Annexure : Logarithm

Let us consider

(i) $10 = 10^1$, $100 = 10^2$, $1000 = 10^3$ etc.

This can be also written as

$\log_{10} 10 = 1$, $\log_{10} 100 = 2$, $\log_{10} 1000 = 3$ etc.

(ii) $8 = 2^3$, $16 = 2^4$, $32 = 2^5$ etc.

This can be also written as

$\log_2 8 = 3$, $\log_2 16 = 4$, $\log_2 32 = 5$ etc.

(iii) $49 = 7^2$, $343 = 7^3$ etc.

This can be also written as

$\log_7 49 = 2$, $\log_7 343 = 3$ etc.

(iv) $1/8 = (2)^{-3}$, $1/16 = (2)^{-4}$ etc.

This can be also written as

$\log_2 (1/8) = -3$, $\log_2 (1/16) = -4$ etc.

(v) $0.01 = (10)^{-2}$, $0.001 = (10)^{-3}$ etc.

This can be also written as

$\log_{10} (0.01) = -2$, $\log_{10} 0.001 = -3$ etc.

Here logarithm is written as log in short.

$\log_a x$ is read as logarith of x on base a.

Here x is always a positive number but the base 'a' is a positive number not equal to 1.

DEFINITION OF LOGARITHM

Logarithm of any positive number b ($= a^x$) to a given base 'a' (a positive number not equal to 1) is the index (or power) 'x' of the base which is equal to that number b.

Thus if $b = a^x$, where 'b' is a +ve number and 'a' is a +ve number but not equal to 1, then $\log_a b = x$

Clearly, $\log_a a = 1$

Also, $16 = 2^4$ or 4^2

$\therefore$ $\log_2 16 = 4$ and $\log_4 16 = 2$

$\therefore$ $\log_2 16 \neq \log_4 16$

Hence value of logarithm of a positive quantity depends upon the base of the log.

If base of the log is not mentioned, then it is taken as 10. Hence $\log 10 = \log_{10} 10 = 1$

LAWS OF LOGARITHM

(i) $\log_b (m \times n) = \log_b m + \log_b n$

For example : $\log (4 \times 5) = \log 4 + \log 5$

(ii) $\log_b \left(\dfrac{m}{n}\right) = \log_b m - \log_b n$

For example : $\log \dfrac{8}{15} = \log 8 - \log 15$

(iii) $\log_b (m)^n = n \log_b m$

For example : $\log (5)^4 = 4 \log 5$

(iv) $\log_b a = \dfrac{\log_c a}{\log_c b}$ **[Change of base rule]**

If $a = c$, then $\log_b a = \log_b a = \dfrac{\log_a a}{\log_a b} = \dfrac{1}{\log_a b}$

for example :

(1) $\log_4 64 = \dfrac{\log_2 64}{\log_2 4}$

(2) $\log_4 64 = \dfrac{1}{\log_{64} 4}$

(v) $\log_b a \log_c b = \log_c a$ **[Chain Rule]**

For example : $\log_4 64 \times \log_2 4 = \log_2 64$

Illustration 1 : If 5 log 3 + log x = 5 log 2, then find the value of x.

Solution : $5 \log 3 + \log x = 5 \log 2$

$\Rightarrow \log x = 5 \log 2 - 5 \log 3$

$= \log (2)^5 - \log (3)^5$ [$\because \log (m)^n = n \log m$]

$= \log 32 - \log 243$

$= \log \dfrac{32}{243}$ [$\because \log \dfrac{m}{n} = \log m - \log n$]

$\therefore \quad x = \dfrac{32}{243}$

Illustration 2 : Find the value of $\dfrac{2 - \log_{10}(10)^3}{\log_6 6}$.

Solution : $\dfrac{2 - \log_{10}(10)^3}{\log_6 6} = \dfrac{2 - 3\log_{10} 10}{1}$ [$\because \log (m)n = n \log m$]

$=$ [$\log_a a = 1$]

$= -1$

Illustration 3 : If 2 log x + 2 log$y$ = k and log xy = 2, then find the value of k.

