\approx 0.3$

Thus, the value of n to the nearest tenth is 0.3 – Sufficient

From statement 2:

Since $h < 5$, possible values of h are $0,\ 1,\ 2,\ 3$ or 4.

This is the same result as obtained from statement 1. – Sufficient

The correct answer is Option D.

300. From statement 1:

Since x has exactly two distinct positive factors, x must be a prime number (the factors of a prime number are 1 and the number itself).

Since 2 is a prime number, we can have $x = 2$.

However, there are other prime numbers greater than 2 as well, for example 3, 5, etc. – Insufficient

From statement 2:

We know that the difference between any two distinct positive factors of x is odd.

This is only possible if one factor is even and the other factor is odd (since the difference between an even and odd number is odd, whereas the difference between any two odd numbers or any two even numbers is even).

Thus, the number must have exactly two factors, one odd (i.e. 1) and the other even (i.e. 2).

Thus, we have $x = 1 \times 2 = 2$. – Sufficient

The correct answer is Option B.

301. Possible values of n so that the product of the digits is 12 are: 26, 34, 43 and 62.

From statement 1:

We know that n can be expressed as the sum of perfect squares in only one way.

Let us see for each of the above numbers:

26:

(1) With 1, we have $1^2 + 5^2 = 26$; we see that is can be expressed as the sum of two perfect squares
(2) With 2: $2^2 + 22 = 26$; however, 22 is not a perfect square
(3) With 3: $3^2 + 17 = 26$; however, 17 is not a perfect square
(4) With 4: $4^2 + 10 = 26$; however, 10 is not a perfect square

34:

(1) With 1: $1^2 + 33 = 34$; however, 33 is not a perfect square

(2) With 2: $2^2 + 30 = 34$; however, 30 is not a perfect square

(3) With 3: $3^2 + 5^2 = 34$; we see that it can be expressed as the sum of two perfect squares

(4) With 4: $4^2 + 18 = 34$; however, 18 is not a perfect square

Thus, we see that both 26 and 34 can be expressed as the sum of two perfect squares in exactly one way.

Thus, it is enough to observe that statement 1 is not sufficient.

Note: Neither 43 nor 62 can be expressed as the sum of two perfect squares in any way.

Thus, we do not get a unique value of n. – Insufficient

From statement 2:

Since n is smaller than 40, possible values of n are 26 and 34. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining both statements, we still have possible values of n as 26 and 34. – Insufficient

The correct answer is Option E.

302. From statement 1:

We know that the sum of three equal integers is divisible by 2; thus, their sum is even.

=> Thrice of an integer is even.

Hence, we can conclude that the integer in question is even.

Thus, each of the three equal integers is even.

Thus, their product must be a multiple of $2 \times 2 \times 2 = 8$.

Hence, the product of the three integers is divisible by 4. – Sufficient

From statement 2:

Since the sum as well as the product of the three integers is even, we may have all the three integers even OR any one integer even and the other two odd.

In the first case, the product of the three integers must be divisible by $2 \times 2 \times 2 = 8$, and hence divisible by 4; while in the second case, the product may be divisible by 4 (if the even number itself is divisible by 4) or may not be divisible by 4 (if the even number is 2).

Thus, we do not have a unique answer. – Insufficient

The correct answer is Option A.

303. From statement 1:

We know that the units digit of X is non-zero (between 1 to 9, inclusive).

Thus, in the number $(X + 9)$, the units digit when added to 9 would always lead to a carryover of '1' to the tens place.

For example:

If the three digit number is 331, where the units digit is the smallest, i.e. 1, then we have $331 + 9 = 340$ i.e. the tens digit has increased by 1.

Again, if the three digit number is 339, where the units digit is the largest, i.e. 9, then too we have $339 + 9 = 348$ i.e. the tens digit has increased by 1.

Since the tens digit in $(X + 9)$ is 3, the tens digit in X (i.e. before adding 9) must have been $3 - 1 = 2$ (subtracting the carry of '1').

Thus, the tens digit in X is 2. – Sufficient

From statement 2:

We know that the units digit of X is non-zero (between 1 to 9, inclusive).

Thus, in the number $(X + 3)$, the units digits when added to 3 may lead to a carryover of '1' to the tens place if the units digit in X is 7 or greater; however, there will not be any carryover to the tens place if the units digit in X is 6 or smaller.

For example:

If the three digit number is 317, where the units digit is 7, then we have

$317 + 3 = 320$ i.e. the tens digit has increased by 1.

Again, if the three digit number is 319, where the units digit is the largest, i.e. 9, then too we have

$319 + 3 = 322$ i.e. the tens digit has increased by 1.

However, if the three digit number is 321, where the tens digit is the smallest, i.e. 1, then we have

$321 + 3 = 324$ i.e. the tens digit has not increased by 1.

Again, if the three digit number is 325, where the units digit is 5, then too we have

$325 + 3 = 328$ i.e. the tens digit has not increased by 1.

Thus, if there is a carryover, the tens digit in X would have been $2 - 1 = 1$.

However, if there is no carryover, the tens digit in X would have been 2 itself.

Thus, there is no unique answer. – Insufficient

The correct answer is Option A.

304. From statement 1:

$xy = x^2$

$=> xy - x^2 = 0$

$=> x\,(y - x) = 0$

$=> x = 0$ or $y = x$

However, we know that: $y \neq x$, since they are different numbers.

Thus, we have $x = 0$ – Sufficient

From statement 2:

Since $y \neq 0,\ x$ may or may not be equal to 0. – Insufficient

The correct answer is Option A.

305. We know that none among $x,\ y,$ & z equals to 0.

We have $x^4y^5z^6$ to analyze.

$x^4y^5z^6 = x^4y^4z^6 \times y$

We know that $x^4y^4z^6 > 0$ (since the exponents are even i.e. the numbers are perfect squares, they must be positive).

Thus, we have to see whether $y > 0$ (This is what we need to know to get the answer to the question)

From statement 1:

$y > x^4$

Since $x^4 > 0,\ y > 0$

=> $x^4y^5z^6 > 0$ – Sufficient

From statement 2:

$y > z^5$

However, z^5 may be positive or negative depending on the value of z

=> y may be positive or negative.

=> $x^4y^5z^6$ may be positive or negative. – Insufficient

The correct answer is Option A.

306. From statement 1:

We have $y\,(y+2) = x(x+1)$

Let us look into two possibilities for x:

(1) If x is odd: $x\,(x+1)$ = odd × even = even
(2) If x is even: $x\,(x+1)$ = even × odd = even

Thus, we have $y(y+2)$ as even.

If y is odd, $(y+2)$ is also odd

=> $y\,(y+2)$ = odd × odd = odd; however, $y(y+2)$ is even, thus, y cannot be odd.

If y is even, $(y+2)$ is also even

=> $y\,(y+2)$ = even × even = even.

Thus, we have y an even integer. The answer is No. – Sufficient

From statement 2:

We have no information about y. – Insufficient

The correct answer is Option A.

307. From statement 1:

We have $a^{2b} = 2^4$

Thus, we have

$8a^{6b} - 2$

$= 8\left(a^{2b}\right)^3 - 2$

$= 8 \times (2^4)^3 - 2 = 8 \times (2^{12}) - 2$ – Sufficient

Note: We need not try to get individual values of a and b from $a^{2b} = 2^4$.

From statement 2:

We have $ab = 2^2 = 4$

Two possible values of $\left(8a^{6b} - 2\right)$ depending on the values of a and b are:

(1) $a = 1,\ b = 4$: $\left(8a^{6b} - 2\right) = 8 \times 1 - 2 = 6$
(2) $a = 2,\ b = 2$: $\left(8a^{6b} - 2\right) = 8 \times 2^{12} - 2$

Thus, there is no unique value. – Insufficient

The correct answer is Option A.

308. From statement 1:

Since x is a factor of 54 and is less than half of 54, the possible values of x are: 1, 2, 3, 6, 9 or 18.

Again, we know that 18 is a multiple of xy^2

=> xy^2 is a factor of 18

The factors of 18 are: 1, 2, 3, 6, 9 and 18.

If $x = 1$, the possible values of y are 1 or 3.

Thus, we observe that the value of y cannot be uniquely determined. – Insufficient

From statement 2:

Since xy^2 is a factor of 18, the possible values of xy^2 are: 1, 2, 3, 6, 9 or 18.

Also, we know that: y is a multiple of 3

=> y^2 is a multiple of $3^2 = 9$

Thus, the only possible value of y is 3 (higher multiples of 3 as the value of y would not be possible since xy^2 is a factor of 18). – Sufficient

The correct answer is Option B.

309. We have

$x^{2y} = x^{4y-6}$

$2y = 4y - 6$

=> $y = 3$, for all values of x except 1

OR

y = any positive integer if $x = 1$

Thus, though it appeared that only possible value of y is 3, it is not necessarily so.

Thus, we need to refer to the statements to get the value of y.

From statement 1:

We have $x^2 = 4$ => $x = 2$; $x \neq -2$ since x is a positive integer.

$x = 2$, (i.e. $x \neq 1$)

Thus, $y = 3$

=> $y^{2x} = 3^4 = 81$ – Sufficient

From statement 2:

We have $-3 < x < 3$

=> $0 < x < 3$ (since x is positive)

=> Possible values of x are: 2 or 1.

=> $y = 3$, if $x = 2$

OR

y = any positive integer if $x = 1$

Since the values of x and y cannot be uniquely determined, we cannot determine the unique value of y^{2x}. – Insufficient

The correct answer is Option A.

310. We have $x^{ky} = x^{(ly^2-8)}$

Since $x \neq 1$, we have

$ky = ly^2 - 8$

=> $y\,(ly - k) = 8$

From statement 1:

We have $k = -6$

=> $y\,(ly + 6) = 8$

Possible values of y: 2 or 4.

If $y = 2$:

$2(2l + 6) = 8$

=> $l = -1$

=> $kl = (-6) \times (-1) = 6 > 2$

If $y = 4$:

$4(4l + 6) = 8$

=> $l = -1$

=> $kl = (-6) \times (-1) = 6 > 2$

Thus, there is a unique answer and the answer is 'Yes.' – Sufficient

From statement 2:

We have $3l - k = 3$

We know that: $y\,(ly - k) = 8$

Possible values of y: 2 or 4.

If $y = 2$:

$2\,(2l - k) = 8$

$=> 2l - k = 4$

$=> (3l - k) - l = 4$

$=> 3 - l = 4$

$=> l = -1$

$=> k = 3l - 3 = -6$ (using the equation: $3l - k = 3$)

$=> kl = (-6) \times (-1) = 6 > 2$

If $y = 4$:

$4\,(4l - k) = 8$

$=> 4l - k = 2$

$=> (3l - k) + l = 2$

$=> 3 + l = 2$

$=> l = -1$

$=> k = 3l - 3 = -6$ (using the equation: $3l - k = 3$)

$=> kl = (-6) \times (-1) = 6 > 2$

Thus, there is a unique answer and the answer is 'Yes.' – Sufficient

The correct answer is Option D.

311. From statement 1:

We have $|x| + |y| = 5$, where $1 < |x| < y$

Thus, y must be a positive integer (since $y > 1$).

Since $|x| + |y| = 5$, and

$|x| > 1$

$=> |y| < 4$

Thus, possible values of y are: 3, 2 or 1.

If $y = 3 : |x| = 2$; thus $y > |x|$ is satisfied.

Here, $|x| = 2$

$=> x = \pm 2$

However, if $y = 2 : |x| = 3$ i.e. $y \ngtr |x|$

Also, if $y = 1 : |x| = 4$ i.e. $y \ngtr |x|$

Thus, the only possible values of x and y are:

$x = 2, y = 3$

OR

$x = -2, y = 3$

Thus, we have

$x^{2y} - 1 = (\pm 2)^{2\times 3} - 1 = (\pm 2)^6 - 1 = 63$ – Sufficient

From statement 2:

We have $|x^2 - 4| + |y - 3| = 0$

The sum of two absolute values can be '0' only if each of them is zero.

Thus, we have

$|x^2 - 4| = 0$

$=> x^2 - 4 = 0$

$=> x = \pm 2$

Also,

$|y - 3| = 0$

=> $y - 3 = 0$

=> $y = 3$

Thus, the only possible values of x and y are:

$x = 2, y = 3$

OR

$x = -2, y = 3$

This is the same result as obtained from statement 1. – Sufficient

The correct answer is Option D.

312. The remainder when a number is divided by 10 is essentially the units digit of the number.

Thus, we need to determine the units digit of $(7^{4x+23} + y)$.

The units digit of exponents of 7 follows a cycle as shown below:

- $7^{4k+1} \equiv 7$
- $7^{4k+2} \equiv 9$
- $7^{4k+3} \equiv 3$
- $7^{4k} \equiv 1$

Thus, the remainder r of the units digit of $(7^{4x+3}+y)$ would be same as the units digit of $(3+y)$.

Thus, we need to determine the value of y.

From statement 1:

We have no information about y. – Insufficient

From statement 2:

We have $y = 2$

Thus, the remainder r = units digit of $(3 + 2) = 5$ – Sufficient

The correct answer is Option B.

313. From statement 1:

We know that:

$y - x = 3$

However, there can be infinitely many positive integer values of x and y satisfying the above equation.

Thus, the value of y cannot be uniquely determined. – Insufficient

From statement 2:

We know that: x and y are prime numbers.

However, there can be infinitely many values of x and y possible.

Thus, the value of y cannot be uniquely determined. – Insufficient

Thus, from statements 1 and 2 together:

We have

$y - x = 3$, where x and y are prime numbers.

Since the difference between two prime numbers is 3 (an odd number), one prime must be even and the other odd.

Thus, one of the prime numbers must be '2' (the only even prime, also the smallest prime number).

Thus, we have $x = 2$

=> $y - 2 = 3$

=> $y = 5$ – Sufficient

The correct answer is Option C.

314. From statement 1:

We need to find which combination of exponents of 3 and 5 add up to 134.

Since the exponents of 5 would reach 134 faster than the exponents of 3, we need to try with the exponents of 5 so that we can get the answer(s) in the least possible trials.

If $y = 1 : 3^x + 5 = 134$

=> $3^x = 129$

However, 129 cannot be expressed as an exponent of 3 => $y \neq 1$

If $y = 2 : 3^x + 25 = 134$

=> $3^x = 109$

However, 109 cannot be expressed as an exponent of 3 => $y \neq 2$

If $y = 3 : 3^x + 125 = 134$

=> $3^x = 9$

=> $x = 2$

Thus, there is only one solution: $x = 2$ – Sufficient

From statement 2:

There is no information about x. – Insufficient

The correct answer is Option A.

315. Assuming that xy is a multiple of 18. Say $xy = 18n$; where n must be an integer.

So, in order to answer the question, we have to determine whether n is an integer.

From statement 1:

x is a multiple of 9.

Say $x = 9m$; where m is any integer.

Plugging-in the value of $x = 9m$ in $xy = 18n$, we get $9my = 18n$ => $my = 2n$

If my is even, n is integer, the answer is 'Yes;' however, if my is odd, n is not an integer, the answer is 'No.' – Insufficient

From statement 2:

y is a multiple of x.

Say $y = xp$; where p is any integer.

Plugging-in the value of $y = xp$ in $xy = 18n$, we get $x^2p = 18n$

If x^2p is divisible by 18, n is an integer, else not. No unique answer. – Insufficient

From statement 1 & 2 together:

From statement 2, we have $x^2p = 18n$ and from statement 1, we have $x = 9m$.

Thus, $x^2p = 18n \Rightarrow (9m)^2 \times p = 18n \Rightarrow 81pm^2 = 18n \Rightarrow 9pm^2 = 2n$

If pm^2 is even, n is integer, the answer is 'Yes;' however, if pm^2 is odd, n is not an integer, the answer is 'No.' – Insufficient

The correct answer is Option E.

316. We have to determine whether $(x+y)(x-y)$ is a prime number OR (x^2-y^2) a prime number.

From statement 1:

Given x is the smallest prime number, it means that $x = 2$. Since we have no information about the value of y, we cannot conclude whether $(x^2 - y^2)$ is a prime number. – Insufficient

From statement 2:

Given y^2 is the smallest prime number, it means that $y^2 = 2$. Since we have no information about the value of x, we cannot conclude whether $(x^2 - y^2)$ is a prime number. – Insufficient

Thus, from statements 1 and 2 together:

Plugging-in the value of $x = 2$ and y^2 in $(x^2 - y^2)$, we get

$x^2 - y^2 = 2^2 - 2 = 4 - 2 = 2$, a prime number. – Sufficient

The correct answer is Option C.

317. The remainder obtained when a number is divided by 100 is the last two digits of the number.

For example, when 1,234 is divided by 100, the remainder obtained is 34, which is the last two digits of the number.

Thus, $(3^x + 2)$ when divided by 100 will leave a remainder having 1 as the units digit only if $(3^x + 2)$ has 1 as its units digit as well.

This is possible only if the units digit of 3^x is 9 (since $9 + 2 = 11 \equiv$ the units digit is 1)

The units digit of exponents of 3 follows a cycle as shown below:

- $3^{4k+1} \equiv 3$
- $3^{4k+2} \equiv 9$
- $3^{4k+3} \equiv 7$

- $3^{4k} \equiv 1$

Thus, the units digit of 3^x is 9 only if $x = 4k + 2$, where k is any positive integer.

From statement 1:

We have

$x = 2(2n + 1)$, where n is a positive integer.

$x = 4n + 2$

This is exactly the condition as discussed above. – Sufficient

From statement 2:

We have $10 > x > 4$.

Thus, a couple of possible values of x are:

$x = 6$, which is of the form $x = 4n + 2$ – satisfies

$x = 7$, which is of the form $x = 4n + 3$, not of the form $x = 4n + 2$ – does not satisfy

Thus, we do not have a unique answer. – Insufficient

The correct answer is Option A.

318. From statement 1:

=> $x(2y - 1)$ is even

For any integer value of y, $2y$ is even.

Thus, $(2y - 1) = \text{even} - 1 = \text{odd}$.

Since the product of two numbers x and $(2y - 1)$ is even and $(2y - 1)$ is odd, it implies that x is even.

=> xz is even (since an even number multiplied with any integer (even or odd) is even). – Sufficient

From statement 2:

=> $x(x + z)$ is even

Possible situations are:

(1) x is even, z is even => xz is even

OR

(2) x is even, z is odd => xz is even

OR

(3) x is odd, z is odd => xz is odd

Thus, xz may be even or odd. – Insufficient

The correct answer is Option A.

319. From statement 1:

$$\frac{y}{x} = \frac{z}{y}$$

=> $x,\ y$ and z form a geometric series

For example:

$x = 1, y = 2, z = 4$: Here, $y > x$ (common ratio of the geometric series is greater than 1)

$x = 4, y = 2, z = 1$: Here, $y \not> x$ (common ratio of the geometric series is smaller than 1)

Thus, there is no unique answer. – Insufficient

From statement 2:

There is no information about y. – Insufficient

Thus, from statements 1 and 2 together:

We know that: $z > x$

Thus, combining with the information from statement 1, we see that $x,\ y,\ z$ form a geometric series with the common ratio greater than 1.

Thus, we have $y > x => y - x > 0$ – Sufficient

The correct answer is option is C.

320. The expression "Is $|x - y|$ a positive number?" means, "Is $|x - y| > 0$?"

We know that the absolute value of any number is always non-negative.

Thus, we have
$|x - y| \geq 0$

Here, $|x - y| > 0$ will be satisfied only if $x \neq y$.

From statement 1:

$xy + z = 0$

$=> xy = -z$

$=> xy < 0$ (since z is positive)

$=> x > 0$ and $y < 0$

OR

$x < 0$ and $y > 0$

Thus, we can conclude that $x \neq y$

$=> |x - y| > 0$ – Sufficient

From statement 2:

$=> x\,(x - 2) = 0$

$x = 0$ or 2

However, we have no information about y.

We cannot get the value of $|x - y|$ – Insufficient

The correct answer is Option A.

321. From statement 1:

This statement is clearly insufficient as x can take any value $-1, -2, -3$, etc. At $x = -1, y = (-1)^2 + (-1)^3 = 1 - 1 = 0$. The answer is No; however, at other values of x, $y < 0$. The answer is Yes. – Insufficient

From statement 2:

This statement is clearly insufficient as y can take any value $0, -1, -2, -3$, etc. If $y = 0$, the answer is No, else Yes. –Insufficient

Thus, from statements 1 and 2 together:

Even after combining both statements, we still have the following situations:

At $x = -1 \Rightarrow y = 0$ – Answer is No.

AND

At $x = -2,\ y = (-2)^2 + (-2)^3 = 4 - 8 = -4 \Rightarrow y < 0$ – Answer is Yes.

Hence, there is no unique answer. – Insufficient

The correct answer is Option E.

322. From statement 1:

Since $0 < d < 1$ and $12d$ is an integer, we must have: $d = \left(\frac{\text{An integer less than 12}}{12}\right)$.

(1) If $d = \frac{1}{12}$ (smallest possible value of d): $d = 0.0833 \Rightarrow$ The tenths digit is zero.

(2) If $d = \frac{11}{12}$ (largest possible value of d): $d = 0.917 \Rightarrow$ The tenths digit is non-zero.

Thus, there is no unique answer. – Insufficient

From statement 2:

Since $0 < d < 1$ and $6d$ is an integer, we must have: $d = \left(\frac{\text{An integer less than 6}}{6}\right)$.

If $d = \frac{1}{6}$ (smallest possible value of d):
$d = 0.167 \Rightarrow$ The tenths digit is non-zero.

Since for the smallest possible value of d, the tenths digit is non-zero, the tenths digit will always be non-zero for all higher values of d. – Sufficient

The correct answer is Option B.

323. We know that for all n:

$$t_{(n+1)} = \frac{t_n}{3}$$

Thus, we have

$$t_2 = \frac{t_1}{3},\ t_3 = \frac{t_2}{3}, \ldots$$

Thus, we see that every term, starting from t_2 is one-third of the previous term.

From statement 1:

$t_2 = \frac{1}{3}$

$=> t_3 = \frac{1}{3} \times \frac{1}{3} = \frac{1}{9}$

$=> t_4 = \frac{1}{3} \times \frac{1}{9} = \frac{1}{27}$

$=> t_5 = \frac{1}{3} \times \frac{1}{27} = \frac{1}{81}$ – Sufficient

From statement 2:

Let $t_5 = x$

We know that $t_2 = 3 \times t_3$

$= 3^2 \times t_4$

$= 3^3 \times t_5$

$= 27x$

$=> t_2 - t_5 = 27x - x = 26x$

$=> 26x = \frac{26}{81}$

$=> x = t_5 = \frac{1}{81}$ – Sufficient

The correct answer is Option D.