Solution : $2 \log x + 2 \log y = k$

$\Rightarrow \quad 2 (\log x + \log y) = k$

$\Rightarrow \quad 2 \log (xy) = k$ [$\because \log(m \times n) = \log m + \log n$]

$\Rightarrow \quad 2 \times 2 = k$ [$\because \log xy = 2$]

$\therefore \quad k = 4$

Illustration 4 : Find the value of $\log_y x \times \log_z y \times \log_x z$

Solution : $\log_y x \times \log_z y \times \log_x z = \log_x z$

$= \log_x x$ [Chain Rule]

$= 1$

Illustration 5 : Prove that log 5040 = 4 log 2 + 2 log 3 + log 5 + log 7

Solution : RHS = 4 log 2 + 2 log 3 + log 5 + log 7

$= \log (2)^4 + \log (3)^2 + \log 5 + \log 7$

$= \log 16 + \log 9 + \log 5 + \log 7$

$= \log (16 \times 9 \times 5 \times 7)$

$= \log 5040$

= LHS

Illustration 6 : Evaluate $3 - \log_{10} 1000$.

Solution : $3 - \log_{10} 1000 = 3 - \log_{10} (10)3$

$= 3 - 3 \log_{10} 10$

$= 3 - 3 \times 1 = 0$ $[\because \log_{10} 10 = 1]$

$= 0$

Illustration 7 : Find the value of $\log_{\sqrt{2}} 16$

Solution : $= \log_{\sqrt{2}} 16 = \log_{\sqrt{2}} (2)^4 = \log_{\sqrt{2}} (\sqrt{2})^8$

$= 8 \log_{\sqrt{2}} \sqrt{2}$

$= 8 \times 1 = 8$

Illustration 8 : If $x^2 + y^2 = 25xy$, then prove that $2 \log (x + y) = 3 \log 3 + \log x + \log y$

Solution : LHS $= 2 \log (x + y)$

$= \log (x + y)^2$

$= \log (x^2 + y^2 + 2xy)$

$= \log (25xy + 2xy)$

$= \log (27xy)$

$= \log (3^3 \times x \times y)$

$= \log (3)^3 + \log x + \log y$

$= 3 \log 3 + \log x + \log y$

= RHS

EXEMPLAR PROBLEMS IN MATHEMATICS

1. What is the remainder when 4^{96} is divided by 6?
(1) 0 (2) 2 (3) 3 (4) 4

2. A boy had to divide 49471 by 210. He made a mistake in copying the divisor and obtained his quotient as 246 with a remainder 25. What divisor did the boy copy?
(1) 310 (2) 201 (3) 102 (4) 120

3. Find the unit's digit in the product $(2467)^{153} \times (341)^{72}$.
(1) 6 (2) 7 (3) 8 (4) 9

4. A number when divided successively by 4 and 5 leaves remainder 1 and 4 respectively. When it is successively divided by 5 and 4, then the respective remainders will be:
(1) 1, 2 (2) 2, 3 (3) 3, 2 (4) 4, 1

5. What is the sum of all two-digit numbers that give a remainder of 3 when they are divided by 7?
(1) 666 (2) 676 (3) 683 (4) 777

6. The digit in the unit's place of the number represented by $(7^{95} - 3^{58})$ is:
(1) 0 (2) 4 (3) 6 (4) 7

DIRECTIONS (Qs. 7 & 8) : Read the information given below and answer the questions that follow :

A salesman enters the quantity sold and the price into the computer. Both the numbers are two-digit numbers. Once, by mistake, both the numbers were entered with their digits interchanged. The total sales value remained the same, i.e. Rs 1148, but the inventory reduced by 54.

7. What is the actual price per piece ?
(1) 82 (2) 41 (3) 56 (4) 28

8. What is the actual quantity sold ?
(1) 28 (2) 14 (3) 82 (4) 41

9. The LCM and HCF of two numbers are 84 and 21, respectively. If the ratio of two numbers be 1 : 4, then the larger of the two numbers is :
(1) 21 (2) 48 (3) 84 (4) 108

10. If $\sqrt{5} = 2.236$, then the value of $\frac{\sqrt{5}}{2} - \frac{10}{\sqrt{5}} + \sqrt{125}$ is equal to
(1) 7.826 (2) 8.944 (3) 5.59 (4) 10.062

11. If $a = \left(\frac{1}{10}\right)^2$, $b = \frac{1}{5}$ and $c = \sqrt{\frac{1}{100}}$, then which of the following statements is correct ?
(1) $a < b < c$ (2) $a < c < b$
(3) $b < c < a$ (4) $c < a < b$

12. In the following number series there is a wrong number. Find out that number.
56, 72, 90, 108, 132
(1) 72 (2) 132
(3) 108 (4) None of these

13. A piece of cloth costs Rs 35. If the length of the piece would have been 4 m longer and each metre costs Re 1 less, the cost would have remained unchanged. How long is the piece?
(1) 12m (2) 10m (3) 8m (4) 9m

14. Students of a class are preparing for a drill and are made to stands in a row. If 4 students are extra in a row, then there would be 2 rows less. But there would be 4 more rows if 4 students are less in a row. The number of students in the class is :
(1) 96 (2) 56 (3) 69 (4) 65

15. Four bells begin to toll together and toll respectively at intervals of 6, 5, 7, 10 and 12 seconds. How many times they will toll together in one hour excluding the one at the start ?
(1) 7 times (2) 8 times (3) 9 times (4) 11 times

16. If $x + y > 5$ and $x - y > 3$, then which of the following gives all possible values of x ?
(1) $x>3$ (2) $x>4$ (3) $x>5$ (4) $x<5$

17. Which of the following integers is the square of an integer for every integer n ?
(1) $n^2 + 1$ (2) $n^2 + n$
(3) $n^2 + 2n$ (4) $n^2 + 2n + 1$

18. The number $6n^2 + 6n$, for any natural number n, is always divisible by :
(1) 6 only (2) 18 only (3) 12 only (4) 6 and 12

19. A bus starts from city X. The number of women in the bus is half of the number of men. In city Y, 10 men leave the bus and five women enter. Now, the number of men and women is equal. In the beginning, how many passengers entered the bus?
(1) 15 (2) 30 (3) 36 (4) 45

20. A number of friends decided to go on a picnic and planned to spend Rs. 96 on eatables. Four of them, did not turn up. As a consequence, the remaining ones had to contribute Rs. 4 each extra. The number of those who attended the picnic was ?
(1) 8 (2) 16 (3) 12 (4) 24

21. If m and n are natural numbers such that $2^m - 2^n = 960$, what is the value of m ?
(1) 10 (2) 12
(3) 16 (4) cannot be determined

22. Ram's age was square of a number last year and it will be cube of a number next year. How long must he wait before his age is again the cube of a number ?
(1) 10 years (2) 39 years (3) 38 years (4) 64 years

23. At the first stop on his route, a driver uploaded 2/5 of the packages in his van. After he uploaded another three packages at his next stop, 1/2 of the original number of packages remained. How many packages were in the van before the first delivery?
(1) 25 (2) 10 (3) 30 (4) 36

24. Lucknow Shatabdi Express has a capacity of 500 seats of which 10% are in the Executive class and the rest are chair cars. During one journey, the train was booked to 85% of its capacity. If Executive class was booked to 96% of its capacity, then how many chair car seats were empty during that journey?
(1) 78 (2) 73 (3) 72 (4) None of these

25. How much water must be added to 48 ml of alcohol to make a solution that contains 25% alcohol ?
(1) 24ml (2) 72ml (3) 144ml (4) 196ml

26. Of the 1000 inhabitants of a town, 60% are males of whom 20% are literates. If, of all the inhabitants, 25% are literates, then what % of the females of the town are literates ?
(1) 22.5 (2) 27.5 (3) 32.5 (4) 35.5