324. From statement 1:

We have

$3^{\sqrt{x}} = 9$

$=> 3^{\sqrt{x}} = 3^2$

$=> \sqrt{x} = 2$

$=> x = 2^2 = 4$

$=> 3^x = 3^4 = 81 < 100$. The answer is No. – Sufficient

From statement 2:

We have

$$\frac{1}{3^x} > 0.01$$

For any value of x, 3^x is positive, also $\frac{1}{0.01}$ is positive. Thus, taking reciprocal and reversing the inequality:

$$=> 3^x < \frac{1}{0.01}$$

$=> 3^x < 100$. The answer is No. – Sufficient

The correct answer is Option D.

325. We need to determine whether:

$$|x| < 1$$

$$=> -1 < x < 1$$

From statement 1:

$$|x + 2| = 3\,|x - 1|$$

$$=> x + 2 = \pm 3\,(x - 1)$$

$$=> x + 2 = \pm\,(3x - 3)$$

$$=> x + 2 = 3x - 3$$

$=> x = \frac{5}{2}$ – Does not satisfy the required condition

OR

$$x + 2 = -\,(3x - 3)$$

$$=> x + 2 = -3x + 3$$

$x = \frac{1}{4}$ – Satisfies the required condition

Thus, there is no unique answer. – Insufficient

From statement 2:

We have

$|2x - 5| \neq 0$

$=> x \neq \frac{5}{2}$

However, we do not have any possible values x can take. – Insufficient

Thus, from statements 1 and 2 together:

Combining both statements, we arrive at:

$x = \frac{1}{4}$ – Satisfies the required condition

Thus, we have a unique answer. – Sufficient

The correct answer is Option C.

326. We know that the radical sign i.e. $\sqrt{k}$ takes only the positive square root of k.

Thus, we can have the following cases:

(a) $\sqrt{(p-3)^2} = (p-3)$ – Condition: If $p - 3 \geq 0 => p \geq 3$

(b) $\sqrt{(p-3)^2} = \sqrt{(3-p)^2} = (3-p)$ – Condition: If $3 - p \geq 0 => p \leq 3$

For the given condition to be satisfied, p must be less than or equal to 3.

From statement 1:

$p < |p|$

We know that $|p| \geq 0$ for all values of p

$=> p < 0$

Thus, it satisfies the condition that $p < 3$

Thus, we have

$\sqrt{(p-3)^2} = (3-p)$ – Sufficient

From statement 2:

$3 > p$

$=> \sqrt{(p-3)^2} = (3-p)$ – Sufficient

The correct answer is Option D.

327. $\frac{m}{n} < mn$ is true under the following conditions:

(a) If m is positive, i.e. $m > 0$:

Canceling m from both sides:

$\frac{1}{n} < n$

$=> n > 1$: (Say, $n = 2 => \frac{1}{n} = \frac{1}{2} < 2 = n$) .... (a)

OR

$=> -1 < n < 0$: (Say, $n = -\frac{1}{2} => \frac{1}{n} = -2 < -\frac{1}{2} = n$) .... (b)

(b) If m is negative, i.e. $m < 0$:

Canceling m from both sides and reversing the inequality sign:

$\frac{1}{n} > n$

$=> 0 < n < 1$: (Say, $n = \frac{1}{2} => \frac{1}{n} = 2 > \frac{1}{2} = n$) .... (c)

OR

$=> n < -1$: (Say, $n = -2 => \frac{1}{n} = -\frac{1}{2} > -2 = n$) .... (d)

From statement 1:

We have

$mn > 0$

$=> m > 0$ and $n > 0$

OR

$m < 0$ and $n < 0$

However, we do not get any of the conditions above. – Insufficient

From statement 2:

We have

$n < -1$

However, we do not know whether m is positive or negative. – Insufficient

Thus, from statements 1 and 2 together:

We have

$n < -1$ i.e. n is negative.

Also, since $mn > 0$, we have

$m < 0$

Thus, we have

$m < 0$ and $n < -1$

Thus, it satisfies condition (d) above. – Sufficient

The correct answer is Option C.

6.2 Percents

328. From statement 1:

We do not have information on the brokerage. – Insufficient

From statement 2:

We do not have information about the value of the property. – Insufficient

Thus, from statements 1 and 2 together:

The required percent = $\frac{3,000}{1.8 \times 10^6} \times 100 = 0.3\%$ – Sufficient

The correct answer is Option C.

329. From statement 1:

We have no information on the aspirations of the students to do the masters in management. – Insufficient

From statement 2:

Since 35% (more than 24%) of the male students and 25% (more than 24%) of the female students aspire for the course, we can definitely say that on an average, more than 24% of that total number of students aspire for the masters in management. – Sufficient

Minimum term < Average > Maximum term

Average is always greater than the minimum and less than the maximum.

The correct answer is Option B.

330. From statement 1:

The initial price of the smartphone is not known.
Hence, the percent increase in the price cannot be determined. – Insufficient

From statement 2:

The amount of increase in price of the smartphone is not known.
Hence, the percent increase in the price cannot be determined – Insufficient

Thus, from statements 1 and 2 together:

Increase in price of the smartphone = $40.

Price of the smartphone after increase = \$400.

Thus, initial price of the smartphone = \$(400 − 40) = \$360.

Hence, the percent increase in the price
$= \frac{40}{360} \times 100 = 11.11\%$ – Sufficient

The correct answer is Option C.

331. From statement 1:

Payment for the phone excluding 20% sales tax = $\$0.85d$

Thus, payment for the phone including sales tax = total price

$= \$(0.85d + 20\% \text{ of } 0.85d)$

$=> \$(0.85d + 0.17d)$

$=> \$01.02d > \$d$. The answer is No. – Sufficient

From statement 2:

The value of d is not given, hence a comparison with d is not possible – Insufficient

The correct answer is Option A.

332. From statement 1:

The number of marbles George has is 75 percent of the number of marbles Suzy has.

Say Suzy has 100 marbles, thus George has 75% of 100 = 75 marbles.

=> Suzy has 25 more marbles than George (75).

=> Suzy has $\frac{25}{75} = \frac{1}{3}$ more marbles than George. – Sufficient

From statement 2:

The number of marbles Suzy has is 133.33% percent of the number of marbles George has.

Say George has 100 marbles, thus Suzy has 133.33% of 100 = ≈ 133 marbles.

=> Suzy has 33 more marbles than George (100).

=> Suzy has $\approx \frac{33}{100} =\approx \frac{1}{3}$ more marbles than George. – Sufficient

The correct answer is Option D.

333. Let the total sales be $\$x$.

Amount paid to the salesperson per month is:
$\$(2,000 + 15\% \text{ of } (x - 10,000))$; provided $(x > 10,000)$

OR

$\$2,000$; provided $(x \leq 10,000)$.

From statement 1:

If $x \leq 10,000$:
$\$2,000 = 17.5\%$ of x
$=> x = \$2,000 \times \dfrac{100}{17.5} = \$\dfrac{20,000}{17.5} = \$10,000 \times \dfrac{20}{17.5} > \$10,000;$
since $\dfrac{20}{17.5} > 1$, the value of $\$10,000 \times \dfrac{20}{17.5} > \$10,000$

However, this contradicts our assumption $x \leq 10,000$.
Thus, we can conclude that $x \nleq 10,000$, i.e., $x > 10,000$.

If $x > 10,000$:
$\$(2,000 + 15\% \text{ of } (x - 10,000)) = 17.5\%$ of x
$=> 2,000 + \dfrac{15\,(x - 10,000)}{100} = \dfrac{17.5x}{100}$

This is a linear equation and will return a unique value of x. So the statement is sufficient to answer the question; however, for the sake of completeness, let's do the calculation.

$=> 2,000 + \dfrac{15x}{100} - \dfrac{150,000}{100} = \dfrac{17.5x}{100}$
$=> 2,000 - 1,500 = \dfrac{17.5x}{100} - \dfrac{15x}{100}$
$=> 500 = \dfrac{2.5x}{100}$
$=> x = 20,000$

Thus, amount paid to the salesperson $= \$(2,000 + 15\% \text{ of } (20,000 - 10,000)) = \$3,500$. – Sufficient

From statement 2:

Since the total sales of the salesperson was \$20,000 ($> \$10,000$), the amount paid to him was:
$\$(2,000 + 15\% \text{ of } (20,000 - 10,000)) = \$3,500$. – Sufficient

The correct answer is Option D.

334. Let the total sales be $\$x$.

Amount paid to Tim per month is:

$\$(1,000 + 10\% \text{ of } (x - 10,000))$; provided $(x > 10,000)$

OR

\$1,000; provided $(x \leq 10,000)$.

From statement 1:

Since Tim's pay exceeds \$1,500 (more than the fixed salary of \$1,000), we can conclude that $x > 10,000$.

Thus, we have

$\$(1,000 + 10\% \text{ of } (x - 10,000)) = \$1,500$

$$=> 1,000 + \frac{10\,(x - 10,000)}{100} = \$1,500$$

$=> x = \$15,000$ – Sufficient

From statement 2:

Since Tim received some commission, we can conclude that $x > 10,000$.

Thus, we have

$10\% \text{ of } (x - 10,000)) = \$500$

$$=> \frac{10\,(x - 10,000)}{100} = \$500$$

$=> x = \$15,000$ – Sufficient

The correct answer is Option D.

335. Cost of the air conditioner, excluding sales tax = \$600.

Sales tax on the cost of the air conditioner = $\$(10\% \text{ of } 600) = \$60$.

Thus, cost of the air conditioner, including sales tax = $\$(600 + 60) = \$660$.

We need to determine the installation cost including sales tax to get the total cost of the air conditioner and the installation.

From statement 1:

Sales tax on installation = 10% of the installation cost = \$6

Thus, installation cost = $\$6 \times \frac{100}{10} = \$60$.

Hence, installation cost, including sales tax = \$(60 + 6) = \$66.

Hence, the air conditioner and the installation, including sales tax = \$(660 + 66) = \$726. – Sufficient

From statement 2:

Total sales tax = \$66.

We know that the sales tax on the air conditioner = 10% of \$600 = 60.

Thus, sales tax on installation cost = \$ (66 – 60) = \$6.

This is the same information as in statement 1. Subsequent to this, following the calculation as we did in statement 1, we get the answer. – Sufficient

The correct answer is Option D.

336. From statement 1:

We have no information on the total number bottles and the corresponding information for the bottles that are labeled orange juice. – Insufficient

From statement 2:

Since 80% of the bottles are labeled orange Juice, (100 – 80) = 20% of the bottles are labeled guava Juice.

However, the specific information about the correct and incorrect labeling is not given.

Hence, the percent of juice bottles are labeled correctly cannot be determined. – Insufficient

Thus, from statements 1 and 2 together:

We know that of those that are labeled guava juice, 20 percent have orange juice in them.

However, we have no information about the number of bottles.

Hence, the percent of juice bottles are labeled correctly cannot be determined. – Insufficient

The correct answer is Option E.

337. From statement 1:

We have no information about the sales revenue in 2010.

Hence, the percentage change cannot be determined. – Insufficient

From statement 2:

We have no information about the sales revenue in 2001.

Hence, the percentage change cannot be determined. – Insufficient

Thus, from statements 1 and 2 together:

We have no information on the value of the the industry's sales revenue in 2010 as compared to that in 2001.

Hence, the percentage change cannot be determined. – Insufficient

The correct answer is Option E.

338. From statement 1:

We have no information about the total sales revenue of the industry in 2005 compared to 2001.

Hence, the percentage change in the sales revenue of Company X from 2001 to 2005 cannot be determined. – Insufficient

From statement 2:

We have no information about the value (or proportion) of sales revenue of Company X in 2001 and 2005.

Hence, the percentage change in the sales revenue of Company X from 2001 to 2005 cannot be determined. – Insufficient

Thus, from statements 1 and 2 together:

Let the total sales revenue of the industry in 2001 be $\$100x$.

Thus, the total sales revenue of the industry in 2005

$= \$(120\% \text{ of } 100x) = \$120x$.

The sales revenue of Company X in 2001

$= \$(20\% \text{ of } 100x) = \$20x$.

The sales revenue of Company X in 2005

$= \$(20\% \text{ of } 120x) = \$24x$.

Hence, the percentage change in the sales revenue of Company X from 2001 to 2005 $= \frac{24x - 20x}{20x} \times 100 = 20\%$

Since the sales revenue of Company X forms a constant percentage share of the total sales revenue of the industry, the percentage change in the sales revenue of Company X must be the same as the percentage change in the total sales revenue of the industry, 20%. – Sufficient

The correct answer is Option C.

339. From statement 1:

The statement gives us information on the balance on January 31 had the rate been 15%.

This can be used to determine the balance on January 1.

However, since the actual percent increase has not been mentioned, we cannot determine the actual balance on January 31. – Insufficient

From statement 2:

The statement gives us information on the actual percent increase from January 1 to January 31.

However, since the balance on January 1 has not been mentioned, we cannot determine the actual balance on January 31. – Insufficient

Thus, from statements 1 and 2 together:

Let the balance on January 1 be $\$x$.

Thus, at 15% increase, the balance on January 31 = $\$(115\% \text{ of } x)$

Thus, we have

$$\frac{115}{100} \times x = 1,150$$

$=> x = \$1,000$

Thus, actual balance on January 31 (at 10% increase) = $\$(110\% \text{ of } 1{,}000) = \$1,100$. – Sufficient

The correct answer is Option C.

340. From statement 1:

There is no information about Mark's taxes. – Insufficient

From statement 2:

There is no information about Mark's salary. – Insufficient

Thus, from statements 1 and 2 together:

There is no information about Mark's actual salary and actual taxes or the taxes as a percent of salary ratio. – Insufficient

Had the taxes as a percent of the salary i been known, say $k\%$, the percent change in net income could have been calculated as follows:

Initial tax = $k\%$ of i. New tax = $1.15 \times (k\%$ of $i)$.

Initial net income: $\{i - (k\%$ of $i)\}$.

Final net income: $1.10i - 1.15(k\%$ of $i)$.

Thus, change in net income

$$= \{1.1i - 1.15(k\% \text{ of } i)\} - \{i - (k\% \text{ of } i)\} = 0.1i - 0.15(k\% \text{ of } i) = i\left[0.1 - \frac{0.15k}{100}\right]$$

$$\text{Thus, percent change} = \frac{\left[i\left[0.1 - \frac{0.15k}{100}\right]\right]}{[i - (k\% \text{ of i})]} = \frac{\left[i\left[0.1 - \frac{0.15k}{100}\right]\right]}{\left[i\left[1 - \frac{k}{100}\right]\right]} = \frac{\left[0.1 - \frac{0.15k}{100}\right]}{1 - \frac{k}{100}}$$

Value of k is not known.

The correct answer is Option E.

341. From statement 1:

We know that the number of teachers with masters degree = $\frac{50}{100} \times 80 = 40$.

However, we cannot determine the number of male teachers with masters degree. – Insufficient

From statement 2:

We only know the number of males = $\frac{50}{100} \times 80 = 40$.

However, we cannot determine the number of male teachers with masters degree. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining the statements, we cannot determine the number of male teachers with masters degree (since the percent of male teachers with masters degree is not known: we cannot assume that since 50% of the teachers have masters degree, 50% of the male teachers would also have masters degree). – Insufficient

The correct answer is Option E.

342. Since each of School A's and School B's number of students in 2015 were 10% higher than that in 2014, the sum of their number of students in 2015 would also be 10% higher than that in 2014.

From statement 1:

The sum of School A's and School B's number of students in 2014 = 1,000.

Thus, the sum of School A's and School B's number of students in 2015 = $\$1,000 \times \frac{110}{100} = 1,100$

However, we cannot determine School A's individual number of students in 2014. – Insufficient

From statement 2:

The sum of School A's and School B's number of students in 2015 = 1,100.

Thus, the sum of School A's and School B's number of students in 2014 = $1,100 \times \frac{110}{110} = 1,000$

However, we cannot determine School A's individual number of students in 2014. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining both statements, we cannot determine School A's individual number of students in 2014, as we are only aware of the sum of School A's and School B's number of students, but no individual values of number of students are known. – Insufficient

The correct answer is Option E.

343. We need to verify if:

25% of $n >$ 20% of $\left(n + \frac{1}{2}\right)$

=> $\frac{25n}{100} > \frac{20\left(n + \frac{1}{2}\right)}{100}$

=> $\frac{n}{4} > \frac{n + 0.5}{5}$

=> $5n > 4n + 2$

=> $n > 2$

From statement 1:

$0 < n < 1$

=> $n \ngtr 2$

Thus, the answer to the question is 'No.' – Sufficient

From statement 2:

$n > 0.5$

Thus, we may have $n = 3(> 2)$ or $n = 1(\not> 2)$.

Thus, the answer to the question is not unique. – Insufficient

The correct answer is Option A.

344. We need to verify whether:

$x \times 100\% = x \times 33.33\%$

$x \times \frac{100}{100} = z \times \frac{33.33}{100}$

$=> x = \frac{z}{3}$

From statement 1:

$z = (100 + 200)\,\%$ of x

$=> z = 300\%$ of x

$=> z = \frac{300}{100} \times x$

$=> z = 3x$

$=> x = \frac{z}{3}$ – the answer is Yes. – Sufficient

From statement 2:

$x = (100 - 75)\,\%$ of $(x + z)$

$=> x = 25\%$ of $(x + z)$

$=> x = \frac{25}{100} \times (x + z)$

$=> x = \frac{x + z}{4}$

$=> x - \frac{x}{4} = \frac{z}{4}$

$=> \frac{3x}{4} = \frac{z}{4}$

=> $x = \frac{z}{3}$ – the answer is Yes. – Sufficient

The correct answer is Option D.

345. Let the expenditures for computers, printers and software be $\$x,\ \$y$ and $\$z$, respectively.

Thus: $x + y + z = 54,000 \ldots$(i)

From statement 1:

$y = (100 + 30)\,\%$ of z

=> $y = 1.3z \ldots$(ii)

The above equation along with equation (i) cannot be used to solve for x since there are three unknowns and only two equations. – Insufficient

From statement 2:

$y + z = (100 - 35)\,\%$ of x

=> $y + z = \frac{7x}{20} \ldots$(iii)

Substituting $(y + z)$ above in equation (i):

$x + \frac{7x}{20} = 54,000$

=> $\frac{27x}{20} = 54,000$

=> $x = \$40,000$ – Sufficient

The correct answer is Option B.

346. From statement 1:

There is no information about the taxable income of the amount of taxes paid by John in 2002. – Insufficient

From statement 2:

There is no information about the amount of taxes paid by John in 2001.
Hence, the amount of taxes paid in 2002 cannot be determined. – Insufficient

Thus, from statements 1 and 2 together:

Taxes paid in 2001 = $(5% of 40,000) = $2,000.

Thus, taxes paid in 2002 = \$(2,000 + 500) = \$2,500.

However, the taxable income in 2002 is not known.

Thus, the percentage of taxable income paid as taxes cannot be determined. – Insufficient

The correct answer is Option E.

347. Let Joe's income in 2001 be \$100

Thus, taxes paid in 2001 = \$(5.1% of 100) = \$5.1

From statement 1:

Joe's income in 2002 = \$\{(100 + 10)% of 100\} = \$110.

However, there is no information about the amount of taxes Joe paid in 2002. – Insufficient

From statement 2:

Taxes paid in 2002 = \$(3.4% of 100) = \$3.4

However, there is no information about Joe's income in 2002. – Insufficient

Thus, from statements 1 and 2 together:

Joe's income in 2002 = \$110.

Taxes paid by Joe in 2002 = \$3.4

Thus, percent of income paid in taxes = $\left(\frac{3.4}{110} \times 100\right) < 5.1$ – Sufficient

The correct answer is Option C.

Alternate approach:

Since income has increased from 2001 to 2002, while the taxes in 2002 has fallen as a percent of the income in 2001, the percent of income paid in taxes in 2002 would be even lower.

Hence, the answer is 'Yes.' – Sufficient

348. We know that the number of students in 2005 = 1050.

Let number of students in 1995 be n.

Thus, the number of students in 2000 = $(100 + 50)\,\%$ of $n = \frac{150}{100} \times n = \frac{3n}{2}$.

From statement 1:

Number of students in 2005 = $(100 + 110)\,\%$ of $n = \frac{210}{100} \times n = \frac{21n}{10}$.

Thus, we have

$\frac{21n}{10} = 1,050$

=> $n = 500$

=> The number of students in 2000 = $\frac{3}{2} \times 500 = 750$.

Thus, the percent increase in the number of students from 2000 to 2005 = $\frac{1,050 - 750}{750} \times 100$

= 40% – Sufficient

From statement 2:

We have $n = 500$

This is the same information as obtained from statement 1. – Sufficient

The correct answer is Option D.

349. We need to find the ratio of the number of employees in Company A and that in Company B in 2001.

From statement 1:

The relation between the number of employees in Company A in 2001 to the number of employees in Company B in 2000 is given.

However, there is no relation given regarding the number of employees in Company B in 2001. – Insufficient

From statement 2:

The relation between the number of employees in Company B in 2001 to the number of employees in Company B in 2000 is given.

However, there is no relation given regarding the number of employees in Company A in 2001. – Insufficient

Thus, from statements 1 and 2 together:

Let the number of employees in Company B in 2000 be p.

Thus, the number of employees in Company A in 2001 = $(100 + 60)\,\%$ of $p = \frac{8p}{5}$.

Also, the number of employees in Company B in 2001 = $(100 + 20)\,\%$ of $x = \frac{6p}{5}$.

Thus, the required ratio = $\frac{8p}{5} : \frac{6p}{5} = 4 : 3$. – Sufficient

The correct answer is Option C.

6.3 Profit & Loss

350. Gross profit = $(y - x)$

The gross profit as a percent of the cost = $\left(\frac{y-x}{x}\right) \times 100 = \left(\frac{y}{x} - 1\right) \times 100$.

From statement 1:

$y - x = 60$

However, we have no information on the value of $\left(\frac{y}{x}\right)$. – Insufficient

From statement 2:

$5y = 6x$

$\frac{y}{x} = \frac{6}{5}$.

Thus, the gross profit as a percent of the cost = $\left(\frac{y}{x} - 1\right) \times 100$

$= \left(\frac{6}{5} - 1\right) \times 100$

= 20%. – Sufficient

The correct answer is Option B.

351. Total earning from the car = \$5,000

Profit = Earning − Cost

Let the cost of repairing the car = \$$l$
Let the cost of buying the car = \$$m$
Hence, profit = \$$(5,000 - (m + l))$

We need to check if the profit is greater than \$1,500.
$=> (5,000 - (m + l)) > 1,500 \;\; => \;\; m + l < 3,500$

From statement 1:

$l + m = 3m$
$=> l = 2m$.
We do not have information on the values of l and m – Insufficient

From statement 2:

$5,000 - (m + l) > l$
$=> m + 2l < 5,000$
We have no information on the value of l and m – Insufficient

From statements 1 and 2 together:

We have $m + 2l < 5,000$, and $l = 2m$
$=> m + 2(2m) < 5,000$
$=> m < 1,000$
$=> l = 2m < 2,000$

Thus, we have $m + l < (1,000 + 2,000 = 3,000) < 3,500$ – Sufficient

The correct answer is Option C.