27. A number is increased by 10% and then reduced by 10%. After these operations, the number :
(1) does not change (2) decreases by 1%
(3) increases by 1% (4) increases by 0.1%

28. Village A has a population of 6800, which is decreasing at the rate of 120 per year. Village B has a population of 4200, which is increasing at the rate of 80 per year. In how many years will the population of the two villages will become equal ?
(1) 9 (2) 11 (3) 13 (4) 16

29. Sumit lent some money to Mohit at 5% per annum simple interest. Mohit lent the entire amount to Birju on the same day at $8\frac{1}{2}$% per annum simple interest. In this transaction, after a year, Mohit earned a profit of Rs 350. Find the sum of money lent by Sumit to Mohit.
(1) Rs 10,000 (2) Rs 9,000
(3) Rs 10,200 (4) None of these

30. In a company, there are 75% skilled workers and remaining ones are unskilled. 80% of skilled workers and 20% of unskilled workers are permanent. If number of temporary workers is 126, then what is the number of total workers ?
(1) 480 (2) 510 (3) 360 (4) 377

31. Two friends A and B jointly lent out Rs. 81,600 at 4% per annum compound interest. After 2 years A gets the same amount as B gets after 3 years. The investment made by B was
(1) Rs. 40,000 (2) Rs. 30,000 (3) Rs. 45,000 (4) Rs. 38,000

32. Mira's expenditure and savings are in the ratio 3 : 2. Her income increases by 10%. Her expenditure also increases by 12%. By how much % do her savings increase?
(1) 7% (2) 9% (3) 10% (4) 13%

33. A 4 cm cube is cut into 1 cm cubes. Find the percentage decrease in surface area.
(1) 200% (2) 94% (3) 400% (4) 300%

34. A loss of 19% gets converted into a profit of 17% when the selling price is increased by Rs 162. Find the cost price of the article.
(1) Rs 450 (2) Rs 600 (3) Rs 460 (4) Rs 580

35. A shopkeeper allows a discount of 10% on the goods. For cash payments, he further allows a discount of 20%. How much single discount will be equivalent to this offer.
(1) 30% (2) 18% (3) 28% (4) 10%

36. At what percentage above the cost price must an article be marked so as to gain 33% after allowing the customer a discount of 5% ?
(1) 48% (2) 43% (3) 40% (4) 38%

37. Raman goes to a shop to buy a radio costing Rs 2568. The rate of sales tax is 7%. He tells the shopkeeper to reduce the price of the radio to such an extent that he has to pay Rs 2568, inclusive of sales tax. How much reduction is needed in the price of the radio.
(1) Rs 179.76 (2) Rs 170
(3) Rs 168 (4) Rs 169

38. Two motor cars were sold for Rs 9,900 each, gaining 10% on one and losing 10% on the other. The gain or loss percent in the whole transaction is :
(1) Neither loss no gain (2) $\frac{1}{99}$% gain
(3) $\frac{100}{99}$% profit (4) 1% loss

39. The retail price of a water geyser is Rs 1265. If the manufacturer gains 10%, the wholesale dealer gains 15% and the retailer gains 25%, then the cost of the geyser is :
(1) Rs 800 (2) Rs 900 (3) Rs 550 (4) Rs 650

40. A man sells an article at 5% profit. If he had bought it at 5% less and sold it for Re 1 less, he would have gained 10%. The cost price of the article is :
(1) Rs 200 (2) Rs 150 (3) Rs 240 (4) Rs 280

41. A company blends two varieties of tea from two different tea gardens, one variety costing Rs 20 per kg and other Rs 25 per kg, in the ratio 5 : 4. He sells the blended tea at Rs 23 per kg. Find his profit per cent :
(1) 5% profit (2) 3.5% loss
(3) 3.5% profit (4) No profit, no loss

42. An alloy contains copper and zinc in the ratio 5 : 3 and another alloy contains copper and tin in the ratio 8 : 5. If equal weights of both the alloys are melted together, then the weight of tin in the resulting alloy per unit will be:
(1) $\frac{26}{5}$ (2) $\frac{5}{26}$ (3) $\frac{7}{40}$ (4) $\frac{40}{7}$