352. From statement 1:

We know that the percentage discount on the book was 10 percentage points more than that on the notebook.

However, the sale price of the two items before the discount is not known.

Thus, we cannot determine which item was discounted by what amount. – Insufficient

From statement 2:

We know that the sale price of the book was \$1 less than the sale price of the notebook.
However, we have no information on the discounts offered on the two items.

Thus, we cannot determine which item was discounted by what amount. – Insufficient

Thus, from statements 1 and 2 together:

Let the percentage discount on the notebook be $s\%$.
Thus, the percentage discount on the book will be $(s + 10)\%$.

Let the sale price of the notebook, before the discount be $\$p$.
Thus, the sale price of the book, before the discount will be $\$(p - 1)$.

Thus, discount on the book = $\$\left[\frac{(s+10)(p-1)}{100}\right] = \$\left[\frac{sp}{100} + \frac{10(p-1)}{100}\right]$; and

the discount on the notebook = $\$\left[\frac{sp}{100}\right]$

If $10(p - 1) = s$, the answer is no, else yes. Since we do not know the values of s and p, we cannot compare the discounts.

Alternatively, since the book has a higher percentage discount on relatively lower price, we cannot compare which of the two items has a higher discount. – Insufficient

The correct answer is Option E.

353. Let the price at which the gas stoves of Type A and Type B were purchased by the trader be $\$c$ each.

Let the price at which the gas stoves of Type A and Type B were sold by the trader be $\$x$ and $\$y$, respectively.

Thus, the profit on Type A = $x - c$ & the profit on Type B = $y - c$

We have to calculate $\frac{(x-c)-(y-c)}{(y-c)} \times 100\% = \frac{(x-y)}{(y-c)} \times 100\%$

From statement 1:

$x = y + 10\%$ of y
$=> x = y\left(1 + \frac{10}{100}\right) = 1.1y$
$=> x - y = 0.1y$ ... (a)

We have no information about the cost of the two gas stoves.

Hence, we cannot determine the answer. – Insufficient

From statement 2:

$y - c = 50$ ... (b)

We have no information about the difference in selling prices of the two gas stoves, i.e. $(x - y)$.

Hence, we cannot determine the answer. – Insufficient

Hence, from statements 1 and 2 together:

From (a) and (b): $\frac{x-y}{y-c} \times 100 = \frac{0.1y}{50} \times 100 = 0.2y$

However, the value of y is not known. - Insufficient

The correct answer is Option E.

354. From statement 1:

Marked price = $(100 + 25)\,\%$ of (Cost price)

=> Cost price = (Marked price) $\times \frac{100}{125}$

$= \$6,250 \times \frac{100}{125}$

$= \$5,000$ – Sufficient

From statement 2:

Selling price of the bike = \$5,500.

Thus, we have

$5,500 = (100 + 10)\,\%$ of (Cost price)

=> $5,500 = \left(1 + \dfrac{1}{10}\right) \times$ (Cost price)

=> Cost price $= \$5,500 \times \dfrac{10}{11}$

$= \$5,000$ – Sufficient

The correct answer is Option D.

6.4 Averages (including weighted averages)

355. From statement 1:

Say R_1 refers to the average of all the amounts in the 1st row.

Similar reasoning is valid for the other rows as well.

Let us take an example:

R_1	1	2	3	6	Average of $R_1 = \dfrac{12}{4} = 3$
R_2	4	6	7	7	Average of $R_2 = \dfrac{24}{4} = 6$
Average of all the values $= \dfrac{1+2+3+6+4+6+7+7}{8} = 4.5$					
Average of R_1 and $R_2 = \dfrac{3+6}{2} = 4.5$					
Thus, average of all the elements is the same as the average of R_1 and R_2					

Thus, we can say that the average of all the 24 amounts

$= \dfrac{R_1 + R_2 + R_3 + R_4 + R_5 + R_5}{6} = \dfrac{720}{6} = 120$ – Sufficient

From statement 2:

Similar reasoning is applicable as in statement 1.

Thus, we can say that the average of all the 24 amounts

$= \dfrac{C_1 + C_2 + C_3 + C_4}{4} = \dfrac{480}{4} = 120$ – Sufficient

The correct answer is Option D.

356. From statement 1:

We know that average age of the employees enrolled for only one course.
Hence, we cannot determine the average age of all the employees. – Insufficient

From statement 2:

We only know the ratio of the average ages of the employees enrolled for the two courses. Hence, we cannot determine the average age of all the employees. – Insufficient

Thus, from statements 1 and 2 together:

Average age of the employees in the NLP course = 40.

Thus, average age of the employees in the HLP course = $\frac{3}{4} \times 40 = 30$.

However, we do not know the number of employees enrolled for each course or the ratio of number of employees enrolled for each course. If the ratio of number of employees in NLP course to number of employees in HLP course is known = $\frac{x}{y}$, then the average would have been $= \frac{40x + 30y}{x + y}$.

Hence, we cannot determine the average age of all the employees. – Insufficient

The correct answer is Option E.

357. From statement 1:

The average annual wage of the workers in Department X is \$15,000.

However, we have no information on the workers in other departments in the factory.

Hence, the average annual wage of the workers at the factory cannot be determined. – Insufficient

From statement 2:

The average annual wage of the workers not in Department X is \$20,000.

However, we have no information on the wage of the workers in Department X in the factory.

Hence, the average annual wage of the workers at the factory cannot be determined. – Insufficient

Thus, from statements 1 and 2 together:

We know the average annual wage of the workers in Department X and that of the the workers who are not in Department X.

However, we have no information on the ratio of the number of workers in Department X and the number of workers other than in Department X.

If the ratio $\frac{\text{Number of workers in Department X}}{\text{Number of workers not in Department X}} = \frac{x}{y}$, Then, the average wage of all the workers in the factory = $\left(\dfrac{x \times 15,000 + y \times 20,000}{x + y}\right)$

Hence, the average annual wage of the workers at the factory cannot be determined – Insufficient

The correct answer is Option E.

358. From statement 1:

There is no information on the number of desktop computers sold, the number of laptop computers sold, and the average selling price of the laptop computers. – Insufficient

From statement 2:

There is no information on the number of desktop computers sold, the number of laptop computers sold, and the average selling price of the desktop computers. – Insufficient

Thus, from statements 1 and 2 together:

Let the number of desktop computers sold and the number of laptop computers be d & l, respectively; thus, the average price for all the computers

$= \$ \left(\dfrac{800d + 1,100l}{d + l}\right)$

However, there is no information about d & l. – Insufficient

The correct answer is Option E.

359. Dave's average score for the three tests = 74.

Thus, Dave's total score for three tests = $74 \times 3 = 222$.

From statement 1:

Dave's highest score = 82.

Thus, sum of Dave's two lowest scores = $222 - 82 = 140$.

However, we cannot determine Dave's lowest scores. – Insufficient

From statement 2:

Sum of Dave's two highest scores = 162.

Thus, Dave's lowest score = $222 - 162 = 60$ – Sufficient

The correct answer is Option B.

360. We know that there are 20 friends in all.

Let the average amount spent by each friend = $\$a$.

The amount spent by the first five friends = $\$\,(5 \times 21) = \$105$.

The average amount spent by the remaining $(20 - 5) = 15$ friends = $\$\,(a - x)$.

Thus, the total amount spent by the 15 friends = $\$\,(15 \times (a - x))$.

Thus, the total amount spent by all the friends = $\$\,\{15 \times (a - x) + 105\} \ldots$(i)

Thus, the average amount spent by all the friends = $\$\left(\frac{15 \times (a - x) + 105}{20}\right)$

Thus, we have

$\frac{15\,(a - x) + 105}{20} = a$

$=> 15\,(a - x) + 105 = 20a$

$=> 3(a - x) + 21 = 4a$

$=> 3a - 3x + 21 = 4a$

$=> a + 3x = 21 \ldots$(ii)

From statement 1:

$x = 3$

Thus, from (ii), we have

$=> a + 3 \times 3 = 21$

$=> a = 12$ – Sufficient

From statement 2:

The total amount spent is \$240, and total friends are 20.

The average amount spent = $\frac{240}{20} = 12$ – Sufficient

The correct answer is Option D.

6.5 Ratio & Proportion

361. Let the number of students = n.

From statement 1:

Say with each student received x candies, y cookies, and z toffees.

Thus, $x : y : z = 3 : 4 : 5$
$=> x = 3k, \ y = 4k, \ z = 5k$, where k is a constant of proportionality.

However, we have no information on n. – Insufficient

From statement 2:

$nx = 27, \ ny = 36, \ nz = 45$.

We have no information about $x, \ y, \ \& \ z$.
Hence, we cannot determine the value of n. – Insufficient

Thus, from statements 1 and 2 together:

Substituting the values of x or y or z from statement 1 in the information from statement 2, we have

$nx = 27 = 3k$
$n = \frac{9}{k}$
Since k is unknown, we cannot determine n. – Insufficient

Note: Since x, y, z and n must be integers, k can be either 1, 3 or 9. For $k = 9$, there would be only one student, whereas for $k = 3$, there would be three students and for $k = 1$, there would be nine students.

The correct answer is Option E.

362. Number of candidates at the beginning of the session in the MBA (Finance) course and MBA (Marketing) course were n each.

Number of candidates at the end of the session in the MBA (Finance) course and MBA (Marketing) course were $(n - 6)$ and $(n - 4)$, respectively.

We have to determine the value of n.

From statement 1:

Number of candidates who left at the end of the session = 6 + 4 = 10

Thus, number of candidates at the beginning of the session = $\frac{5}{1} \times 10 = 50$

Thus: $2n = 50$
$=> n = 25$ – Sufficient

From statement 2:

Number of candidates remained in MBA (Marketing) course = 21
Number of candidates who had left MBA (Marketing) course = 4

Thus, number of candidates in MBA (Marketing) course at the beginning of the session $= 21 + 4 = 25$

Thus, number of candidates in MBA (Finance) course at the beginning of the session $n = 25$ – Sufficient

The correct answer is Option D.

363. From statement 1:
Before the milk from Tub A was poured, Tub A was $\frac{1}{3}$ full.
However, the capacity of Tub B in terms of Tub A is not known.

Hence, fraction of milk in Tub B after pouring cannot be determined. – Insufficient

From statement 2:

Let the capacity of Tub A and Tub B be c units.
Though we know the initial amount of milk in Tub $B = \frac{c}{2}$, we do not know the initial amount of milk present in Tub A.

Hence, fraction of milk in Tub B after pouring milk from Tub A cannot be determined. – Insufficient

Thus, from statements 1 and 2 together:

The capacity of Tub A and Tub B is c units.
Initial amount of milk in Tub A and $B = \frac{c}{3}$ and $\frac{c}{2}$, respectively.

Final amount of milk in Tub B when all the milk in Tub A is poured in Tub $B = \frac{c}{2} + \frac{c}{3} = \frac{5c}{6}$.

Hence, fraction of milk in Tub B after pouring $= \frac{5}{6}$ – Sufficient

The correct answer is Option C.

364. Ratio of marbles is:

Red : Blue : Green : Yellow = 6 : 5 : 2 : 2.

Thus, we have

Number of red marbles = $6k$
Number of blue marbles = $5k$
Number of green marbles = $2k$
Number of yellow marbles = $2k$, where k is the constant of proportionality

We need to determine the number of green marbles, i.e. $2k$.

From statement 1:

Since number of red marbles is 2 more than blue marbles, we have

$6k = 2 + 5k$
$=> k = 2$

=> The number of green marbles = $2k = 2 \times 2 = 4$ – Sufficient

From statement 2:

Total number of marbles = $6k + 5k + 2k + 2k = 15k$.

Thus, we have $15k = 30$
$=> k = 2$

=> The number of green marbles = $2k = 2 \times 2 = 4$ – Sufficient

The correct answer is Option D.

365. From statement 1:

We have the ratio of Chemical X and Chemical Y mixed.
Since no volume is mentioned, we cannot determine the number of milliliters of Chemical X. – Insufficient

From statement 2:

The volume of Chemical Y is known. However, we cannot determine the amount of Chemical X. – Insufficient

Thus, from 1 and 2 together:

$\frac{\text{Chemical X}}{\text{Chemical Y}} = \frac{2}{3}$

$=> \frac{\text{Chemical X}}{60} = \frac{2}{3}$

$=>$ Chemical X = $60 \times \frac{2}{3} =$ 40 milliliters. – Sufficient

The correct answer is Option C.

366. From statement 1:

The ratio of the number of male workers to female workers = 2 : 5.

There is no information about the present scenario. – Insufficient

From statement 2:

Let the number of male workers last year be m.
Let the number of female workers last year be f.

Thus, the number of male workers at present = $(m + 300)$.
The number of female workers at present = f.

Thus, we have

$\frac{m + 300}{f} = \frac{2}{3}$

There are two unknowns and hence, this equation cannot be solved. – Insufficient

Thus, from statements 1 and 2 together:

$m : f = 2 : 5$
$=> f = \frac{5m}{2}$

Substituting this in the equation obtained in statement 2, we have

$\frac{(m + 300)}{\frac{5m}{2}} = \frac{2}{3}$

$=> m = 450$

$=> f = 5 \times \frac{450}{2} = 1,125$

Thus, the number of male workers now = $(m + 300) = 750$.

The number of female workers now = $f = 1,125$.

Thus, the total number of workers now = $750 + 1125 = 1,875$. – Sufficient

The correct answer is Option C.

367. From statement 1:

Steve bought $\frac{3}{5}$ of the total candies they bought together.

Thus, David bought $\left(1 - \frac{3}{5}\right) = \frac{2}{5}$ of the total candies they bought together.

Thus, Steve bought more candies than David did. – Sufficient

From statement 2:

We know that they together bought a total of 50 candies.

However, we have no information on the number of candies each bought; we cannot compare their number of candies. – Insufficient

The correct answer is Option A.

368. We know that:

The ratio of the number of male and female workers in 2002 = 3 : 4.

Let the number of male and the number of female workers in 2002 be $3k$ and $4k$, respectively, where k be a constant of proportionality.

From statement 1:

We know that:

The ratio of the number of male workers in 2002 to that in 2003 = 3 : 5.

Thus, the number of male workers in 2002 = $3k$.
And, the number of male workers in 2003 = $\frac{5}{3} \times 3k = 5k$.

However, we have no information about the number of female workers in 2003. – Insufficient

From statement 2:

We know that:

The ratio of the number of male and female workers in 2003 = 10 : 7.

Let the number of male and female workers in 2003 be $10l$ and $7l$, respectively; where l is another constant of proportionality (not necessarily be the same as k).

Percent increase in the number of male workers from 2002 to 2003
$= \left(\frac{10l - 3k}{3k}\right) \times 100 = \left(\frac{10l}{3k} - 1\right) \times 100\% = P_m$

Percent increase in the number of female workers from 2002 to 2003
$= \left(\frac{7l - 4k}{4k}\right) \times 100 = \left(\frac{7l}{4k} - 1\right) \times 100\% = P_f$

Comparing P_m and P_f, we see that there are two ratios involved: $\left(\frac{10l}{3k}\right)$ and $\left(\frac{7l}{4k}\right)$, respectively.

Comparing the ratios, we see that:

$$\left(\frac{10l}{3k}\right) = \frac{10}{3} \times \frac{l}{k} = 3.33 \times \frac{l}{k}$$

$$\left(\frac{7l}{4k}\right) = \frac{7}{4} \times \frac{l}{k} = 1.75 \times \frac{l}{k}$$

As l and k both are positive, the ratio $\left(\frac{l}{k}\right)$ must also be positive. Hence, from above equations we can conclude that

$$\left(\frac{10l}{3k}\right) > \left(\frac{7l}{4k}\right)$$

$=> P_m > P_f$ – Sufficient

The correct answer is Option B.

369. From statement 1:

There is no information about the male employees in the company. – Insufficient

From statement 2:

There is no information about the female employees in the company. – Insufficient

Thus, from statements 1 and 2 together:

We know that 40% of females are above 50 years of age and 2/5 of 40% = 16% of females are above 55 years of age.

We know that 20 male employees are over 55 years of age.

However, we cannot find the number of female employees over 55 years of age.

Also, the total number of employees is not known.

Thus, the answer cannot be determined. – Insufficient

The correct answer is Option E.

370. From statement 1:

There is no information about the male members in the club. – Insufficient

From statement 2:

There is no information about the female members in the club. – Insufficient

Thus, from statements 1 and 2 together:

Percent of female members who are mechanical engineers = $\frac{1}{3} \times 75\% = 25\%$.

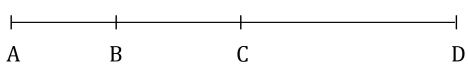
Percent of male members who are engineers = 30%.

Thus, the percent of male members who are mechanical engineers $\leq$ 30%, (since only engineers can be mechanical engineers).

Since for both male and female members, the fraction of mechanical engineers among them is less than $\frac{1}{3}$, the fraction of mechanical engineers is definitely not more than $\frac{1}{3}$. – Sufficient

The correct answer is Option C.

371. From statement 1:



AD = AC + BD − BC

However, the length of BC is not known. – Insufficient

From statement 2:

$BC^2 = AB \times CD$

However, none of the lengths are known. – Insufficient

Thus, from statements 1 and 2 together:

Let the length of BC = x.

Thus, from statement 1, we have

AB = $10 - x$

CD = $15 - x$

Thus, from statement 2, we have

$x^2 = (10 - x)(15 - x)$

=> $x^2 = 150 - 25x + x^2$

=> $25x = 150$

=> $x = 6$

Thus, we have

AD = AC + BD − BC

= 10 + 15 − 6 = 19 – Sufficient

The correct answer is Option C.

6.6 Mixtures

372. We need to find the minimum concentration of milk in any of the two containers so that when mixed they result in 80% milk solution.

Since one container has the minimum milk concentration, the other must have the maximum possible milk concentration, i.e. 100% (this is the limiting case).

Also, in order to find the minimum concentration in one container, we must have 100% concentration of milk in the container having the larger volume so that a large quantity of milk is obtained.

From statement 1:

We have

$x = 2y$

$=> x > y$

Thus, the container with x liters must be taken to be 100% milk.

Since the entire contents of both containers are mixed to get 30 liters of solution, we have

$x + y = 30$

$=> 2y + y = 30$

$=> y = 10$

$=> x = 20$

Thus, we have two solutions: 20 liters of 100% concentration of milk and 10 liters of $n\%$ concentration of milk, where $n\%$ represents the minimum concentration of milk.

Thus, equating the final concentration of milk, we have

$$\frac{20 \times \left(\frac{100}{100}\right) + 10 \times \left(\frac{n}{100}\right)}{20 + 10} = \frac{80}{100}$$

$$=> 20 + \frac{n}{10} = \frac{4}{5} \times 30$$

$$=> 20 + \frac{n}{10} = 24$$

$=> n = 40\%$ – Sufficient

From statement 2:

We have

$x = y + 10$

$=> x > y$

Thus, the container with x liters must be taken to be 100% milk.

Since the entire contents of both containers are mixed to get 30 liters of solution, we have

$x + y = 30$

$=> (y + 10) + y = 30$

$=> y = 10$

$=> x = 20$

This is the same result as obtained from statement 1.

Hence, we would obtain a unique answer. – Sufficient

The correct answer is Option D.

373. From statement 1:

We have

$x = 10$, and

$y = 100$

However, the value of z is not known (we should not assume that $x = z$). – Insufficient

From statement 2:

We have

$x = 20\%$ of y, and

$z = 10\%$ of y

Since we need the fraction of milk finally present in the mixture, we can assume a suitable value for y for ease of calculations.

Let y = 100 liters

Thus, we have

$x = 20$, and

$z = 10$

Thus, we have

From 100 liters of milk in a cask, 20 liters are removed and then 10 liters of water are added.

This process is repeated twice.

Thus, in the first cycle, fraction of the total contents of the cask removed $= \frac{20}{100} = \frac{1}{5}$

Thus, fraction of contents left $= 1 - \frac{1}{5} = \frac{4}{5}$

Thus, amount of milk left after the first cycle $= 100 \times \frac{4}{5} = 80$ liters.

Now, 10 liters of water are added.

Thus, total contents of the cask = 80 + 10 = 90 liters.

Thus, in the second cycle, fraction of the total contents of the cask removed $= \frac{20}{90} = \frac{2}{9}$

Thus, fraction of contents left $= 1 - \frac{2}{9} = \frac{7}{9}$

Thus, amount of milk left after the second cycle $= 80 \times \frac{7}{9} = \frac{560}{9}$ liters.

Total volume of cask after removal = (90 − 20) = 70 liters.

Now, 10 liters of water are added.

Thus, total contents of the cask = (70 + 10) = 80 liters.

Thus, required fraction of milk $= \left(\frac{\frac{560}{9}}{80}\right) = \frac{7}{9}$ – Sufficient

The correct answer is Option B.

374. Let the price of each bottle of beer = $\$x$.

From statement 1:

Total bottles purchased = 4 + 6 + 2 = 12.

Thus, total cost of all beer bottles = $\$12x$.

Number of bottles of beer consumed by each friend = $\frac{12}{3}$ = 4 bottles.

However, C had purchased only 2 bottles of beer.

Thus, he had to pay to A and B the price of $4 - 2 = 2$ bottles of beer.

Thus, the amount C paid to A and B = $\$2x$.

However, we cannot determine the value of x. – Insufficient

From statement 2:

There is no information about the number of bottles of beer purchased. – Insufficient

Thus from statement 1 and 2 together:

We have

$2x = 16$

$=> x = \$8$ – Sufficient

The correct answer is Option C.

375. Let the amount of milk and water in the mixture be m and w respectively.

From statement 1:

When 2 liters of milk is added to the mixture, the resultant mixture has equal quantities of milk and water.

Thus, we have

$(m + 2) = w \ldots$(i)

However, we cannot determine the value of m. – Insufficient

From statement 2:

The initial mixture had 2 parts of water to 1 part milk.

Thus, we have

$\frac{m}{w} = \frac{1}{2}$

=> $w = 2m \ldots$(ii)

However, we cannot determine the value of m. − Insufficient

Thus, from statements 1 and 2 together:

Substituting w from (ii) in (i):

$m + 2 = 2m$

=> $m = 2$ − Sufficient

The correct answer is Option C.

6.7 Speed, Time, & Distance

376. From statement 1:

Dave's average speed was $\frac{3}{5}$ of Jack's speed.

Thus, Dave's travel time

$= \frac{1}{\left(\frac{3}{5}\right)} = \frac{5}{3}$ of Jack's travel time (since for the same distance, time is inversely proportional to speed).

It is given that Jack's travel time = 12 hours.

Thus, Dave's travel time = $12 \times \frac{5}{3}$ = 20 hours – Sufficient

From statement 2:

The length of the route is of no use since actual speeds are not mentioned. – Insufficient

The correct answer is Option A.

377. Let the length of the route be d miles.

From statement 1:

Time taken to cover the route at 65 miles per hour is $\dfrac{d}{65}$ hours.

Time taken to cover the route at 60 miles per hour is $\dfrac{d}{60}$ hours.

Thus, we have

$$\frac{d}{65} = \frac{d}{60} - \frac{20}{60}$$

$$\frac{d}{65} = \frac{d}{60} - \frac{1}{3}$$

=> d = 260 miles. – Sufficient

From statement 2:

Since we do not know the average speed and the time for the second half of the route, we cannot find out the distance. – Insufficient

The correct answer is Option A.

378. From statement 1:

There is no information about Suzy's average speed. – Insufficient

From statement 2:

There is no information about the distance. – Insufficient

Thus, from statements 1 and 2 together:

Let the actual distance be d miles.

Thus, Suzy's estimate of the distance ranged from $(d + 10)$ miles to $(d - 10)$ miles.

Let Suzy's actual average speed be s miles/hour.

Thus, Suzy's estimate of her speed ranged from $(s + 5)$ miles to $(s - 5)$ miles/hour.

Thus, actual time = $\frac{d}{s}$ hours.

Maximum value of estimated time = $\left(\frac{d + 10}{s - 5}\right)$ hours.

Minimum value of estimated time = $\left(\frac{d - 10}{s + 5}\right)$ hours.

We need to determine whether:

- $\left(\frac{d + 10}{s - 5}\right) - \frac{d}{s} \leq \frac{30}{60} = 0.5,$

  AND

- $\frac{d}{s} - \left(\frac{d - 10}{s + 5}\right) \leq \frac{30}{60} = 0.5$

Since the relation between s and d is not known, we cannot determine the answer.

Let us take some values to verify:

(1) If $d = 20, s = 15$:

$$\left(\frac{d + 10}{s - 5}\right) - \frac{d}{s} = \frac{30}{10} - \frac{20}{15} = 3 - \frac{4}{3} = \frac{5}{9} > 0.5 \text{ – does not satisfy}$$

(2) If $d = 60, s = 50$:

$$\frac{d}{s} - \left(\frac{d - 10}{s + 5}\right) = \frac{60}{50} - \frac{50}{65} = \frac{6}{5} - \frac{10}{13} = \frac{28}{65} < 0.5 \text{ – satisfies}$$

Thus, there is no unique answer. – Insufficient

The correct answer is Option E.

379. Time (t) taken to travel d miles at r miles per hour

$t = \frac{d}{r}$

Time (T) taken to travel D miles at R miles per hour

$T = \frac{D}{R}$

From statement 1:

$d = D + 20 \ldots$(i)

However, there is no information on the values of r and R. – Insufficient

From statement 2:

$r = R + 20 \ldots$(i)

However, there is no information on the values of d and D. – Insufficient

Thus, from statements 1 and 2 together:

From (i) and (ii), we have

$$t = \frac{d}{r}$$

$$= \frac{D + 20}{R + 20}$$

$$= \frac{\left(\frac{D + 20}{R}\right)}{\left(\frac{R + 20}{R}\right)}$$

$$= \frac{\left(\frac{D}{R} + \frac{20}{R}\right)}{\left(1 + \frac{20}{R}\right)}$$

$$= \frac{\left(T + \frac{20}{R}\right)}{\left(1 + \frac{20}{R}\right)}$$

Let $\frac{20}{R} = k$

Thus, we have

$t = \frac{T + k}{1 + k}$

There are two possible cases:

(a) If $T > 1$: $\frac{T + k}{1 + k} < T$; for example:

If $T = 2$ and $k = 1$: $\frac{T + k}{1 + k} = \frac{3}{2} < 2$

$=> t < T$

(b) If $T < 1$: $\frac{T + k}{1 + k} > T$; for example:

If $T = \frac{1}{2}$ and $k = 1$: $\frac{T + k}{1 + k} = \frac{\left(\frac{3}{2}\right)}{2} = \frac{3}{4} > \frac{1}{2}$

$=> t > T$

Thus, there is no unique answer. – Insufficient

The correct answer is Option E.

6.8 Time & Work

380. From statement 1:

Time taken to manufacture 20 screws = 28 seconds.

However, no information is provided about the time taken to manufacture a bolt. – Insufficient

From statement 2:

Time taken to manufacture 1 bolt = 1.5 times the time taken to manufacture one screw.

However, no information is provided about the time taken to manufacture one screw. – Insufficient

Thus, from statements 1 and 2 together:

Time taken to manufacture one screw = $\frac{28}{20}$ = 1.4 seconds.
Thus, time taken to manufacture one bolt = $1.4 \times 1.5 = 2.1$ seconds.

Thus, time taken to manufacture 1,000 bolts = $2.1 \times 1000 = 2{,}100$ seconds. – Sufficient

The correct answer is Option C.

381. From statement 1:

We have information about only one machine. – Insufficient

From statement 2:

We do not have any information about the actual rates at which the bolts are made. – Insufficient

Thus, from statements 1 and 2 together:

We know that one machine manufactures bolts at the rate of 50 bolts per minute.

Since one machine is twice as fast as the other machine (we have no information about which machine is twice as efficient), we can have the second machine making bolts at the rate of

(1) $\frac{50}{2}$ = 25 bolts per minute

OR

(2) $50 \times 2 = 100$ bolts per minute

Thus, we do not know the actual rate at which the bolts are made by the other machine. – Insufficient

The correct answer is Option E.

382. Time taken by 5 skilled workers to complete the job = 18 hours.

Thus, time taken by 1 skilled worker to complete the job = $18 \times 5 = 90$ hours . . . (i)

Also, number of skilled workers required to complete the job in 1 hour = $5 \times 18 = 90$ . . . (ii)

We need to find the time it takes for a group of 3 skilled workers and 4 apprentices to do the same job.

From statement 1:

Since an apprentice works at $\frac{2}{3}$ the rate of a skilled worker, we can say that 1 apprentice is equivalent to $\frac{2}{3}$ of a skilled worker.

Thus, 3 apprentices are equivalent to $\left(3 \times \frac{2}{3}\right) = 2$ skilled workers.

Thus, 4 skilled workers and 3 apprentices are equivalent to $(4 + 2) = 6$ skilled workers.

Thus, from (i), we have

Time taken by 6 skilled workers to complete the job

$= \frac{90}{6} = 15$ hours – Sufficient

From statement 2:

Time taken by 6 apprentices and 5 skilled workers to complete the job = 10 hours.

Thus, in order to complete the job in 1 hour, number of people required

$= 6 \times 10$ apprentices and 5×10 skilled workers

= 60 apprentices and 50 skilled workers

Thus, from (ii), we have

60 apprentices and 50 skilled workers $\equiv$ 90 skilled workers

=> 60 apprentices $\equiv$ 40 skilled workers

=> 1 apprentice $\equiv \frac{40}{60} = \frac{2}{3}$ skilled worker

This is the same information as in statement 1. – Sufficient

The correct answer is Option D.

6.9 Computational

383. Say there are n number of sales persons.

Thus from statement 1, total number of computers = $5n + 18$ – Insufficient

Thus from statement 2, total number of computers = $4n + 28$ – Insufficient

Thus from statement 1 & 2 together:

$5n + 18 = 4n + 28 => n = 10$

Thus, the number of computers = $5 \times 10 + 18 = 68$ - Sufficient

The correct answer is Option C.

384. The employee gets paid \$10 per hour for 8 hours i.e. \$80 for a total of 8 hours.

Hence, for an excess of 8 hours, his pay per hour = $\$10 \times \left(1\frac{1}{4}\right) = \$\left(10 \times \frac{5}{4}\right) = \$\left(\frac{25}{2}\right)$.

From statement 1:

Since we have no information on the number of hours the employee worked yesterday, we cannot calculate his yesterday's pay.

Thus, we cannot find his today's pay.

Hence, we cannot determine the number of hours he worked today. – Insufficient

From statement 2:

We have no information on the pay received by the employee today.

Hence, we cannot determine the number of hours he worked today. – Insufficient

From statements 1 and 2 together:

Since the employee worked for 8 hours yesterday, he received \$80 as pay.

Hence, the pay received by the employee today $\$(25 + 80) = \$105$.

For the first 8 hours today, the employee received \$80.

For each hour of additional work, the employee receives = $\$\frac{25}{2}$.

Since he received \$25 extra today, the number of hours he worked extra today = $\frac{25}{\frac{25}{2}} = 2$ hours.

Hence, the employee worked for $8 + 2 = 10$ hours today. – Sufficient

The correct answer is Option C.

385. Let a popular-size box contain b numbers of batteries.

From statement 1:

The large-size box contains $(b + 10)$ numbers of batteries.
We cannot determine the cost per battery since no price is mentioned. – Insufficient

From statement 2:

Cost of a large-size box = \$20
We cannot determine the cost per battery since no quantity is mentioned. – Insufficient

Thus from statements 1 and 2 together:

Cost per battery of the large-size box = \$ $\left(\frac{20}{b + 10}\right)$.
We cannot determine the cost per battery since b is unknown. – Insufficient

The correct answer is Option E.

386. From statement 1:

We have no information on how many students received how many candies. – Insufficient

From statement 2:

We know that 15 students received two candies each.
This accounts for $15 \times 2 = 30$ candies.

We have no information on the number of candies received by the others. – Insufficient

Thus, from statements 1 and 2 together:

Let x students received one candy each.

Also, 15 students received two candies each (from Statement 2).

Thus, the remaining $(50 - x - 15) = (35 - x)$ students received exactly three candies each (since no one received more than three candies–from Statement 1).

Total number of candies distributed = 105.

Thus, $x \times 1 + 15 \times 2 + (35 - x) \times 3 = 105$
$=> x = 15$ – Sufficient

The correct answer is Option C.

387. Let the number of teachers = x

Thus, number of males = $\frac{x}{4}$

Number of non-academic staff = $\frac{x}{2}$

From statement 1:

We know that there are 14 males who are non-academic staff.

However, we cannot determine x from this information. – Insufficient

From statement 2:

Number of males = $\frac{x}{4}$

Thus, number of females = $x - \frac{x}{4} = \frac{3x}{4}$

Hence, we have $\frac{3x}{4} - \frac{x}{4} = 32$

=> $x = 64$ – Sufficient

The correct answer is Option B.

388. Let the price of each eraser yesterday be $\$x$.

Thus, the price of each pencil yesterday = $\$(x + 0.20)$

Let the number of pencils sold = p and that of erasers sold = e

We have to calculate the revenue from the sale of erasers = ex

From statement 1:

$e = p + 10$.

Since we do not know the actual number of erasers sold, we cannot determine the revenue from the erasers. – Insufficient

From statement 2:

Revenue from pencils = $p \times (x + 0.20) = 30$.

Since we do not know the number of pencils sold or the price of each pencil, we cannot determine the revenue from the sale of erasers. – Insufficient

Thus, from statements 1 and 2 together:

Revenue from erasers = $ex = (p + 10)x$; (substituting $e = p + 10$).

We have $p \times (x + 0.20) = 30$;

However, we cannot determine the value of p or x.

Hence, we cannot determine the revenue from the erasers. – Insufficient

The correct answer is Option E.

389. Total amount of inventory, in dollars, at the end = Total amount of inventory at the beginning + Total amount of purchases in the month − Total amount of sales in the month

From statement 1:

The seller effectively had purchased 300 copies of Magazine X at \$4 per magazine and 100 copies of Magazine X at \$3.75 per magazine.

However, the number of copies of Magazine X sold and their price are not known.

Hence, total amount of inventory, in dollars, of stock by the seller at the end of last month cannot be determined – Insufficient

From statement 2:

The total revenue from the sale of Magazine X = \$800.

However, the number of copies of Magazine X purchased by the seller and its price in the last month is not known.

Hence, total amount of inventory, in dollars, of stock by the seller at the end of last month cannot be determined – Insufficient

Thus, from statements 1 and 2 together:

Total amount of inventory, in dollars, at the end

$= 300 \times 4 + 100 \times 3.75 - 800 = 1,200 + 375 - 800 = \$775$ – Sufficient

The correct answer is Option C.

390. We know that $C \propto N$.

$=> C = kN$; where k is a constant

From statement 1:

We have

$C = kN$,

$N = 100.$

However, since k is unknown, we cannot determine the value of C. – Insufficient

From statement 2:

We have

$C = kN,$
$N = 450$

$C = 90$

Thus,

$$k = \frac{C}{N} = \frac{90}{450} = \frac{1}{5}.$$

Thus, we have

$$C = \frac{N}{5}$$

However, no information is given on the value of N.

Hence, the value of C cannot be determined. – Insufficient

From statements 1 and 2 together:

We know:

$$C = \frac{N}{5},$$

$N = 100$

Thus, we have

$C = \frac{100}{5} = 20$ – Sufficient

The correct answer is Option C.

391. From statement 1:

We have no information about the distance travelled in one gallon of diesel.
Hence, the cost of diesel per mile cannot be determined – Insufficient

From statement 2:

We have no information about the cost of diesel.

Hence, the cost of diesel per mile cannot be determined. – Insufficient

Thus, from statements 1 and 2 together:

Since we need to find the cost of diesel per mile, we need to know the total cost of diesel and the total number of miles travelled.

The cost per gallon of diesel is known.

Since the number of gallons of diesel consumed is not known, we cannot determine the total cost of diesel.

Hence, the cost of diesel per mile cannot be determined – Insufficient

The correct answer is Option E.

392. Total number of visitors = 950.

We also know that twice as many visitors chose Monday than Tuesday.

From statement 1:

We know that the maximum number of visitors present on any weekday = 150.

Say on each of the weekdays except Tuesday and Sunday, maximum number of visitors, 150 each, visited the pagoda. Thus, on Tuesday $150/2 = 75$ visitors chose to go to the pagoda.

The maximum number of visitors on weekdays except Sunday = $5 \times 150 + 75 = 750 + 75 = 825$.

Thus, the least number of visitors on Sunday = $950 - 825 = 125 > 100$. – Sufficient

From statement 2:

We know that on each of days, Tuesday to Saturday had at least 75 visitors, thus Monday had at least $2 \times 75 = 150$ visitors.

Thus, the minimum number of visitors from Monday to Saturday = $150 + 5 \times 75 = 150 + 375 = 525$.

Thus, the maximum number of visitors on Sunday = $950 - 525 = 425$.

However, this does not help in determining the minimum number of visitors on Sunday. – Insufficient

The correct answer is Option A.

393. From statement 1:

We have $e + i = 6$

Since none of the numbers are more than '3', the above equation is valid only if $e = i = 3$.

We also know that each of the numbers 1, 2, and 3 appear exactly once in each row and column. Thus, in the first row: $b \neq 3$ (as in column 2 => $e = 3$ is already present) and $c \neq 3$ (as in column 3 => $i = 3$ is already present).

Since in the first row there must be at one '3'; thus, $a = 3$ – Sufficient

From statement 2:

Since each of the numbers 1, 2, and 3 appear exactly once in each row and column.

Thus, the sum of each row and each column = 1 + 2 + 3 = 6.

Hence, we have

$a + b + c = 6$; (considering the first row)

$a + d + g = 6$; (considering the first column)

Adding the above two equations, we have

$2a + b + c + d + g = 12$.

However, we know: $b + c + d + g = 6$

Hence, $2a = 12 - (b + c + d + g) = 12 - 6 = 6$

=> $a = 3$ – Sufficient

The correct answer is Option D.

394. From statement 1:

$t \bigtriangleup 2 = 74$

=> $(t + 2)^2 + (2 + 3)^2 = 74$

=> $(t + 2)^2 = 49$

=> $t + 2 = \pm 7$

=> $t = 5$ or -9.

Hence, we do not have a unique value of t. – Insufficient

From statement 2:

$2 \triangle t = 80$

$=> (2+2)^2 + (t+3)^2 = 80$
$=> (t+3)^2 = 64$
$=> t + 3 = \pm 8$
$=> t = 5$ or -11.

Hence, we do not have a unique value of t. – Insufficient

Thus, from statements 1 and 2 together:

We find that $t = 5$ is common to both statements 1 and 2.
Hence, $t = 5$. – Sufficient

The correct answer is Option C.

395. Total deduction = $X \times \frac{Y}{100} + Z = \frac{XY}{100} + Z$.

Thus, dealer's gross profit = $X - \frac{XY}{100} - Z = X - Z - \frac{XY}{100}$.

From statement 1:

$X - Z = 400$

However, we do not have the value of X or Y. – Insufficient

From statement 2:

$XY = 11,000$

However, we do not have the value of $\frac{XY}{100}$. – Insufficient

Thus, from statements 1 and 2 together:

Dealer's gross profit = $(X - Z) - \frac{XY}{100}$
$= 400 - \frac{11,000}{100} = 400 - 110 = \$290$ – Sufficient

The correct answer is Option C.

396. Let the monthly wheat allotment be x tons.

Loss in wheat allotment per month = $\frac{5x}{100}$ tons.

Let the cost to the company for every gallon lost be $\$y$.

Thus, we need to determine:

The dollar cost to the company per month for the loss = $\$\left(\frac{5xy}{100}\right)$

From statement 1:

We know $x = 400 \times 10^6$ tons.
However, the value of y is unknown.

Hence, the dollar cost to the company per month for the loss cannot be determined. – Insufficient

From statement 2:

The statement gives us the cost to the company for every ton lost as
$y = \$\left(\frac{5}{10,000}\right) = \$\left(\frac{1}{2,000}\right)$

However, the value of x is unknown.

Hence, the dollar cost to the company per month for the loss cannot be determined. – Insufficient

Thus, from statements 1 and 2 together:

$x = 400 \times 10^6$

$y = \$\left(\frac{1}{2,000}\right)$

Thus, the dollar cost to the company per month for the loss:

$= \$\left(\frac{5\times\left(400\times10^6\right)\times\left(\frac{1}{2,000}\right)}{100}\right) = \$10,000.$ – Sufficient

The correct answer is Option C.

397. We have to determine the value of $(s + d)$.

From statement 1:

$d = s + 100$

Since the actual values of s or d is not known, we cannot determine the total amount spent per month i.e. $(s + d)$. – Insufficient

From statement 2:

Amount spent by Suzy in seven months = $\$7s$.

Amount spent by Dave in six months = $\$6d$.

Thus, we have

$7s = 6d$

Since the actual values of s or d is not known, we cannot determine the total amount spent per month i.e. $(s + d)$. – Insufficient

Thus, from statements 1 and 2 together:

We have

$7s = 6d$

$=> d = \frac{7s}{6}$

Substituting the value of d from statement 1, in the equation, we have

$\frac{7s}{6} = s + 100$

$=> s = 600$

$=> d = \frac{7 \times 600}{6} = 700$

Thus, the total amount spent per month = $\$(s + d) = \$1,300$. – Sufficient

The correct answer is Option C.

398. From statement 1:

Let the regular price of the cake Martin bought be $\$x$ per one-pound piece.

Thus, the price for the second one-pound piece he paid = $\$\left(\frac{3x}{4}\right)$.

Thus, Martin's savings = $\$\left(\frac{x}{4}\right)$.

Total regular price (without the discounted offer) = $\$2x$.

Thus, the percent of the total regular price saved:

$=> \frac{\left(\frac{x}{4}\right)}{2x} \times 100 = 12.5\%$. – Sufficient

From statement 2:

The offered discounted rate is not mentioned.

Hence, the percent of the total regular price saved cannot be determined. – Insufficient

The correct answer is Option A.

399. We know that '#' represents either addition, subtraction, multiplication or division.

From statement 1:

25 # 5 = 5

Checking one at a time:

- $25 + 5 = 30 \neq 5$
- $25 - 5 = 20 \neq 5$
- $25 \times 5 = 125 \neq 5$
- $25 \div 5 = 5$

Thus, we can say that '#' represents division.

=> 14 # 7 = $14 \div 7 = 2$ – Sufficient

From statement 2:

2 # 1 = 2

Checking one at a time:

- $2 + 1 = 3 \neq 2$
- $2 - 1 = 1 \neq 2$
- $2 \times 1 = 2$
- $2 \div 1 = 2$

Thus, we can say that '#' represents either multiplication or division.

=> 14 # 7 = $14 \times 7 = 98$

OR

=> 14 # 7 = $14 \div 7 = 2$

Thus, there is no unique answer. – Insufficient

The correct answer is Option A.

400. Number of shares of stock P with Steve = x.

Dividend earned on the above x shares = \$225.

Thus, dividend earned per share = \$ $\left(\frac{225}{x}\right)$.

From statement 1:

We have

We have the annual dividend on each share of stock P was \$1.25

=> David's total dividend on his 200 shares = 200 $\times$ 1.25 = \$250. – Sufficient

From statement 2:

We have

$x = 180$

We know that dividend earned per share = $\frac{225}{x}$

Thus, dividend earned per share = $\frac{225}{x} = \frac{225}{180}$ = \$1.25

This is the same information as obtained from statement 1. – Sufficient

The correct answer is Option D.

401. Let the upper limit for the population be p.

Let the upper limit for the total area be a.

From statement 1:

There is no information about the total area. – Insufficient

From statement 2:

There is no information about the population. – Insufficient

Thus, from statements 1 and 2 together:

We have

$p = 50,000,000$

$i = 90,000$ square kilometers

Thus, based on the upper estimates, the Population Density

$= \dfrac{50,000,000}{90,000}$

$= 555.55$ persons per square kilometers

$=\approx 555 > 500$

Though it seems that we got the unique answer; however, it is not so. Since we do not have any information on the lower estimates, we cannot be sure that the Population Density for the country must be greater than 500 persons per square kilometers.

For example:

Let population $= 40,000,000$ & area $= 80,000$ square kilometers

Thus, based on the above estimates, the Population Density

$= \dfrac{40,000,000}{80,000}$

$= 500$ persons per square kilometers

$= 500 \ngtr 500$

Thus, there is no unique answer. – Insufficient

The correct answer is Option E.

402. Since $\blacksquare$, $\triangle$ and $\forall$ represent positive digits, their values can only be from 1 to 9 (inclusive).

From statement 1:

Since $3 < \forall < 5$, it means that $\forall = 4$; there is only one possible value of $\blacksquare$ and $\triangle$ so that $\blacksquare < \triangle$: $\blacksquare = 1, \& \triangle = 3$. – Sufficient

From statement 2:

Since $\blacksquare < 2$, it means that $\blacksquare = 1$, the possible values of $\triangle$ are: 2, 3, 4, 5, 6, 7 or 8; since in each case, the addition does not lead to a carry.

Thus, the value of $\triangle$ cannot be uniquely determined. – Insufficient

The correct answer is Option A.