43. The average weight of 45 students in a class is 52 kg. 5 of them whose average weight is 48 kg leave the class and other 5 students whose average weight is 54 kg join the class. What is the new average weight (in kg) of the class ?
(1) 52.6 (2) $52\frac{2}{3}$
(3) $52\frac{1}{3}$ (4) None of these

44. The sum of three numbers is 98. If the ratio of the first to the second is 2 : 3 and that of the second to the third is 5 : 8, then the second number is :
(1) 20 (2) 30 (3) 38 (4) 48

45. In three numbers, the first is twice the second and thrice the third. If the average of these three numbers is 44, then the first number is :
(1) 72 (2) 24 (3) 36 (4) 44

46. Tea worth Rs 126 per kg and Rs 135 per kg are mixed with a third variety in the ratio 1 : 1 : 2. If the mixture is worth Rs 153 per kg, then the price of the third variety per kg is:
(1) Rs 169.50 (2) Rs 170
(3) Rs 175.50 (4) Rs 180

47. The monthly income of two persons are in the ratio of 4 : 5 and their monthly expenditures are in the ratio of 7 : 9. If each saves Rs 50 a month, then what are their monthly incomes ?
(1) Rs 100, Rs 125 (2) Rs 200, Rs 250
(3) Rs 300, Rs 375 (4) Rs 400, Rs 500

48. The average of 11 numbers is 10.9. If the average of the first six numbers is 10.5 and that of the last six numbers is 11.4, then the middle number is :
(1) 11.5 (2) 11.4 (3) 11.3 (4) 11.0

49. After doing 3/5 of the Biology homework on Monday night, Sanjay did 1/3 of the remaining homework on Tuesday night. What fraction of the original homework would Sanjay have to do on Wednesday night to complete the Biology assignment ?
(1) 1/15 (2) 2/15 (3) 4/15 (4) 2/5

50. An iron cube of size 10 cm is hammered into a rectangular sheet of thickness 0.5 cm. If the sides of the sheet be in the ratio 1 : 5, then the sides are
(1) 20 cm, 100 cm (2) 10 cm, 50 cm
(3) 40 cm, 200 cm (4) None of these

51. Fresh grapes contain 80 per cent water while dry grapes contain 10 per cent water. If the weight of dry grapes is 250 kg then what was its total weight when it was fresh ?
(1) 1000 kg (2) 1125 kg (3) 1225 kg (4) 1100 kg

52. The average of marks obtained by 120 candidates was 35. If the average of the passed candidates was 39 and that of the failed candidates was 15, then the number of those candidates who passed the examination, was
(1) 120 (2) 110 (3) 100 (4) 150

53. Robin says, "If Jai gives me Rs 40, he will have half as much as Atul, but if Atul gives me Rs 40, then the three of us will all have the same amount." What is the total amount of money that Robin, Jai and Atul have between them?
(1) Rs 240 (2) Rs 320 (3) Rs 360 (4) Rs 420

54. Sonu is 4 years younger to Manu while Dolly is four years younger to Sumit but 1/5 times as old as Sonu. If Sumit is eight years old, how many times as old is Manu as Dolly?
(1) 3 (2) 2 (3) 1/2 (4) 1

55. A student rides on a bicycle at 8 km/h and reaches his school 2.5 minutes late. The next day he increases his speed to 10 km/h and reaches the school 5 minutes early. How far is the school from his house?
(1) 1.25 km (2) 8 km (3) 5 km (4) 10 km

56. Two cyclists start on a circular track from a given point but in same directions with speeds of 7 m/s and 8 m/s, respectively. If the circumference of the circle is 300 metres, after what time will they be together at the starting point again ?
(1) 20 s (2) 100 s (3) 300 s (4) 30 s

57. A clock gains 15 minutes per day. It is set right at 12 noon. What time will it show at 4.00 am, the next day?
(1) 4 : 10 am (2) 4 : 45 am (3) 4 : 20 am (4) 5 : 00 am

58. A tap can fill a cistern in 8 hours and another tap can empty it in 16 hours. If both the taps are opened simultaneously, the time taken (in hours) to fill the cistern will be :
(1) 8 (2) 10 (3) 16 (4) 24

59. Two trains each of 120 m in length, run in opposite directions with a velocity of 40 m/s and 20 m/s respectively. How long will it take for the tail ends of the two trains to meet each other during the course of their journey ?
(1) 20 s (2) 3 s (3) 4 s (4) 5 s

60. Two trains starting at the same time from two stations, 200 km apart and going in opposite directions, cross each other at a distance of 110 km from one of them. What is the ratio of their speeds ?
(1) 11 : 20 (2) 9 : 20 (3) 11 : 9 (4) 19 : 20

61. Ramesh is twice as good a workman as Sunil and finishes a piece of work in 3 hours less than Sunil. In how many hours they together could finish the same piece of work ?
(1) $2\frac{1}{3}$ (2) 2
(3) $1\frac{2}{3}$ (4) None of these

62. A certain job was assigned to a group of men to do it in 20 days. But 12 men did not turn up for the job and the remaining men did the job in 32 days. The original number of men in the group was :
(1) 32 (2) 34 (3) 36 (4) 40

63. Walking at $\frac{3}{4}$ of his usual, a man reaches, his office 20 minutes late. Find the usual time taken to reach the office.
(1) 2 h (2) 1 h (3) 3 h (4) 4 h

64. A cistern is filled up in 5 hours and it takes 6 hours when there is a leak in its bottom. If the cistern is full, in what time shall the leak empty it ?
(1) 6 h (2) 5 h (3) 30 h (4) 15 h

65. If 600 men dig a 5.5 m wide, 4 m deep and 405 m long canal in half an hour, then how long a canal will 2500 men working for 6 hrs, dig if it is 10 m wide and 8 m deep ?
(1) 6452 m (2) $5568\frac{3}{4}$ m
(3) $2694\frac{1}{3}$ m (4) 4082 m

66. A passenger train takes two hours less for a journey of 300 km if its speed is increased by 5 km/h from its normal speed. The normal speed of the train is :
(1) 35 km/h (2) 50 km/h (3) 25 km/h (4) 30 km/h

67. A train 100 m long passes a bridge at the rate of 72 km/h per hour in 25 seconds. The length of the bridge is :
(1) 150 m (2) 400 m (3) 300 m (4) 200 m

68. A train travels 20% faster than a car. Both start from the same point A at the same time and reach the point B, 75 km away from A at the same time. On the way, however the train lost about 12.5 minutes while stopping at the stations. The speed of the car is :
(1) 50 km/h (2) 55 km/h (3) 60 km/h (4) 65 km/h

69. A starts 3 min after B for a place 4.5 km away. B on reaching his destination, immediately returns back and after walking a km meets A. If A walks 1 km in 18 minutes then what is B's speed ?
(1) 5 km/h (2) 4 km/h (3) 6 km/h (4) 3.5 km/h

70. $\frac{1}{3}$rd of the contents of a container evaporated on the first day. $\frac{3}{4}$th of the remaining evaporated on the second day. What part of the contents of the container is left at the end of the second day?
(1) $\frac{1}{4}$ (2) $\frac{1}{2}$ (3) $\frac{1}{18}$ (4) $\frac{1}{6}$

71. Two trains of equal lengths are running on parallel tracks in the same direction at 46 km/h and 36 km/h, respectively. The faster train passes the slower train in 36 sec. The length of each train is :
(1) 50 m (2) 80 m (3) 72 m (4) 82 m

72. Excluding stoppages, the speed of a train is 45 km/h and including stoppages, it is 36 km/h. For how many minutes does the train stop per hour ?
(1) 10 min. (2) 12 min. (3) 15 min. (4) 18 min.