6.10 Interest

403. From statement 1:

We only have information about the ratio of the rates of interest.

However, we have no information on the amounts invested at the given rates $x\%$ and $y\%$.

Thus, we cannot determine the value of x. – Insufficient.

From statement 2:

The amount invested at $x\% = \$\left(\frac{5}{5+3}\right) \times 80,000 = \$50,000$.

The amount invested at $y\% = \$\left(\frac{3}{5+3}\right) \times 80,000 = \$30,000$.

However, we have no information on the rates of interest.

Thus, we cannot determine the value of x. – Insufficient

Thus, from statements 1 and 2 together:

We have $x = \frac{5}{4}y$

$=> y = \frac{4x}{5}$

Thus, total interest:

$50,000 \times x\% + 30,000 \times y\% = 7,400$

$50,000 \times \frac{x}{100} + 30,000 \times \frac{y}{100} = 7,400$

$=> 500x + 300\left(\frac{4x}{5}\right) = 7,400$

$=> x = \frac{7,400}{740} = 10\%$ – Sufficient

The correct answer is Option C.

404. Let John had lent $\$x$ at 10% and $\$y$ at 22%.

From statement 1:

$x + y = 2,400$

However, there is no information about the interest received on each amount. – Insufficient

From statement 2:

Since the average rate of interest obtained was 15%, we have

$$\frac{(x \times 10) + (y \times 22)}{(x + y)} = 15$$

$=> 10x + 22y = 15x + 15y$

$=> 5x = 7y$

$=> \frac{x}{y} = \frac{7}{5}$

Thus, the larger part is $\$x$ and the smaller part is $\$y$.

Thus, the larger part was lent at 10% rate of interest. – Sufficient

The correct answer is Option B.

405. From statement 1:

Given: $A(2) = 121$

$=> 100\left(1 + \frac{r}{100}\right)^2 = 121$

$=> \left(1 + \frac{r}{100}\right)^2 = \frac{121}{100}$

$=> 1 + \frac{r}{100} = \left(\frac{121}{100}\right)^{1/2}$

$=> 1 + \frac{r}{100} = \frac{11}{10}$

$=> \frac{r}{100} = 0.1$

$=> r = 10\%$.

Amount after three years

$= A(3) = 100\left(1 + \frac{10}{100}\right)^3$ – Sufficient.

From statement 2:

$r = 10\%$

It is the same information as obtained from statement 1 – Sufficient.

The correct answer is Option D.

6.11 Functions

406. From statement 1:

$f(2) = p^2 = 81$
$=> p = \pm 9$

Thus, $f(1) = p^1 = p = \pm 9$.
Hence, we do not have a unique value of $f(1)$. – Insufficient

From statement 2:

$f(3) = p^3 = -729$
$=> p = -9$

Thus: $f(1) = p^1 = a = -9$. – Sufficient

The correct answer is Option B.

407. From statement 1:

$h(k) = 2k - 1 = 7$
Thus: $2k - 1 = 7$
$=> k = 4$.

Thus, we have $g(k = 4) = \dfrac{2k-3}{5} = \dfrac{8-3}{5} = 1$. – Sufficient

From statement 2:

$h(1) = 2 \times 1 - 1 = 1$.

$=> 1 = \frac{k}{4}$

$k = 4$

This is the same as the information as obtained from the first statement. – Sufficient

The correct answer is Option D.

408. From statement 1:

$|k| = 3$
$=> k = \pm 3$

If $k = 3 \geq 0$:

$f(k) = f(3) = 27 \times 3 = 81$; (since $k \geq 0$, $f(k) = 27k$)

If $k = -3 < 0$:
$f(k) = f(-3) = (-3)^4 = 81$; (since $k < 0$, $f(k) = k^4$)

Thus, we have a unique value of $f(k) = 81$. – Sufficient

From statement 2:

$k < 0$
$=> f(k) = k^4$

However, the value of k is not known.

Hence, the value of $f(k)$ cannot be determined. – Insufficient

The correct answer is Option A.

6.12 Permutation & Combination

409. We are given that total number of balls = 30.

Say the number of green balls is n

From statement 1:

We know that

$$\frac{C_2^n}{C_2^{30}} = \frac{3}{29}$$

$$=> \frac{\frac{n \times (n-1)}{1 \times 2}}{\frac{30 \times 29}{1 \times 2}} = \frac{3}{29}$$

$$=> n \times (n-1) = 30 \times 3 = 10 \times 9$$

Since $n \times (n-1)$ is a product of two consecutive integers, which are 10 & 9, thus $n = 10$ – Sufficient.

From statement 2:

We know that

$$\frac{C_2^{(30-n)}}{C_2^{30}} = \frac{38}{87}$$

$$=> \frac{\frac{(30-n) \times (29-n)}{1 \times 2}}{\frac{30 \times 29}{1 \times 2}} = \frac{38}{87}$$

$$=> (30-n) \times (29-n) = 38 \times 10 = 20 \times 19$$

Since $(30-n) \times (29-n)$ is a product of two consecutive integers, which are 20 & 19, thus $(30-n) = 20 => n = 10$ – Sufficient.

The correct answer is Option D.

410. Probability that the token chosen is green = $\frac{g}{b+w+g}$.

Probability that the token chosen is white = $\frac{w}{b+w+g}$.

From statement 1:

$$g(b+g) > w(b+w)$$

$=> \dfrac{g}{b+w} > \dfrac{w}{b+g}$

$=> 1 + \dfrac{g}{b+w} > 1 + \dfrac{w}{b+g}$ (adding 1 to both sides)

$=> \dfrac{b+w+g}{b+w} > \dfrac{b+g+w}{b+rg}$

$=> \dfrac{1}{b+w} > \dfrac{1}{b+g}$; (canceling $(b+w+g)$ from both sides)

$=> b+g > b+w$

$=> g > w.$

Since the number of green tokens is greater than the number of white tokens, the probability that the token chosen will be green is greater than the probability that the token chosen will be white. – Sufficient

From statement 2:

$=> b > w + g$

We see that the number of black tokens is the greatest.

However, we have no information on whether $g > w$. – Insufficient

The correct answer is Option A.

411. From statement 1:

There are 6 females among which, 3 are are pursuing Ph. D.

Thus, required probability = $\dfrac{3}{19}$ – Sufficient

From statement 2:

Since 3 of the 6 females are not are pursuing Ph. D., number of females who are are pursuing Ph. D. = $6 - 3 = 3$.

Thus, required probability = $\dfrac{3}{19}$ – Sufficient

The correct answer is Option D.

412. From statement 1:

We have no information on the total number of tokens or on the number of black and green tokens. – Insufficient

From statement 2:

The probability that the token will be blue = $\frac{1}{2}$

Thus, the probability that the token will be red or green = $1 - \frac{1}{2} = \frac{1}{2}$

Since we do not know the probability of the token being red, we cannot determine the probability of the token being green. – Insufficient

Thus, from statements 1 and 2 together:

Since we do not know the total number of tokens, we cannot determine the probability of the token being red. – Insufficient

The correct answer is Option E.

413. Let the number of men be m.

Thus, we have

$$p = \frac{C_2^m}{C_2^{10}}$$

We need to determine whether $p > 0.5 = \frac{1}{2}$.

From statement 1:

Number of men, $m > \frac{10}{2} = 5$.

If $m = 6$:

$$p = \frac{C_2^m}{C_2^{10}} = \frac{C_2^6}{C_2^{10}} = \frac{15}{45} = \frac{1}{3} \ngtr \frac{1}{2}.$$

Thus, if $m \geq 6$:

$$1 \geq p \geq \frac{1}{3}.$$

Thus, the value of p can be less than $\frac{1}{2}$ or even be more than $\frac{1}{2}$ (for example, if $m = 10$, then $p = 1$).

Thus, the answer cannot be uniquely determined. – Insufficient

From statement 2:

Number of women = $(10 - m)$.

We know that the probability that both are women is less than $\frac{1}{10}$.

Thus, we have

$$\frac{C_2^{(10-m)}}{C_2^{10}} < \frac{1}{10}.$$

Rather than solving, it is best to put a few test values of m.

Since the probability $\frac{1}{10}$ is very small, possible values of m would be on the higher side, but less than or equal to '8' (since there are at least two men).

- $m = 8: \ \frac{C_2^{(10-m)}}{C_2^{10}} = \frac{C_2^2}{C_2^{10}} = \frac{1}{45} < \frac{1}{10}$; (satisfies)
- $m = 7: \ \frac{C_2^{(10-m)}}{C_2^{10}} = \frac{C_2^3}{C_2^{10}} = \frac{3}{45} = \frac{1}{15} < \frac{1}{10}$; (satisfies)
- $m = 6: \ \frac{C_2^{(10-m)}}{C_2^{10}} = \frac{C_2^4}{C_2^{10}} = \frac{6}{45} = \frac{2}{15} \not< \frac{1}{10}$; (does not satisfy)

Thus, possible values of m are 7 or 8.

Let us now calculate the probability that both are men i.e. p.

At $m = 7: \ p = \frac{C_2^m}{C_2^{10}} = \frac{C_2^7}{C_2^{10}} = \frac{21}{45} \not> \frac{1}{2}$

At $m = 8: \ p = \frac{C_2^m}{C_2^{10}} = \frac{C_2^8}{C_2^{10}} = \frac{28}{45} > \frac{1}{2}$

Thus, the answer cannot be uniquely determined. – Insufficient

Thus, statements 1 and 2 together:

Even after combining both statements, p may be more than $\frac{1}{2}$ or less than $\frac{1}{2}$. – Insufficient

The correct answer is Option E.

414. Let the number of males and the number of females be m and w, respectively.

We need to determine the value of $(m + w)$.

From statement 1:

The probability of selecting a male $= \left(\frac{m}{m+w}\right)$

Thus, we have

$$\frac{m}{m+w} = \frac{4}{7}$$

$$=> m = \frac{4w}{3}$$

Since the exact values of m and w are not known, we cannot determine the value of $(m + w)$. – Insufficient

From statement 2:

$m = w + 10$

Since the exact values of m and w are not known, we cannot determine the value of $(m + w)$. – Insufficient

Thus, from statements 1 and 2 together:

Substituting the value of $m = \frac{4w}{3}$ in the equation from statement 2, we have

$$\frac{4w}{3} = w + 10$$

$=> w = 30$

$=> m = w + 10 = 40$

$=> m + w = 70$. – Sufficient

The correct answer is Option C.

6.13 Sets

415. From statement 1:

It is known that each of the participants ordered for exactly one drink.

We also know that 70 percent of the female participants ordered Tea.

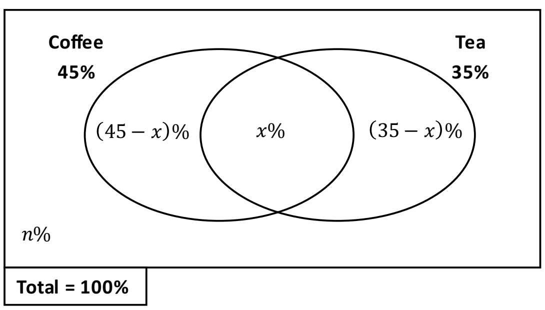
Thus, the remaining (100 – 70)% = 30% of the female participants ordered Coffee. – Sufficient

From statement 2:

There is no information about the female participants. – Insufficient

The correct answer is Option A.

416. Let us draw the corresponding Venn-diagram:



We need to determine the value of n.

From statement 1:

We have

$(45 - x)\% = 25\%$
$=> x = 20\%$

Thus, the percent of employees who take coffee or tea

$= (45 + 35 - x)\%$

$= (45 + 35 - 20)\%$

$= 60\%$

Thus, the percent of employees who take neither tea nor coffee ($n\%$)

$= (100 - 60)\%$

$= 40\%$ – Sufficient

From statement 2:

Percent of employees who take tea = 35%.

Thus, percent of employees who tea as well as coffee $(x\%)$

$= \frac{400}{7}\%$ of 35%

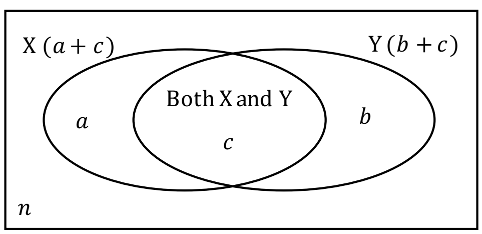
$= \frac{4}{7} \times 35\%$

$= 20\%$

This is the same information as obtained from statement 1. – Sufficient

The correct answer is Option D.

417. Let us refer to the Venn-diagram shown below:



From statement 1:

$c = 25\%$ of $(a + c)$

$\Rightarrow c = \frac{a + c}{4}$

$\Rightarrow 4c = a + c$

$\Rightarrow a = 3c \ldots$ (i)

However, there is no information on the value of b. – Insufficient

From statement 2:

$c = 37.5\%$ of $(b + c)$

$\Rightarrow c = \frac{375}{1000}(b + c)$

$=> c = \frac{3}{8}(b + c)$

$=> b = \frac{5c}{3} =\approx 1.67c \ldots$ (ii)

However, there is no information on the value of a. – Insufficient

Thus, from statements 1 and 2 together:

From (i) and (ii):

$a > b$

$=> a + c > b + c$

=> The number of clients of Company X is greater than that of Company Y. – Sufficient

Alternately, we have

25% of X = 37.5% of Y

$=> \frac{X}{Y} = \frac{37.5}{25} > 1$

=> X > Y

=> The number of clients of Company X is greater than that of Company Y. – Sufficient

The correct answer is Option C.

6.14 Statistics & Data Interpretation

418. Standard deviation (SD) is a measure of deviation of items in a set w.r.t. their arithmetic mean (average). Closer are the items to the mean value, lesser is the value of SD, and vice versa; thus, it follows that if a set has all equal items, its SD = 0.

From statement 1:

Statement 1 is clearly insufficient as we do not know how many numbers of students are there in each class; merely knowing the mean value is insufficient.

From statement 2:

Statement 2 is clearly sufficient. As discussed above since each class has an equal number of students, their mean = number of students in each class, so SD = 0: no deviation at all!

The correct answer is Option B.

419. The median weight of 45 mangoes would be the weight of the $\left(\frac{45+1}{2}\right)^{\text{th}} = 23^{\text{rd}}$ mango once the mangoes have been arranged in increasing order of weight (the mangoes may be arranged in decreasing order of their weight as well).

Since each of the 23 mangoes in box X weighs less than each of the 22 mangoes in box Y, the median weight will be the weight of the heaviest mango, i.e., 23^{rd} mango, in box X.

From statement 1:

The heaviest mango in box X weighs 100 grams.

Hence, the median weight of 45 mangoes = 100 grams. – Sufficient

From statement 2:

The lightest mango in box Y weighs 120 grams.

However, we need information on the heaviest mango in box X. – Insufficient

The correct answer is Option A.

420. From statement 1:

Standard deviation (SD) is a measure of deviation of items in a set with respect to their arithmetic mean (average). Closer are the items to the mean value, lesser is the value of SD, and vice versa.

Thus, it follows that if a set has all equal items, its SD = 0.

Since the SD of the amounts of the 10 prizes is ‘0’, the amount for each prize must be same. – Sufficient

From statement 2:

The total amount of the 10 prizes will not help us to determine whether the amount for each prize was the same. – Insufficient

The correct answer is Option A.

421. Let the seven numbers be a, b, c, d, e, f and g (where $a > b > c > d > e > f > g$).

Thus, we have

$$\frac{a+b+c+d+e+f+g}{7} = 20$$

$$=> a+b+c+d+e+f+g = 140$$

We need to determine the median of the seven numbers.

It is clear that the median is one of the seven numbers.

Since we have assumed $a > b > c > d > e > f > g$, the median must be d.

From statement 1:

Thus, we have

$$d = \frac{1}{6}(a+b+c+e+f+g)$$

$$=> d = \frac{1}{6}\{(a+b+c+d+e+f+g) - d\}$$

$$=> d = \frac{1}{6}(140 - d)$$

$$=> 6d = 140 - d$$

$$=> d = 20$$

Thus, the median is 20. – Sufficient

From statement 2:

It is clear that the median is one of the seven numbers.

Since we have assumed $a > b > c > d > e > f > g$, the median must be d.

Thus, we have

$a + b + c + e + f + g = 120$

However, we have

$a + b + c + d + e + f + g = 140$

=> $d = 140 - 120 = 20$

Thus, the median is 20. – Sufficient

The correct answer is Option D.

422. Let the four numbers be a, b, c and d.

Thus, we have

$$\frac{a + b + c + d}{4} = 40$$

=> $a + b + c + d = 160$

From statement 1:

We know that no number is greater than 70.

However, it may be that only one number is greater than 40, three numbers are greater than 40 or three numbers are greater than 40 as shown below:

- 37, 38, 39, 46: Average is 40; only one number greater than 40
- 38, 39, 41, 42: Average is 40; two numbers greater than 40
- 34, 41, 42, 43: Average is 40; three numbers greater than 40

Hence, we cannot determine the answer. – Insufficient

From statement 2:

We know that two of the numbers are 19 and 20.

Without loss of generality, we can assume that:

$a = 19$
$b = 20$

$a + b + c + d = 160$

=> $19 + 20 + c + d = 160$

=> $c + d = 121$

Thus, it may be that:

Both c and d are more than 40, for example: $a = 60$ & $b = 61$

OR

Only one among them is more than 40, for example: $a = 90$ & $b = 31$

Hence, we cannot determine the answer. – Insufficient

Thus, from statements 1 and 2 together:

We know that no number is greater than 70.

Also, we have $c + d = 121$.

Thus, maximum value of either c or d is 70.

Hence, the value of the other number = 121 – 70 = 51.

Thus, we see that two numbers are greater than 40. – Sufficient

The correct answer is Option C.

423. The average of the scores of x students = 40.

Thus, the total score of x students = $40x$.

The average of the scores of y students = 30.

Thus, the total score of y students = $30y$.

Thus, the total score of $(x + y)$ students = $(40x + 30y)$.

Thus, the average of the scores of $(x + y)$ students = $\left(\frac{40x + 30y}{x + y}\right)$.

From statement 1:

We only know the value of $(x + y)$ but not the relation between x and y.

Hence, the average of the scores of $(x + y)$ students cannot be determined. – Insufficient

From statement 2:

We have $x = 3y$

Thus, the average of the scores of $(x + y)$ students

$$= \left(\frac{40x + 30y}{x + y}\right)$$

$$= \left(\frac{40 \times 3y + 30y}{3y + y}\right)$$

$$= \frac{150y}{4y}$$

$= 37.5$ – Sufficient

The correct answer is Option B.

424. Standard deviation (SD) is a measure of deviation of items in a set with respect to their arithmetic mean (average). Closer are the items to the mean value, lesser is the value of SD, and vice versa; this follows that if a set has all equal items, its SD = 0.

From statement 1:

We know that the average score of Class A's students is greater than the average score of Class B's students.

However, we have no information about the deviations of the scores of the students about the mean.

Hence, we cannot compare the standard deviations. – Insufficient

From statement 2:

We know that the median score of Class A's students is greater than the median score of Class B's students.

However, we have no information about the deviations of the scores of the students about the mean.

Hence, we cannot compare the standard deviations. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining the two statements we cannot determine the deviation of the scores of the students about the mean. – Insufficient

The correct answer is Option E.

6.15 Linear Equations

425. Let the price of a A-4 size notebook be $\$x$ and that of a A-5 size notebook be $\$y$.

We need to find the value of y.

From statement 1:

$x + y = 4$ – Insufficient

From statement 2:

$3x + y = 9$ – Insufficient

Thus, from statements 1 and 2 together:

We can solve for y: $(3x + y - 9) - (x + y - 4) = 0 \Rightarrow x = 2.50$

$\Rightarrow\ y = 4 - 2.50 = \$1.50$ – Sufficient

The correct answer is Option C.

426. We need to find the value of r.

From statement 1:

$r + 12m = 620$ – Insufficient

From statement 2:

$r + 24m = 1,220$ – Insufficient

Thus, from statements 1 and 2 together:

$(r + 24m) - (r + 12m) = 1,220 - 620 \Rightarrow 12m = 600 \Rightarrow m = \$50$

$\Rightarrow r = \$20$ – Sufficient

The correct answer is Option C.

427. Let the price of the pencil be $\$x$ and the price of the eraser be $\$y$.

Thus, we have $x + y = 2$.

From statement 1:

$x = 3y$.

Thus: $x + y = 2$
$\Rightarrow 3y + y = 2$
$\Rightarrow y = \$0.50$ – Sufficient

From statement 2:

$x = 1.50$.

Thus: $y = 2 - x = 2 - 1.50$
$\Rightarrow y = \$0.50$ – Sufficient

The correct answer is Option D.

428. Let the charge of a group membership be $\$g$.

The charge of an individual membership = \$200.

Let the number of group and number of individual memberships be x and y, respectively.

Thus, revenue from group and revenue from individual memberships are $\$xg$ and $\$200y$, respectively.

Thus: $xg + 200y = 240,000$.

We need to determine the value of g.

From statement 1:

$200y = \frac{1}{3}(240,000)$

$\Rightarrow y = 400$

We have no information on x.

Hence, we cannot determine g. – Insufficient

From statement 2:

$x = 2y$

We have no information about the value of x and y.

Hence, we cannot determine g. – Insufficient

From statements 1 and 2 together:

$xg + 200y = 240,000$
$=> 2yg + 200y = 240,000$; (Substituting $x = 2y$ from Statement 2)
$=> 2 \times 400g + 200 \times 400 = 240,000$ (Substituting $y = 400$ from Statement 1)
$=> g = 200$ – Sufficient

The correct answer is Option C.

429. Let the price of each cap and each sunglass be $\$x$ and $\$y$, respectively.

We need to find the value of: $(4x + 5y)$

From statement 1:

$x = y + 2$

We do not know the actual values of y and x.

Hence, we cannot determine the answer. – Insufficient

From statement 2:

$8x + 10y = 45$

$=> 2(4x + 5y) = 45$

$=> 4x + 5y = \frac{45}{2} = \$22.50$ – Sufficient

The correct answer is Option B.

430. From statement 1:

Let the number of smaller cartons (holding 50 bottles each) required be x.
Number of smaller cartons is 10 more than the standard size cartons.

Thus, the number of standard size cartons (holding 75 bottles each) $= (x - 10)$.

Thus, equating the total number of cartons:

$75(x - 10) = 50x$
$=> 25x = 750$
$=> x = 30$ – Sufficient

From statement 2:

Number of standard size cartons (holding 75 bottles each) = 20.
Thus, total number of bottles = $20 \times 75 = 1{,}500$.

Each smaller carton can hold 50 bottles.
Thus, the number of smaller cartons required = $x = \frac{1,500}{50} = 30$ – Sufficient

The correct answer is Option D.

431. From statement 1:

We have no information on n – Insufficient

From statement 2:

$6m = 9n$

$=> 2m = 3n$; (canceling 3 from both the sides)
$=> 2m - 3n = 0$ – Sufficient

The correct answer is Option B.

432. Let the customer consumes t units.

If $t \leq 200$: customer's bill = $\$xt$
If $t > 200$: customer's bill = $\$\left(200x + (t - 200)\,y\right)$

From statement 1:

$y = 1.25x$

Since y is unknown, we cannot determine the value of x. – Insufficient

From statement 2:

Customer's bill for 210 units = $\$\left(200x + (210 - 200)\,y\right) = \$425$

$=> \;200x + 10y = 425$...(i)

There are two unknowns, hence we cannot determine the value of x. – Insufficient

Thus, from statements 1 and 2 together:

Substituting $y = 1.25x$ in equation (i):

$200x + 10 \times 1.25x = 425$

$=> 212.5x = 425$

$=> x = \frac{425}{212.5} = \$2$

The customer who consumes 200 units in a month would be charged $2 \times 200 = \$400$. – Sufficient

The correct answer is Option C.

433. Let the number of additional dishes be p.

Thus, total cost for all $(p + 1)$ dishes = $\$(50 + xp)$.

We need to calculate the value of x.

From statement 1:

Total cost for 4 dishes (i.e. 3 additional dishes) = $\$(50 + 3x)$.

Thus, average cost for 4 dishes = $\$\left(\frac{50 + 3x}{4}\right)$.

Thus, we have $\frac{50 + 3x}{4} = 27.50$

$=> x = \$20$. – Sufficient

From statement 2:

Total cost for 4 dishes (i.e. 3 additional dishes) = $\$(50 + 3x)$

Thus, average cost for 4 dishes = $\$\left(\frac{50 + 3x}{4}\right)$

Similarly, average cost for 6 dishes = $\$\left(\frac{50 + 5x}{6}\right)$

Thus, we have $\left(\frac{50 + 3x}{4}\right) - \left(\frac{50 + 5x}{6}\right) = 2.50$

$=> \frac{50 - x}{12} = 2.50$

$=> x = \$20$. – Sufficient

The correct answer is Option D.

434. Total items sold = 200
Let the number of pens sold = x.
Thus, the number of pencils sold = $(200 - x)$

From statement 1:

Revenue from item sales = \$ $(1.5x + 0.50\,(200 - x))$

Thus, we have

$1.5x + 0.5(200 - x) = 150$
=> $x = 50$ – Sufficient

From statement 2:

Revenue from item sales = \$ $(1.5x + 0.5\,(200 - x))$

Thus, average price per item sold = \$ $\left(\dfrac{1.5x + 0.5\,(200 - x)}{200}\right)$

Thus, we have

$$\frac{1.5x + 0.5\,(200 - x)}{200} = 0.75$$

=> $1.5x + 0.5\,(200 - x) = 150.$

This equation is same as that in Statement 1. – Sufficient

The correct answer is Option D.

435. Let the number of hours worked in a week be w.

If $w \le t$: Jack's earnings = \$ xw.
If $w > t$: Jack's earnings = \$ $(xt + 2\,(w - t))$.

From statement 1:

We have $w = (t - 3)$; i.e. $w < t$.
Jack's earnings = \$ $(x\,(t - 3))$.
Thus, we have $x\,(t - 3) = 14$

Since x and t are integers, possible values of x and t are:

(1) $x = 14; t - 3 = 1 \Rightarrow t = 4$: not possible since $t > 4$
(2) $x = 7; t - 3 = 2 \Rightarrow t = 5$: possible
(3) $x = 2; t - 3 = 7 \Rightarrow t = 10$: possible
(4) $x = 1; t - 3 = 14 \Rightarrow t = 17$: possible

There are multiple possible values of t possible, hence we cannot determine the value of t. – Insufficient

From statement 2:

We have $w = (t + 3)$; i.e. $w > t$.
Jack's earnings = \$ $(xt + 2((t + 3) - t))$ = \$ $(xt + 6)$.
Thus, we have $xt + 6 = 23$
=> $xt = 17$.

Since x and t are integers, possible values of x and t are:

(1) $x = 17; t = 1$: not possible since $t > 4$
(2) $x = 1; t = 17$: possible

Thus, we have a unique value of t. – Sufficient

The correct answer is Option B.

436. We know that the number of students in 1991 was one-third of the number of students in 2000.

We need to determine the number of students in 1991.

From statement 1:

There is no information regarding the number of students in 1991. – Insufficient

From statement 2:

There is no information regarding the actual number of students in 2009. – Insufficient

Thus, from statements 1 and 2 together:

Let the number of students in 1991 be x.
Thus, the number of students in 2000 = $3x$.

Hence, the number of students in 2009 = $(2 \times 3x) = 6x$.
Thus, increase in number of students from 2000 to 2009 = $6x - 3x = 3x$.

Thus, we have

$3x = 120$
=> $x = 40$. – Sufficient

The correct answer is Option C.

437. Let the number of marbles with Kevin be n.

From statement 1:

$n - 10 = \frac{n}{2}$

$=> n = 20$. – Sufficient

From statement 2:

This statement gives us information on the ratio of types of marbles with Kevin and not the total number of marbles. – Insufficient

The correct answer is Option A.

438. Let the number of years for which Mrs. Peterson lived be x.

Let the number of years for which Mrs. Peterson had been a professor be y.

From statement 1:

we have
$y + 20 = \frac{3x}{4} \ldots \text{(i)}$

We cannot determine x from this equation since there are two unknowns. – Insufficient

From statement 2:

We have
$y - 20 = \frac{x}{4} \ldots \text{(ii)}$

We cannot determine x from this equation since there are two unknowns. – Insufficient

Thus, from statements 1 and 2 together:

Subtracting equations (i) and (ii):
$40 = \frac{x}{2}$
$x = 80$. – Sufficient

The correct answer is Option C.

439. We have

$x + y = 2p$ and $x - y = 2q$

$\Rightarrow\ 2p + 2q = (x + y) + (x - y) = 2x.$

$p + q = x$

Now, in order to find $(p + q)$, we need to find x.

From statement 1:

We do not have the value of x. – Insufficient

From statement 2:

$p + q = x = 3$. – Sufficient

The correct answer is Option B.

440. We have

$\frac{x}{6} = \frac{y}{3}$

$\Rightarrow x = 2y.$

From statement 1:

$x + y = 30$
$\Rightarrow 2y + y = 30$; (substituting $x = 2y$)
$\Rightarrow y = 10$. – Sufficient

From statement 2:

$3x = 60$
$\Rightarrow x = 20$
$\Rightarrow 2y = 20$; (substituting $x = 2y$)
$\Rightarrow y = 10$. – Sufficient

The correct answer is Option D.

441. From statement 1:

Kevin was born in 1990 and is 5 years older than Chris.

Thus, Chris must have been born 5 years after Kevin was born, i.e. in the year

1990 + 5 = 1995 – Sufficient

From statement 2:

We have no information on Chris. – Insufficient

The correct answer is Option A.

6.16 Quadratic Equations & Polynomials

442. Let the number of boys and girls be b and g respectively.

We need to determine the value of $(b - g)$.

From statement 1:

We have
$b + g = 10$.

We cannot determine $(b - g)$ from this information. – Insufficient

From statement 2:

We have
$b = g^3$

We cannot determine $(b - g)$ from this information. – Insufficient

Thus, from statements 1 and 2 together:

$b = g^3$ and $b + g = 10$:

$g^3 + g = 10$

$g(g^2 + 1) = 10$

The optimum approach to solve this polynomial is by plugging in test values.

Say $g = 1$; At $g = 1$, $g(g^2 + 1) = 1(1^2 + 1) = 2 \neq 10$

Say $g = 2$; At $g = 2$, $g(g^2 + 1) = 2(2^2 + 1) = 10 = 10$

$=> g = 2$

$=> b = 2^3 = 8$

$=> b - g = 8 - 2 = 6$ – Sufficient

The correct answer is Option C.

443. $(a + b)^2 = a^2 + b^2 + 2ab$

$=> (a + b) = \pm\sqrt{(a^2 + b^2 + 2ab)}$

From statement 1:

$(a+b) = \pm\sqrt{(a^2+b^2)+2ab}$

$=> (a+b) = \pm\sqrt{1+0} = \pm 1.$

Thus, the value of $(a+b)$ may be or may not be '1.' – Insufficient

From statement 2:

Since $b = 0$, we have

$a^2 + b^2 = 1 => a^2 + 0 = 1 => a = \pm 1$

$=> a + b = \pm 1$

Thus, the value of $(a+b)$ may be or may not be '1.' – Insufficient

Thus, from statements 1 and 2 together:

Even after combining, we still get the same solution: $(a+b) = \pm 1$. – Insufficient

The correct answer is Option E.

444. From statement 1:

$(1-x)(1-y) = 1$

$=> 1 - x - y + xy = 1$

$=> x + y = xy$

$=> x + y - xy = 0$ – Sufficient

From statement 2:

$=> (x+y)(x-y) = xy(x-y)$

We know:

$x \neq y$ i.e. $(x-y) \neq 0$ and hence it can be cancelled from both sides.

$=> x + y = xy$

$=> x + y - xy = 0$ – Sufficient

The correct answer is Option D.

445. $a\,(a-5)\,(a+2) = 0$
=> $a = 0$, 5 or -2.

From statement 1:

$a\,(a-7) \neq 0$
=> $a \neq 0$ and $a \neq 7$.

However, from the question statement, we can still have: $a = 5\ (\nless 0)$ or $a = -2\ (< 0)$. – Insufficient

From statement 2:

$a^2 - 2a - 15 \neq 0$
=> $(a-5)\,(a+3) \neq 0$
=> $a \neq 5$ and $a \neq -3$.

However, from the main question, we can still have: $a = 0\ (\nless 0)$ or $a = -2\ (< 0)$. – Insufficient

Thus, from statements 1 and 2 together:

$a \neq 0$ and $a \neq 5$

Thus, from the main question, we have $a = -2\ (< 0)$. – Sufficient

The correct answer is Option C.

446. $\frac{1}{a} + \frac{1}{b} = \frac{a+b}{ab}$

From statement 1:

The value of ab is not known.

Hence, the value of $\left(\frac{1}{a} + \frac{1}{b}\right)$ cannot be determined. – Insufficient

From statement 2:

$ab = 6\,(a+b)$
=> $\frac{a+b}{ab} = \frac{1}{6}$ => $\frac{1}{a} + \frac{1}{b} = \frac{1}{6}$. – Sufficient

The correct answer is Option B.

447. $a^2 - b = n$

$=> a^2 = n + b$.

From statement 1:

$n + b = 4$

Thus: $a^2 = n + b = 4$

$=> a = \pm 2$

Thus, the value of a is not unique. – Insufficient

From statement 2:

The value of n is unknown.

Hence, the value of a cannot be determined. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining both statements, we cannot determine a unique value of a. – Insufficient

The correct answer is Option E.

448. $(n + 3)(n - 1) - (n - 2)(n - 1) = m(n - 1)$

$=> (n + 3)(n - 1) - (n - 2)(n - 1) - m(n - 1) = 0$

$=> (n - 1)[(n + 3) - (n - 2) - m] = 0$

$=> (n - 1)(5 - m) = 0$

$=> n = 1$ or $m = 5$

Looking at the results, it seems that the question is sufficient in itself and not even a single statement is needed as it yields $n = 1$; however it is not so. The meaning of $n = 1$ or $m = 5$ is that at least one of these must be true. Thus, if $m = 5$, then n may be or may not be 1. However, if $m \neq 5$, then n must be 1.

Moreover, if $m = 5$, n may have any value under the sun!

So the question boils down to the either the determination of value of n or the determination whether $m \neq 5$.

From statement 1:

$|m| = 5$

$=> m = \pm 5$

If $m = 5$, n can take any value.

If $m = -5 \, (\neq 5)$, then $n = 1$.

Thus, the unique value of n cannot be determined. – Insufficient.

From statement 2:

If $m = 5$, n can take any value.
Thus, the unique value of n cannot be determined. – Insufficient.

Thus, from statements 1 and 2 together:

Even after combining both statements, we cannot determine the unique value of n. – Insufficient

The correct answer is Option E.

449. We have

$x^2 + mx + n = (x + p)^2$

$=> x^2 + mx + n = x^2 + 2px + p^2$

Since this is true for all values of x, we can compare the coefficients of x and the constant terms on either side:

$m = 2p$;
$n = p^2$

From statement 1:

$n = p^2 = 3^2 = 9$. – Sufficient

From statement 2:

$m = 2p$
$=> 6 = 2p$
$=> p = 3$

$=> n = p^2 = 9$. – Sufficient

The correct answer is Option D.

450. Since the equation $x^2 + 3x + c = x^2 + x\,(a + b) + ab$ is valid for all values of x, we have (equating the coefficients of x and constants):

$a + b = 3 \ldots$(i)

$ab = c \ldots$(ii)

From statement 1:

We have $a = 1$

Thus, from (i), we have
$b = 2$

Thus, from (ii), we have
$c = 1 \times 2 = 2$ – Sufficient

From statement 2:

We know that: $a + b = 3$
Since a and b are positive integers, possible solutions are:

$a = 1, \ b = 2$

OR

$a = 2, \ b = 1$

In either of the two cases: $c = ab = 1 \times 2 = 2$ – Sufficient

The correct answer is Option D.

6.17 Inequalities

451. Let the average score that Steve got per subject = s,

and the average score that David got per subject = d.

We need to determine whether $s > d$.

From statement 1:

$2s > 2d - 5$

$\Rightarrow s > d - \frac{5}{2}$

However, we cannot determine whether $s > d$, since s is greater than a quantity d, which is reduced by a certain amount, $\frac{5}{2}$ – Insufficient

From statement 2:

$2d < 2s + 5$

$\Rightarrow 2s > 2d - 5$

It is the same inequality that we got from statement 1. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining the statements, we do not get any additional information – Insufficient

The correct answer is Option E.

452. Let the larger and the smaller numbers be l and s, respectively.

Thus, we have

$\frac{l}{5} > 6s$

$\Rightarrow s < \frac{l}{30}$

We need to determine if:

$s < 5$

$\Rightarrow l < 150.$

From statement 1:

We have $l > 120$

Say, if $l = 150$, then $s < \frac{150}{30}$ => $s < 5$.

However, if $l = 180$, then $s < \frac{180}{30}$ => $s < 6$. Thus, s may be or may not be less than 5. – Insufficient

From statement 2:

We have $l < 150$. As discussed in Statement 1, we have $s < 5$. – Sufficient

The correct answer is Option B.

453. We have $xy \neq 0$
=> None of x or y is 0.

From statement 1:

$|x| = |y|$
=> $x = \pm y$
Thus, x and y may be or may not be equal. – Insufficient

From statement 2:

$xy > 0$

=> $x > 0$ and $y > 0$

OR

$x < 0$ and $y < 0$.

However, we cannot determine whether $x = y$. – Insufficient

Thus, from statements 1 and 2 together:

From statement 1, we have $x = \pm y$

From statement 2, we have $x \neq -y$, (since x and y must be of the same sign.)

=> $x = y$. – Sufficient

The correct answer is Option C.

454. We have $abc \neq 0$

=> None of a, b and c is '0.'

$a\,(b + c) \geq 0$

=> $a \geq 0$ and $(b + c) \geq 0$

OR

$a \leq 0$ and $(b + c) \leq 0$.

From statement 1:

$|b + c| = |b| + |c|$

=> b and c are of the same sign i.e. $b \geq 0$ and $c \geq 0$

OR

$b \leq 0$ and $c \leq 0$.

However, there is no information on a. – Insufficient

From statement 2:

$|a + b| = |a| + |b|$

=> a and b are of the same sign i.e. $a \geq 0$ and $b \geq 0$

OR

$a \leq 0$ and $b \leq 0$.

However, there is no information on c. – Insufficient

Thus, from statements 1 and 2 together:

We have two possibilities:

(1) $a \geq 0,\ b \geq 0,\ c \geq 0$ => $a \geq 0$ and $(b + c) \geq 0$

(2) $a \leq 0,\ b \leq 0,\ c \leq 0$ => $a \leq 0$ and $(b + c) \leq 0$

In both the cases, we have $a\,(b + c) \geq 0$. – Sufficient

The correct answer is Option C.

455. We have

$$R = \frac{M}{N}$$

Thus, for $R \leq M$, we have

$N \geq 1$ if ($R \geq 0$ and $M \geq 0$); for example, $5 = \frac{10}{2}$

OR

$N < 0$ if ($R \leq 0$ and $M \geq 0$); for example, $-2 = \frac{4}{-2}$

From statement 1:

$M > 40$
Since no information on N is provided, we cannot determine if $R \leq M$. – Insufficient

From statement 2:

$0 < N \leq 15$.
Since no information on M is provided, we cannot determine if $R \leq M$. – Insufficient

Thus, from statements 1 and 2 together:

We find that both M and N are positive, thus R is also positive.
However, $N \geq 1$ or $0 < N \leq 1$ is possible.

$N \geq 1 => R \leq M$
Whereas, $0 < N \leq 1 => R \geq M$ – Insufficient

The correct answer is Option E.

456. $x^7y^4z^3 < 0$

$=> (x^6y^4z^2)(xz) < 0$

$=> xz < 0$; since $(x^6y^4z^2) > 0$ (being a perfect square).

We need to determine whether $xyz < 0$.

If $xyz < 0$, then we have

$y > 0$, (since $xz < 0$)

Thus, we need to determine whether $y > 0$.

From statement 1:

There is no information on y. – Insufficient

From statement 2:

There is no information on y. – Insufficient

Thus, from statements 1 and 2 together:

There is still no information on y. – Insufficient

The correct answer is Option E.

457. We have $xy = 6$.

From statement 1:

$y \geq 3$.

Since we want to know whether $x < y$, we must test the inequality for minimum possible value of y against the maximum possible value of x.

The minimum value of y results in the maximum value of x since xy is constant.

Minimum value of $y = 3$.

Thus, we have the maximum value of $x = \frac{6}{3} = 2$.

Since the maximum value of x is less than the minimum value of y, we have $x < y$. – Sufficient

From statement 2:

$y \leq 3$.

We know that the maximum value of y results in the minimum value of x since xy is constant.

Maximum value of $y = 3$.

Thus, we have the minimum value of $x = \frac{6}{3} = 2$. Thus, for these set of values, we have $x < y$.

However, x can attain values higher than 2, while y can attain values lower than 3.

For example: if $y = 1$
$\Rightarrow x = \frac{6}{1} = 6 \Rightarrow x > y$.

Thus, there is no unique answer. – Insufficient

The correct answer is Option A.

458. For the given inequality $x < -\frac{3y}{2}$, if y is positive, the answer is Yes, else the answer may be Yes or No.

From statement 1:

$y > 0$
$=> -\frac{3y}{2} < 0$

Thus, we have

$x < -\frac{3y}{2} < 0$. – Sufficient

From statement 2:

We have $2x + 5y = 20 \ldots$ (i)

We know that $x < -\frac{3y}{2}$ => $-2x > 3y$; the sign of inequality would reverse.
$=> -2x - 3y > 0 \ldots$ (ii)

Adding (i) and (ii), we get:
$5y - 3y > 20$
$=> y > 10$
$=> y > 0$.

This is the same as in statement 1. – Sufficient

The correct answer is Option D.

459. We need to determine whether $\frac{1}{a+b} < 1$

If $\frac{1}{a+b} < 1$, then $a + b > 1$ (We know that $a > 0$ and $b > 0$, thus, taking reciprocal of the positive quantity $(a + b)$ and reversing the inequality.)

From statement 1:

$\frac{a}{b} = 2$

However, we cannot determine whether $a + b > 1$. – Insufficient

From statement 2:

$a + b > 1$ – Sufficient

The correct answer is Option B.

460. We need to determine whether:

$\frac{w}{x} \times \frac{y}{z} > \frac{y}{z}$

$=> \frac{w}{z} \times \frac{y}{x} > \frac{y}{x}$ (rearranging terms)

Since w, x, z and z are positive, we can cancel $\frac{y}{x}$ from both sides, it implies that:

$=> \frac{w}{z} > 1$

$=> \ w > z$

From statement 1:

We have $y > x$

However, there is no comparison between w and z. – Insufficient

From statement 2:

We have $w > z$ – Sufficient

The correct answer is Option B.

461. From statement 1:

$x + y > 60$

Since x and y are any integers, we can have a situation where:

(1) $x = 0$ and $y = 61 => x + y = 61 > 60$. We see that $x \ngtr 0$.
(2) $x = 3$ and $y = 60 => x + y = 63 > 60$. We see that $x > 0$.
(3) $x = -2$ and $y = 66 => x + y = 64 > 60$. We see that $x \ngtr 0$.

Thus, x may be greater than ‘0’ or equal to ‘0’ or less than ‘0.’ – Insufficient

From statement 2:

There is no information about x. – Insufficient

Thus, from statements 1 and 2 together:

Even after combining the statements, we can still have all the situations shown for statement 1. – Insufficient

The correct answer is Option E.

462. From statement 1:

We have

$xy < 2$, and $x > 2$

Since the product xy is smaller than 2 with x itself being greater than 2, we must have y as either a fraction between '0' and '1' or a number less than or equal to '0.'

For example:

(1) Say $xy = 1$ and $x = 3$
$=> y = \frac{1}{3} < 1$

(2) Say $xy = -1$ and $x = 3$
$=> y = -\frac{1}{3} < 1$

Thus, we have

$y < 1$ – Sufficient

From statement 2:

We have

$xy < 2$, and $y < 3$

Since the product xy is smaller than 2 with y itself being smaller than 2, y can take any value depending on the value assigned to x.

For example:

(1) If $3 > y > 1$
$y = \frac{3}{2}, x = 1$
$=> xy < 2$

The answer is no, $y \nless 1$.

(2) If $y < 1$
$y = \frac{1}{2}$, $x = 2$
$=> xy < 2$

The answer is yes, $y < 1$.

Thus, there is no unique answer. – Insufficient

The correct answer is Option A.

463. We know that $x > 0$.

There are two possibilities:

(1) $0 < x < 1$: Here, x is a proper fraction.

Thus, higher the exponent of x, smaller is the value of (since the denominator is greater than the numerator).

$x^4 < x^3 < x^2 < x$

For example: $x = 0.2$
$=> x^2 = 0.04 < 0.2 = x$

(2) $x > 1$:

Here, higher the exponent of x, higher is the value (since the numerator is greater than the denominator).

For example: $x = 2$
$=> x^2 = 4 > 2 = x$

From statement 1:

We have

$\frac{1}{10} < x < \frac{2}{5}$

$=> 0.1 < x < 0.4$

$=> 0 < x < 1$

$=> x^2 < x$ – Sufficient

From statement 2:

We have

$x^3 < x^2$

Since $x^2 > 0$, we can cancel x^2 from both sides:

=> $x < 1$

=> $0 < x < 1$

=> $x^2 < x$ – Sufficient

The correct answer is Option D.

464. From statement 1:

$x^2 < xy + x$

=> $x^2 < x(y + 1)$

=> $x < y + 1$ (since x is positive, we can cancel x from both sides without reversing the inequality)

However, we cannot determine whether $x < y$. – Insufficient

From statement 2:

$xy < y(y - 1)$

$x < (y - 1)$
(since y is positive, we can cancel y from both sides without reversing the inequality)

=> $x < y - 1$
(since $y > 2$ => $y - 1 > 0$, we can cross-multiply $(y - 1)$ without reversing the inequality)

=> $x + 1 < y$

Thus, we can definitely say that: $x < y$ – Sufficient

The correct answer is Option B.

465. We need to determine whether $x^2 < |x|$

=> $|x|^2 < |x|$ since $x^2 = |x|^2$

=> $|x| < 1$

=> $-1 < x < 1$

From statement 1:

We know: $x < 1$

However, we do not have the lower bound. – Insufficient

From statement 2:

We know: $x > -1$

However, we do not have the higher bound. – Insufficient

Thus, from statements 1 and 2 together:

We have $-1 < x < 1$; which is the required condition. – Sufficient

The correct answer is Option C.

466. Give: $y = |x + 5| + |6 - x|$

We have to determine whether $y = 11$.

From statement 1:

Let's take two extreme test values.

Case 1: Say $x = 6$
=> $y = |x + 5| + |6 - x|$ => $y = |6 + 5| + |6 - 6| = 11$. The answer is yes.

Case 2: Say $x = -10$
=> $y = |x + 5| + |6 - x|$ => $y = |-10 + 5| + |6 + 10| = |-6| + 16 = 6 + 16 = 22 \neq 11$. The answer is no.

No unique answer. – Insufficient

From statement 2:

Let's take two extreme test values.

Case 1: Say $x = -5$
=> $y = |x + 5| + |6 - x|$ => $y = |-5 + 5| + |6 + 5| = 11$. The answer is yes.

Case 2: Say $x = 10$

$\Rightarrow y = |x+5| + |6-x| \Rightarrow y = |10+5| + |6-10| = 15 + |-4| = 15 + 4 = 19 \neq 11$. The answer is no.

No unique answer. – Insufficient

Thus, from statements 1 and 2 together:

We have $-5 \leq x \leq 6$

We see that at the extreme values of $x (= -5 \text{ \& } 6)$ for $-5 \leq x \leq 6$, the value of $y = 11$. You may also check some values in this interval, for example: $x = 0, -4, 2$, etc. In each case you will find that $y = 11$. – Sufficient

The correct answer is Option C.

467. From statement 1:

$2y < 7x$

$\Rightarrow y < \frac{7x}{2}$

Thus, we see that y is smaller than a positive quantity i.e. $\left(\frac{7x}{2}\right)$.
Thus, the value of y may be positive, may be zero or may even be negative. – Insufficient

From statement 2:

$y > -x$

Thus, we see that y is greater than a negative quantity, $-x$.

Thus, the value of y may be positive, may be zero or may even be negative. – Insufficient

Thus, from statements 1 and 2 together:

$-x < y < \frac{7x}{2}$

If $x = 5$

$-5 < y < \frac{7 \times 5}{2}$

Thus, depending on the value of x, the value of y may be positive, may be zero or may even be negative. – Insufficient

The correct answer is Option E.

468. From statement 1:

$x^2 < 1$

$=> -1 < x < 1$

Since x is an integer, $x = 0$

However, we have no information about y. – Insufficient

From statement 2:

We have $y < 1$

y may be negative or zero.

However, we have no information about x. – Insufficient

Thus, from statements 1 and 2 together:

We have

$x = 0$, and

$y < 1$

The greatest value of y would be 0.

Thus, we have

$x + y < 0 + 0 => x + y < 0$

$=> x + y < 2$. The answer to the question is No. – Sufficient

The correct answer is Option C.

469. Since $y^2 = 9 - x$, in order that y^2 is a positive integer, we must have:

$9 - x > 0$

$=> x < 9$

From statement 1:

We have $x \leq 7$:

Possible values of x are: 1, 2, 3, 4, 5, 6 or 7.

The only value of x for which y is an integer is: $x = 5$

Thus, we have

$y^2 = 9 - x = 9 - 5 = 4 \implies y = 2$; since y is a positive integer, it cannot be -2.

Thus, we have a unique value of y. – Sufficient

From statement 2:

We have $y \geq 2$

We have already established that: $x < 9$

Thus, possible values of x are: 1, 2, 3, 4, 5, 6, 7 or 8.

The possible values of x for which y is an integer are: $x = 5$ or 8

If $x = 5$: $y^2 = 9 - 5 = 4 \implies y = 2 \geq 2$

If $x = 8$: $y^2 = 9 - 8 = 1 \implies y = 1 \ngeq 2$

Thus, there is only possible value of $y = 2$ – Sufficient

The correct answer is Option D.

470. From statement 1:

$x - y > 4$

$\implies x > y + 4$

$\implies 3x > 3y + 12$

However, there is no relation between $(3y + 12)$ and $8y$ since y can be any positive number.

Thus, we cannot conclude that $3x > 8y$. – Insufficient

From statement 2:

$x > \frac{14y}{5}$

$\implies x > 2.8y$

$=> 3x > 8.4y$

Since $y > 0$, we have

$8.4y > 8y$

$=> 3x > 8y$ – Sufficient

The correct answer is Option B.

471. We have to determine whether $8x > 5y$.

Or, $\frac{x}{y} > \frac{5}{8}$?

From statement 1:

$x^2 > y^2$

$=> \left(\frac{x}{y}\right)^2 > 1$

$=> \frac{x}{y} > 1$ or $\frac{x}{y} < -1$

However, $\frac{x}{y} < -1$ is not valid since x and y are positive.

Since $\frac{x}{y} > 1 > \frac{5}{8}$, the answer is Yes. –Sufficient

From statement 2:

$x^3 > y^3$

$=> \left(\frac{x}{y}\right)^3 > 1$

$=> \frac{x}{y} > 1$

Since $\frac{x}{y} > 1 > \frac{5}{8}$, the answer is Yes. –Sufficient

The correct answer is Option D.

472. From statement 1:

$x^2 + 6x < 7$

$=> x^2 + 6x + 9 < 16$ (in order to convert the quadratic equation to a perfect square)

=> $(x + 3)^2 < 16$

=> $-4 < x + 3 < 4$

=> $-7 < x < 1$

But, we know that $x < 0$ and is an integer.

Thus, possible values of x are: $-1, -2, -3, -4, -5$ or -6.

Thus, x may be greater than -3 or equal to -3 or even smaller than -3. – Insufficient

From statement 2:

$x^2 + |x| \leq 2$

We know that both x^2 and $|x|$ are non-negative.

Also, $x^2 + |x|$ must be an integer since x is a negative integer.

Thus, we have

(1) $x^2 + |x| = 2$

This is only possible if each of x^2 and $|x|$ are 1

=> $x^2 = |x| = 1$

=> $x = -1$, which is not less than -3, Or $x = 1$, which is non-negative and hence not valid.

(2) $x^2 + |x| = 0$

=> $x = 0$, which is not negative, hence not valid.

Thus, we only have $x = -1 \nless -3$.

Thus, we have a unique answer 'No.' – Sufficient

The correct answer is Option B.

473. We have
$x + y > 0 => x > -y \ldots$(i)

From statement 1:

$x^{2y} < 1 => (x^2)^y < 1$

We know that $x^2 \geq 0$ for all values of x.

The above inequality can be satisfied in any of the following situations:

(1) $x > 1$ and $y < 0$, for example:

$x = 2$ and $y = -1$ (satisfying $x + y > 0$)

$=> x^{2y} = 2^{-2} = \frac{1}{4} < 1$

$=> xy = 2 \times (-1) = -2 < 0$

(2) $0 < |x| < 1$ and $y > 1$, for example:

$x = \pm\frac{1}{2}$ and $y = 2$ (satisfying $x + y > 0$)

$=> x^{2y} = \left(\frac{1}{2}\right)^4 = \frac{1}{16} < 1$

$=> xy = \left(\frac{1}{2}\right) \times 2 = 1 > 0$

OR

$xy = \left(-\frac{1}{2}\right) \times 2 = -1 < 0$

(3) $|x| = 0$ and y is any number except 0, where $x^{2y} = 0$ and $xy = 0$

Thus, xy may be positive, negative or zero. – Insufficient

From statement 2:

$x + 2y < 0$
$=> x < -2y \ldots$(ii)

Thus, combining (i) with (ii), we have $-y < x < -2y$

Thus, we have $-y < -2y$

$=> y > 2y$

$=> y < 0$; Note that y cannot be positive since if were so, then y can be cancelled and the result would be $1 > 2$, which is invalid.

Thus, y is negative.

Hence, $-y$ and $-2y$ are both positive.

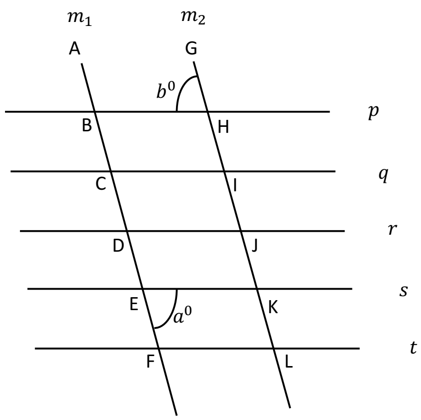
Thus, x lies between two positive numbers ($-y < x < -2y$), implying x is positive.

Thus, we have $x > 0$ and $y < 0 \Rightarrow xy < 0$ – Sufficient

The correct answer is Option B.

6.18 Geometry–Lines & Triangles

474. Let us reproduce the figure, assigning names for intersection points.



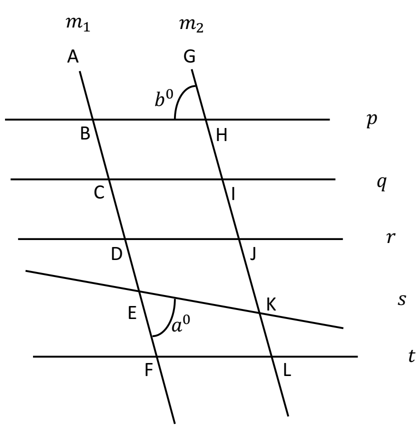
From statement 1:

Since $p||r$, we have ∠GHB =∠GJD = $b°$ (corresponding angles).

Since $r||t$, we have ∠GJD =∠GLF = $b°$ (corresponding angles).

Since it is not given that $t||s$, we cannot relate ∠FEK and ∠GHB.

The above diagram may be as following.



Note: If it were known that $t||s$, since $p||r$ and $r||t$, we would have $s||p$.

In that case, we would have:

∠JKE = $a°$ = ∠FEK (alternate angles) and ∠GHB = $b°$ = ∠JKE (corresponding angles).

Thus, we would have had $a = b$.

Hence, we cannot conclude that $a = b$ – Insufficient

From statement 2:

Since $q||s$, we have ∠FCI =∠FEK =a° (corresponding angles).

Since it is not given that $q||p$, we cannot relate ∠FEK and ∠GHB.

Note: If it were known that $q||p$, since $q||s$, we would have $s||p$.

Thus, following the reasoning presented in statement 1, we would have had $a = b$.

Hence, we cannot conclude that $a = b$ – Insufficient

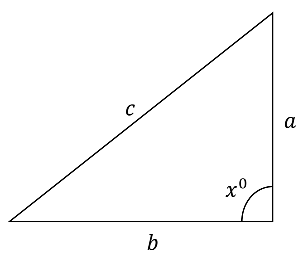
Thus, from statements 1 and 2 together:

Even after combining both statements, we cannot relate ∠FEK and ∠GHB.

Hence, we cannot conclude that $a = b$ – Insufficient

The correct answer is Option E.

475. We need to determine if $x > 90$:



We have the following possibilities:

(1) If $x = 90$, we have $c^2 = a^2 + b^2$
(2) If $x < 90$, we have $c^2 < a^2 + b^2$
(3) If $x > 90$, we have $c^2 > a^2 + b^2$

Thus, we need to check which of the above three conditions is true.

From statement 1:

We have no information about c. – Insufficient

From statement 2:

We have no information about a and b. – Insufficient

Thus, from statements 1 and 2 together:

We know that:

$a^2 + b^2 < 25$

Also, we know that:

$c > 5$

$=> c^2 > 25$

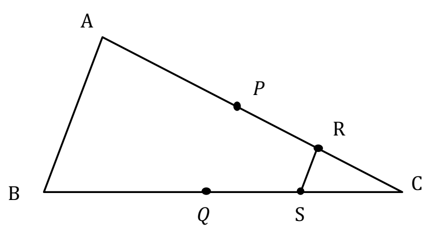
Thus, we see that:

$c^2 > a^2 + b^2$

$=> x > 90$ – Sufficient

The correct answer is Option C.

476. The figure depicting the information in the problem is shown below:



We know that:

AP = CP . . . (i)

RP = RC . . . (ii)

BQ = CQ . . . (iii)

QS = SC . . . (iv)

We have

$$\frac{\text{CR}}{\text{CA}} = \frac{\text{CR}}{2 \times \text{CP}} = \frac{\text{CR}}{2 \times 2 \times \text{CR}} = \frac{1}{4}$$

Also, we have

$$\frac{\text{CS}}{\text{CB}} = \frac{\text{CS}}{2 \times \text{CQ}} = \frac{\text{CS}}{2 \times 2 \times \text{CS}} = \frac{1}{4}$$

Thus, triangle CRS is similar to triangle CAB since:

$\frac{CR}{CA} = \frac{CS}{CB}$, and $\angle RCS = \angle ACB$ (included angle)

Thus, ratio of the corresponding sides of the above two similar triangles $= \frac{CR}{CA} = \frac{CS}{CB} = \frac{1}{4}$

Thus, ratio of the areas of the above two similar triangles

$$= \frac{\text{Area of triangle CRS}}{\text{Area of triangle CAB}} = (\text{Ratio of their corresponding sides})^2 = \left(\frac{1}{4}\right)^2 = \frac{1}{16} \ldots \text{(i)}$$

From statement 1:

Area of triangle ABP = 40

We know that a line drawn from the vertex which divides the base in the ratio 1 : 1, also divides the area in the same ratio i.e. 1 : 1.

Since AP = CP, we have

Area of triangle BCP = Area of triangle ABP = 40.

Thus, area of triangle CAB = 40 + 40 = 80.

Thus, from (i):

$$\frac{\text{Area of triangle CRS}}{80} = \frac{1}{16}$$

=> Area of triangle CRS $= \frac{80}{16} = 5$ – Sufficient

From statement 2:

We only know the length of an altitude of triangle ABC.

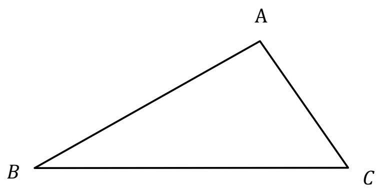
However, the length of the corresponding base of the triangle ABC is not known.

Hence, the area of triangle ABC cannot be determined.

Hence, the area of triangle CRS cannot be determined either. – Insufficient

The correct answer is Option A.

477. The figure depicting the information in the problem is shown below:



We know that:

$\angle A = 40^\circ + 2 \times \angle B \ldots$(i)

Also, in triangle ABC:

$\angle A + \angle B + \angle C = 180^\circ$

=> $(40 + 2 \times \angle B) + \angle B + \angle C = 180$

=> $3 \times \angle B + \angle C = 140^\circ \ldots$(ii)

From statement 1:

Since AB = BC, we have

$\angle A = \angle C$

Thus, from (i), we have

$\angle C = 40^\circ + 2 \times \angle B \ldots$(iii)

From (ii) and (iii), we have

$3 \times \angle B + (40^\circ + 2 \times \angle B) = 140^\circ$

=> $5 \times \angle B = 100^\circ$

=> $\angle B = 20^\circ$

Thus, from (iii)

=> $\angle C = 40^\circ + 2 \times \angle B$

$= 40^\circ + 2 \times 20^\circ$

$= 80^\circ$ – Sufficient

From statement 2:

We have

$\angle A = 80^\circ$

Thus, from (i), we have

$80^\circ = 40^\circ + 2 \times \angle B$

$=> \angle B = 20^\circ$

Thus, from (ii), we have

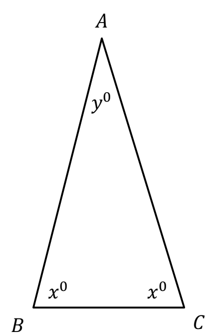
$3 \times 20^\circ + \angle C = 140^\circ$

$=> \angle C = 140^\circ - 60^\circ$

$= 80^\circ$ – Sufficient

The correct answer is Option D.

478. Let us bring out the figure.



We know that the sum of the angles in a triangle is 180°.

$=> 2x + y = 180 \ldots$(i)

From statement 1:

$x = 80$

Thus, from (i), we have

$2 \times 80 + y = 180$

$=> y = 20$ – Sufficient

From statement 2:

$x = 100 - y$

Thus, from (i), we have

=> $2\left(100 - y\right) + y = 180$

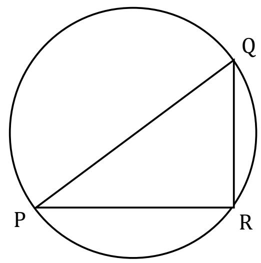
=> $200 - y = 180$

=> $y = 20$ – Sufficient

The correct answer is Option D.

6.19 Geometry–Circles

479. From statement 1:



Since we have no information about the nature of the triangle PQR, we cannot determine the sides of the triangle.

Hence, we cannot determine the radius of the circle. – Insufficient

From statement 2:

Let the length of the sides QR, PR and PQ respectively be $3x,\ 4x$ and $5x$, where x is a constant of proportionality.

We see that: $(5x)^2 = (3x^2) + (4x)^2$

=> Triangle PQR is right-angled at R.

=> PQ is the diameter of the circle (since the diameter subtends 90° at the circumference).

However, the exact lengths are not known.

Hence, we cannot determine the radius of the circle. – Insufficient

Thus, from statements 1 and 2 together:

Sum of the three sides = $3x + 4x + 5x = 12x$.

Thus, we have

$12x = 60$

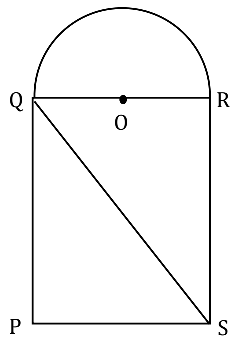
=> $x = 5$

=> Diameter of the circle = PQ = $5x = 25$

=> Radius of the circle = $\frac{25}{2} = 12.5$ – Sufficient

The correct answer is Option C.

480. Area of a semi-circle = $\frac{\pi r^2}{2}$, where r is the radius of the semi-circle.



Thus, to determine the area, we need to determine the radius using the relation: QR = $2r$.

From statement 1:

We only know the ratio of the sides of the rectangle.

We have no information about any actual dimensions. – Insufficient

From statement 2:

We know: QS = 25

From Pythagoras' theorem:

$PQ^2 + QR^2 = BD^2$

=> $PQ^2 + QR^2 = 25^2$

However, we cannot determine QR since both QR and PQ are unknowns. – Insufficient

Thus, from statements 1 and 2 together:

$\frac{PQ}{QR} = \frac{4}{3}$

=> Let PQ = $4x$ and QR = $3x$, where x is a constant of proportionality.

Thus, we have

$PQ^2 + QR^2 = 25^2$

=> $(4x)^2 + (3x)^2 = 25^2$

=> $x^2 = 1$

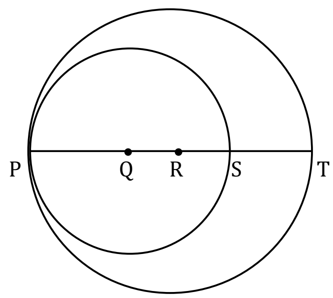
=> $x = 1$ (x cannot be -1 since lengths must be positive)

=> QR = $3x = 3$

=> Radius of the semi-circle = $\frac{15}{2}$. – Sufficient

The correct answer is Option C.

481. Required area = (Area of bigger circle with centre R) − (Area of smaller circle with centre Q)
$= \pi \times PR^2 - \pi \times PQ^2$



From statement 1:

We know:

PS = 6 and QR = 2

=> PQ = PS/2 = 6/2 = 3

=> PR = PQ + QR = 3 + 2 = 5

Thus, required area

$= \pi \times PR^2 - \pi \times PQ^2$

$= \pi\ (5^2 - 3^2)$

$= 16\pi$ – Sufficient

From statement 2:

We know:

ST = 4 and RS = 1

=> RT = 1 + 4 = 5

=> PR = RT = 5

Plso, we have

PS = PT − ST

= 2 × PR − ST

= 10 − 4 = 6

=> PQ + QS = 6

=> 2 × PQ = 6

=> PQ = 3

Thus, we have PR = 5 and PQ = 3, which is the same result as obtained from statement 1. – Sufficient

The correct answer is Option D.

6.20 Geometry–Polygon

482. We need to check if the rectangular table cloth covers the entire tabletop.

From statement 1:

We only have information on the dimensions of the tabletop.
However, we have no information on the rectangular table cloth. – Insufficient

From statement 2:

We only have information on the area of the table cloth.
However, we have no information on the tabletop. – Insufficient

Thus, from statements 1 and 2 together:

Combining both statements we can see:
The area of the table cloth = 4,000 square inches
The area of the table top = $40 \times 70 = 2{,}800$ square inches
Thus, the area of the table cloth is more than that of the tabletop.

However, it is not sufficient to determine if the table cloth can cover the table top entirely.

Say, for example, if, say, the table cloth is 50 inches by 80 inches, i.e. both the length and breadth are more than the corresponding dimensions of the tabletop, the table cloth will cover the tabletop entirely.

However, if, say, the table cloth is 20 inches by 200 inches, i.e. both the length and breadth are **not** more than the corresponding dimensions of the tabletop, the table cloth will not cover the tabletop entirely.

Hence, we cannot determine if the table cloth covers the entire tabletop. – Insufficient

The correct answer is Option E.

483. Let the width of the rectangle be x units.

Thus, the length of the rectangle = $(x + 1)$ units.

Hence, the perimeter = $2\,(x + (x + 1)) = (4x + 2)$ units.

From statement 1:

Diagonal of the rectangle = $\sqrt{x^2 + (x + 1)^2}$

Thus, we have

$\sqrt{x^2 + (x+1)^2} = 5$

$=> x^2 + (x+1)^2 = 25$

$=> 2x^2 + 2x - 24 = 0$

$=> x^2 + x - 12 = 0$

$=> (x+4)(x-3) = 0$

$=> x = 3$ or -4

However, the width cannot be negative.

Hence, $x = 3$

Thus, the perimeter = $4x + 2 = 14$ units. – Sufficient

From statement 2:

Area of the rectangle = $x(x+1)$ square units.

Thus, we have

$x(x+1) = 12$

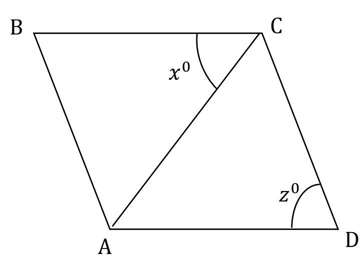
$=> x^2 + x - 12 = 0$

This is the same as the result obtained from statement 1. – Sufficient

The correct answer is Option D.

Alternately, we know that a triangle with sides 3, 4 and 5 is a right triangle. Here, the longest side (diagonal) is 5, thus, the sides should have been 3 and 4, which satisfies the condition that one side is 1 greater than the other.

484. We know that in a triangle, the longest side is opposite to the largest angle and the shortest side is opposite to the smallest angle.



From statement 1:

Since BC || AD, we have

$\angle BCA = \angle CAD = x^\circ = 50^\circ$ (alternate angles)

Thus, the sum of the other two angles in triangle ACD = $180^\circ - 50^\circ = 130^\circ$.

If AC has to be the shortest side, $\angle ADC = z$ must be the smallest angle.

However, since the other two angles in triangle ACD are not known, we can have:

(1) $\angle ACD = 20^\circ$, $\angle CDA = 110^\circ$
=> $\angle ACD$ is the smallest angle
=> AD is the shortest side
=> AC is not the shortest side.

(2) $\angle ACD = 110^\circ$, $\angle CDA = 20^\circ$
=> $\angle CDA$ is the smallest angle
=> AC is the shortest side.

Thus, we cannot uniquely determine whether AC is the shortest side of the triangle. – Insufficient

From statement 2:

We have

$\angle CDA = z^\circ = 70^\circ$

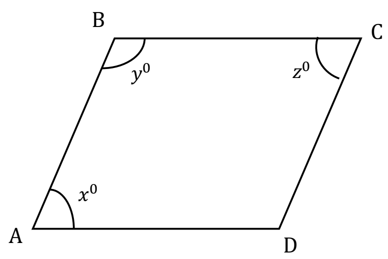
Thus, the sum of the other two angles in triangle ACD = $180^\circ - 70^\circ = 110^\circ$.

If AC is the shortest side, then $\angle CDA$ should be the smallest angle.
It follows that the other two angles of the triangle ACD must be more than 70°.
In such an event, the sum of those two angles should be more than 140°, which is not possible.

Thus, $\angle CDA$ is not the smallest angle
=> AC is not the shortest side. – Sufficient

The correct answer is Option B.

485. In the parallelogram below, we have



$x = z$; (angles at opposite vertices are equal) ... (i)

$\angle D = y$

$x + y = y + z = 180$; (angles at adjacent vertices are supplementary) ... (ii)

From statement 1:

We know:

$x = \frac{y}{3}$

$=> y = 3x$

Substituting the above value of y in (ii), we have

$x + y = 180$

$=> x + 3x = 180$

$=> x = 45$ – Sufficient

From statement 2:

We know:

$x + z = 90$

Using relation (i) along with the equation above, we have

$x = z = \frac{90}{2} = 45$ – Sufficient

The correct answer is Option D.

6.21 Co-ordinate geometry

486. The equation of a circle in the XY-plane with its centre at the origin is given by: $x^2 + y^2 = r^2$, where r is the radius of the circle and (x, y) are the coordinates of any point on the circle.

From statement 1:

$x^2 + y^2 = 5^2 = 25$.

Thus, sum of the squares of the coordinates of any point M on the circle is 25. – Sufficient

From statement 2:

$x + y = 7$
$=> (x + y)^2 = 49$
$=> x^2 + y^2 = 49 - 2xy$.

Since we do not know the values of xy, we cannot determine the answer. – Insufficient

The correct answer is Option A.

487. $y = mx + c$

We need to determine the slope of the above line i.e. the value of m.

From statement 1:

We know that:

$y = (1 - 2m)\,x + 2c$ and $y = mx + c$ are parallel.

Thus, their slope should be same.

Thus, we have

$(1 - 2m) = m$

$=> m = \frac{1}{3}$. – Sufficient

From statement 2:

We know that:

$y = mx + c$ and $y = 2x - 4$ intersect at (3, 2).

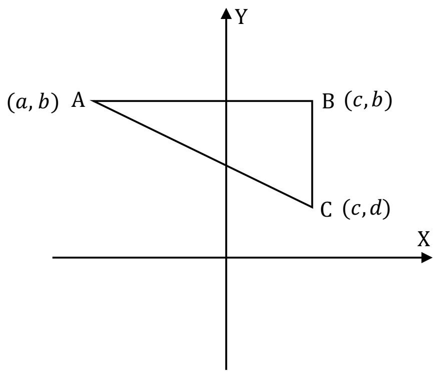
Substituting $x = 3$ & $y = 2$ in $y = mx + c$, we have

$2 = 3m + c$

Since there are two unknowns, we cannot determine the value of m. – Insufficient

The correct answer is Option A.

488. Let the coordinates of A be (a, b) and that of C be (c, d).



Thus, the coordinates of B = (c, b), since A and B have the same Y-coordinate (AT parallel to X-axis, also, C and B have the same X-coordinate (CB parallel to the Y-axis).

From statement 1:

We have $d = 2$.

However, we cannot determine the values of c or b. – Insufficient

From statement 2:

We have $a = -8$.

However, we cannot determine the values of c or b. – Insufficient

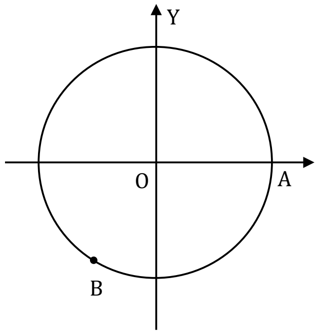
Thus, from statements 1 and 2 together:

We have $a = -8$, & $d = 2$.

However, we still cannot determine the values of c or b. – Insufficient

The correct answer is Option E.

489.



The equation of the above circle has its centre at the origin and point A lies on X-axis with its Y-coordinate being 0, its X-coordinate is the radius = 13.

$x^2 + y^2 = 13^2$

From statement 1:

Let the coordinates of point B be $(-5, a)$.

Since B is on the circle, it must satisfy the equation of the circle. Thus:

$(-5)^2 + a^2 = 13^2$

=> $a^2 = 169 - 25 = 144$

=> $a = \pm 12$

Thus, the length of AB = $\sqrt{(13-(-5))^2 + (0-a)^2}$

= $\sqrt{(13-(-5))^2 + (0-(\pm 12))^2}$

= $\sqrt{18^2 + 12^2}$

= $\sqrt{468}$ – Sufficient

From statement 2:

Let the coordinates of point B be $(b, -12)$.

Since B is on the circle, it must satisfy the equation of the circle. Thus:

$b^2 + (-12)^2 = 13^2$

=> $b^2 = 169 - 144 = 25$

=> $b = \pm 5$

Thus, the length of AB = $\sqrt{(13-(\pm 5))^2+(0-(-12))^2}$

$= \sqrt{(13 \mp 5)^2+(12)^2}$

$= \sqrt{8^2+12^2}$ OR $\sqrt{18^2+12^2}$

$= \sqrt{204}$ OR $\sqrt{468}$

Thus, there is no unique answer. – Insufficient

The correct answer is Option A.

490. The points (a, b) and (c, d) would be equidistant from the origin $(0,\ 0)$ if:

$\sqrt{(a-0)^2+(b-0)^2} = \sqrt{(c-0)^2+(d-0)^2}$

=> $a^2+b^2=c^2+d^2$; (this is the condition we need to verify).

From statement 1:

We have no information about c and d. – Insufficient

From statement 2:

We have

$c = 1-a$ and $d = 1-b$

=> $c^2+d^2=(1-a)^2+(1-b)^2$

$= 2+a^2+b^2-2(a+b)$

We do not know the value of $(a+b)$. – Insufficient

Thus, from statements 1 and 2 together:

$c^2+d^2 = 2+a^2+b^2-2\,(a+b)$

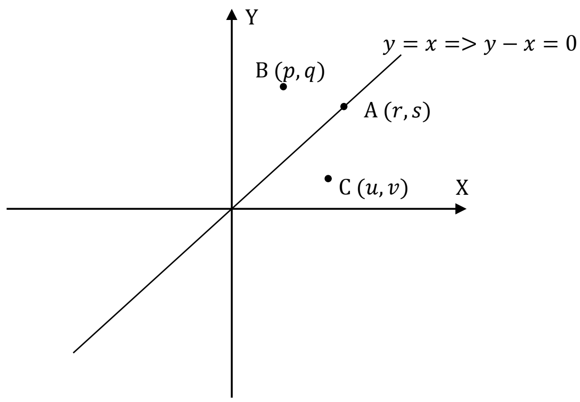
$= 2+a^2+b^2-2\times 2$ (since $a+b=2$)

$= a^2+b^2-2$

$\neq a^2+b^2$ – Sufficient

The correct answer is Option C.

491.



Let us refer to the figure above:

(1) For a point A on the line, it must satisfy the equation of the line. Thus, we have

$y - x = 0$
$=> s - r = 0$
$=> s = r$

(2) For a point B above the line, we have

$y - x > 0$ (it can be observed that the value of the Y-coordinate is greater than the value of the X-coordinate)
$=> q - p > 0$
$=> q > p$

(3) For a point C below the line, we have

$y - x < 0$ (it can be observed that the value of the Y-coordinate is smaller than the value of the X-coordinate)
$=> v - u < 0$
$=> v < u$

Thus, we need to determine which of the above cases is true.

From statement 1:

There is no information about b. – Insufficient

From statement 2:

We have

$n = m + 4$

=> $m - n = 4$

=> $m - n > 0$ (i.e. it satisfies $y - x > 0$)

=> The point is not below but above the line $y = x$ – Sufficient

The correct answer is Option B.

492. Form statement 1:

Slope of the line joining $(1,\ 1)$ and $(-2,\ 5)$

$= \frac{5-1}{-2-1}$

$= -\frac{4}{3}$

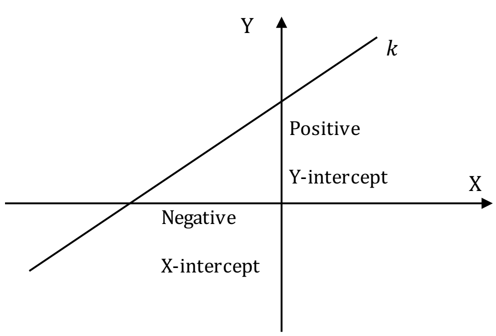
Since the line k is perpendicular to the above line, product of slopes of the above line and the slope of the line k is -1.

Thus, slope of line $k = \frac{3}{4}$

Thus, the line k has a positive slope. – Sufficient

From statement 2:

It is clear that the line must be oriented as shown in the diagram below:



If a line is increasing towards right hand side, the slope is positive.

If line is parallel to x- axis, the slope is 0.

And, if the line is decreasing towards the right hand side, the slope is negative.

Thus, we see that the line k has a positive slope. – Sufficient

The correct answer is Option D.

493. From statement 1:

We have no information about the value of the slope of line n. – Insufficient

From statement 2:

We have no information about line m. – Insufficient

Thus, from statements 1 and 2 together:

We can see that line n passes through the points $(0,0)$ and $(-5,4)$.

Thus, slope of line $n = \left(\frac{4-0}{-5-0}\right) = -\frac{4}{5}$.

Since the product of the slopes of lines m and n is -1, slope of line $m = -\left(\frac{1}{-\frac{4}{5}}\right) = \frac{5}{4}$. – Sufficient

The correct answer is Option C.

494. If a line intersects the X-axis at $(p,0)$ and the Y-axis at $(0,q)$, the slope of the line $= \frac{q-0}{0-p}$

$= -\frac{q}{p}$

$= -\left(\frac{\text{Y intercept}}{\text{X intercept}}\right)$

Let line K intersect the X-axis and Y-axis at points $(m,0)$ and $(0,n)$ respectively.

We need to determine the value of n.

From statement 1:

Slope of line L

$= -\left(\frac{-1}{-1}\right) = -1$

Since lines L and K are parallel, slope of line K is -1.

Thus, for line K, we have

$-\left(\frac{n}{m}\right) = -1$

$=> n = m$.

We cannot determine the value of n since m is not known. – Insufficient

From statement 2:

We see that line K passes through the point $(5,\ 10)$ and the points $(m, 0)$ and $(0, n)$ as assumed earlier.

We cannot determine the value of n, since we do not know the slope of line K. – Insufficient

Thus, from statements 1 and 2 together:

We see that line K passes through the point $(5,\ 10)$ and the point $(0, n)$ and has a slope of -1.

Thus, we have

Slope $= \frac{10 - n}{5 - 0} = -1$

$=> 10 - n = -5$

$=> n = 15$ – Sufficient

The correct answer is Option C.

495. The equation of a circle with centre at the origin and radius c is given by:
$x^2 + y^2 = c^2$

Since (a, b) lies on the circle, it must satisfy the equation of the circle.

Thus, we have
$a^2 + b^2 = c^2$

From statement 1:

$c = 5$

$=> a^2 + b^2 = c^2 = 25$ – Sufficient

From statement 2:

Since the point $(3, -4)$ lies on the circle, it must satisfy the equation of the circle.

Thus, we have

$(3)^2 + (-4)^2 = c^2$

$=> 9 + 16 = c^2$

$=> c^2 = 25$

=> $a^2 + b^2 = 25$ – Sufficient

The correct answer is Option D.

496. The point (r, s) would lie in region X if it satisfies the condition: $3x + 4y \leq 12$.

Thus, we have

$3r + 4s \leq 12 \ldots$(i)

From statement 1:

We have

$4r + 3s = 12$

=> $(3r + 4s) + (r - s) = 12$

=> $3r + 4s = 12 + (s - r) \ldots$(ii)

Comparing (i) and (ii), we have

$12 + (s - r) \leq 12$

=> $s - r \leq 0$

=> $s \leq r$

Thus, the point (r, s) would lie in region X if $s \leq r$

However, such a condition has not been stated in the problem.

Hence, the answer cannot be determined. – Insufficient

From statement 2:

We have

$r \leq 4$

=> $3r \leq 12 \ldots$(iii), and

$s \leq 3$

=> $4s \leq 12 \ldots$(iv)

Thus, from (iii) and (iv):

$3r + 4s \leq 12 + 12$

$=> 3r + 4s \leq 24 \ldots$(v)

If $3r + 4s \leq 12$, the answer is yes.

However, if $12 < 3r + 4s \leq 24$, the answer is no.

Thus, the answer cannot be uniquely determined. – Insufficient

Thus, from statements 1 and 2 together:

We have from statement 2:

$r \leq 4$, and $s \leq 3$

We also have from statement 1:

$4r + 3s = 12$

We cannot determine the value of $(4r + 3s)$ from the above two relations. – Insufficient

The correct answer is Option E.

Alternate approach 1:

Let us try with some values:

Statement 1:

$4r + 3s = 12$:

(1) $r = 3,\ s = 0$: the inequality $3x + 4y \equiv 3r + 4s = 9 \leq 12$ – Satisfies

(2) $r = 1,\ s = \frac{8}{3}$: the inequality $3x + 4y \equiv 3r + 4s = 3 \times 1 + 4 \times \frac{8}{3} = \frac{41}{3} = 13.67 \nleq 12$ – Does not satisfy

Thus, statement 1 is not sufficient.

Statement 2:

$r \leq 4,\ s \leq 3$:

(1) $r = 3,\ s = 0$: the inequality $3x + 4y \equiv 3r + 4s = 9 \leq 12$ – Satisfies

(2) $r = 1,\ s = \frac{8}{3}$: the inequality $3x + 4y \equiv 3r + 4s = 3 \times 1 + 4 \times \frac{8}{3} = \frac{41}{3} = 13.67 \nleq 12$ – Does not satisfy

Thus, statement 2 is not sufficient.

Combining statements 1 and 2:

We can still have the same above values of r and s.

Thus, even combining the statements is not sufficient.

Alternate approach 2:

From statement 1:

$4r + 3s = 12 \Rightarrow r = \frac{(12 - 3s)}{4} = 3 - \frac{3s}{4}$

Thus, $3r + 4s \le 12 = 3\left(3 - \frac{3s}{4}\right) + 4s \le 12$

$\Rightarrow 9 - \frac{9s}{4} + 4s \le 12$

$\Rightarrow \frac{5s}{4} \le 3$

$\Rightarrow s \le \frac{12}{5} \Rightarrow s \le 2.4$

However, Statement 2 states that $s \le 3$, which is not sufficient to conclude whether $3r + 4s \le 12$ (since s can take a value, say, 2.5 which doesn't satisfy the required condition of $s \le 2.4$.)

497. From statement 1:

Slope of the line l passing through $(0,\ 0)$ and (m, n) is:

Slope $= \frac{n - 0}{m - 0} = \frac{n}{m}$

Thus, we have

$\frac{n}{m} < 0$

Thus, the possible cases are:

(a) $m > 0$ and $n < 0$

OR

(b) $m < 0$ and $n > 0$

Thus, there is no unique answer. – Insufficient

From statement 2:

We know that: $m < n$

However, it is not sufficient to determine the answer, whether $n > 0$. – Insufficient

Thus, from statements 1 and 2 together:

From statement 1, we had:

(a) $m > 0$ and $n < 0$ => $m > n$ – Does not satisfy the condition of statement 2

(b) $m < 0$ and $n > 0$ => $m < n$ – Satisfies the condition of statement 2

Thus, combining the statements, we can conclude that: $m > 0$. – Sufficient

The correct answer is Option C.

498. $ax + by + c = 0$

=> $by = -ax - c$

=> $y = \left(-\frac{a}{b}\right)x - \frac{c}{b}$

=> The slope of the line = $\left(-\frac{a}{b}\right)$

=> $-\frac{a}{b} = -3$

=> $b = \frac{a}{3}$

From statement 1:

$a = 2$

=> $b = \frac{2}{3}$ – Sufficient

From statement 2:

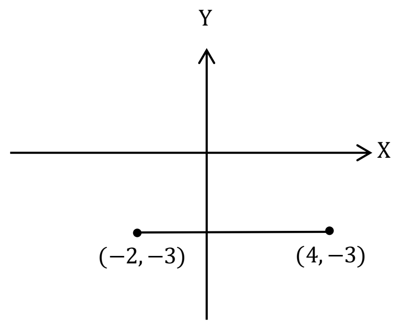
The value of c cannot be used to determine the value of b, as we are not aware of the value of the Y-intercept.

If Y-intercept would have been given it would be $-\frac{c}{b}$, and then we would have been able to find the value of b. – Insufficient

The correct answer is Option A.

499. From statement 1:

The figure depicting the two vertices of the rectangle $(-2, -3)$ and $(4, -3)$ is shown below:



Thus, we know that the length of the rectangle is the difference between the X values of the coordinates of the two points (since the length is parallel to the X axis).

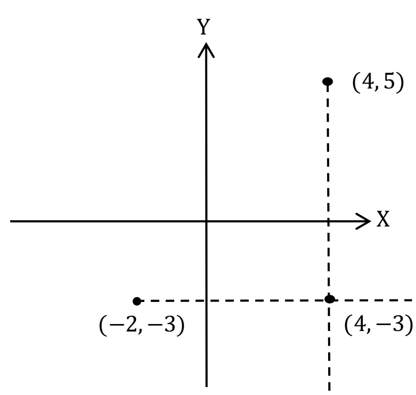
Thus, the length of the rectangle

$= 4 - (-2) = 6$

However, we do not know the width of the rectangle and hence, the area cannot be determined. – Insufficient

From statement 2:

The figure depicting the two vertices of the rectangle $(-2, -3)$ and $(4, 5)$ is shown below:



Since the length and width of the rectangle are parallel to the X and Y axes, the dotted lines shown in the figure above must denote the length and width of the rectangle.

Thus, the third vertex must be the point of intersection of the dotted lines i.e. $(4, -3)$.

Thus, we know that the length of the rectangle is the difference between the X values of the coordinates of the two points: $(-2, -3)$ and $(4, -3)$ (since the length is parallel to the X axis).

Thus, the length of the rectangle

$= 4 - (-2) = 6$

Also, the width of the rectangle is the difference between the Y values of the coordinates of the two points: $(4, 5)$ and $(4, -3)$ (since the width is parallel to the Y axis).

Thus, the width of the rectangle

$= 5 - (-3) = 8$

Thus, the area of the rectangle

$= 6 \times 8 = 48$ – Sufficient

The correct answer is Option B.

500. From statement 1:

Since line m s parallel to the line $y = 1 - x$, their slopes are equal.

We have

$y = -x + 1$

=> Slope of the line is -1.

Thus, slope of line m is -1. – Sufficient

From statement 2:

Since the line m is perpendicular to the line $y = x + 1$, the product of their slope = -1.

We have

$y = x + 1$

=> Slope of the line is 1.

Thus, slope of line m is $\frac{-1}{1} = -1$. – Sufficient

The correct answer is Option D.

Chapter 7

Talk to Us

Have a Question?

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Please mention the page number when quoting from the book.

Best of luck!

Professor Dr. Joern Meissner
& The Manhattan Review Team

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Manhattan Review's origin can be traced directly back to an Ivy League MBA classroom in 1999. While teaching advanced quantitative subjects to MBAs at Columbia Business School in New York City, Professor Dr. Joern Meissner developed a reputation for explaining complicated concepts in an understandable way. Remembering their own less-than-optimal experiences preparing for the GMAT, Prof. Meissner's students challenged him to assist their friends, who were frustrated with conventional GMAT preparation options. In response, Prof. Meissner created original lectures that focused on presenting GMAT content in a simplified and intelligible manner, a method vastly different from the voluminous memorization and so-called tricks commonly offered by others. The new approach immediately proved highly popular with GMAT students, inspiring the birth of Manhattan Review.

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Professor Dr. Joern Meissner has more than 25 years of teaching experience at the graduate and undergraduate levels. He is the founder of Manhattan Review, a worldwide leader in test prep services, and he created the original lectures for its first GMAT preparation classes. Prof. Meissner is a graduate of Columbia Business School in New York City, where he received a PhD in Management Science. He has since served on the faculties of prestigious business schools in the United Kingdom and Germany. He is a recognized authority in the areas of supply chain management, logistics, and pricing strategy. Prof. Meissner thoroughly enjoys his research, but he believes that grasping an idea is only half of the fun. Conveying knowledge to others is even more fulfilling. This philosophy was crucial to the establishment of Manhattan Review, and remains its most cherished principle.

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