73. At Srinagar, starting at 9 a.m. on a certain day, snow began to fall at the rate of $1\frac{1}{4}$ inches every two hours until 3 p.m. If there was already $2\frac{1}{4}$ inches of snow on the ground at 9 am., then how many inches of snow was on the ground at 3 p.m. that day ?
(1) $3\frac{3}{4}$ (2) 6 (3) 7 (4) $7\frac{1}{2}$

74. A sailor can row a boat 8 km downstream and return back to the starting point in 1 hour 40 minutes. If the speed of the stream is 2 km/h, then the speed of the boat in still water is:
(1) 5 km/h (2) 10 km/h (3) 15 km/h (4) 20 km/h

75. A fast train takes 3 hours less than a slow train for a journey of 600 km. If the speed of the slow train is 10 km/hr less than that of the fast train, then the speeds of the two trains are:
(1) 60 km/hr and 70 km/hr (2) 50 km/hr and 60 km/hr
(3) 40 km/hr and 50 km/hr (4) 30 km/hr and 40 km/hr

76. A ship, 40 km from the shore, springs a leak which admits $3\frac{3}{4}$ tonnes of water in 12 min. 60 tonnes would suffice to sink her, but the ship's pumps can throw out 12 tonnes of water in one hour. Find the average rate of sailing, so that it may reach the shore just as it begins to sink.
(1) $1\frac{1}{2}$ km/h (2) $2\frac{1}{2}$ km/h
(3) $3\frac{1}{2}$ km/h (4) $4\frac{1}{2}$ km/h

77. A man sitting in a train travelling at the rate of 50 km/hr observes that it takes 9 sec for a goods train travelling in the opposite direction to pass him. If the goods train is 187.5 m long, find its speed.
(1) 40 km/hr (2) 25 km/hr (3) 35 km/hr (4) 36 km/hr

78. A person travels 285 km in 6 hrs in two stages. In the first part of the journey, he travels by bus at the speed of 40 km per hr. In the second part of the journey, he travels by train at the speed of 55 km per hr. How much distance did he travel by train?
(1) 165 km (2) 145 km (3) 205 km (4) 185 km

79. A boatman goes 2 km against the current of the stream in 1 hr and goes 1 km along the current in 10 min. How long will he take to go 5 km in stationary water?
(1) 1 hour (2) $1\frac{1}{2}$ hours
(3) 1 hour 15 minutes (4) 40 minutes

80. How many litres of water flows out of a pipe of cross section 5 cm^2 in 1 min. If the speed of water in the pipe is 20 cm/sec?
(1) 2 litres (2) 5 litres (3) 6 litres (4) 9 litres

81. A train 75 m long overtook a person who was walking at the rate of 6 km/hr and passes him in $7\frac{1}{2}$ seconds. Subsequently, it overtook a second person and passed him in $6\frac{3}{4}$ seconds. At what rate was the second person travelling?
(1) 4 km/hr (2) 1 km/hr (3) 2 km/hr (4) 5 km/hr

82. Ten men can finish a piece of work in 10 days, whereas it takes 12 women to finish it in 10 days. If 15 men and 6 women undertake the work, how many days will they take to complete it?
(1) $4\frac{1}{2}$ days (2) 4 days (3) 5 days (4) 6 days

83. A long distance runner runs 9 laps of a 400 metres track every day. His timings (in min.) for four consecutive days are 88, 96, 89 and 87 respectively. On an average, how many metres/minute does the runner cover?
(1) 17.78 (2) 90
(3) 40 (4) None of these

84. A train passes a station platform in 36 seconds and a man standing on the platform in 20 seconds. If the speed of the train is 54 km/h, then find the length of the platform.
(1) 225 m (2) 235 m (3) 230 m (4) 240 m

85. A railway passenger counts the telegraph poles on the rail road as he passes them. The telegraph poles are at a distance of 50 meters. What will be his count in 4 hours if the speed of the train is 45 km per hour?
(1) 2500 (2) 600 (3) 3600 (4) 5000

86. A car driver, driving in a fog, passes a pedestrian who was walking at the rate of 2 km/hr in the same direction. The pedestrian could see the car for 6 minutes and it was visible to him up to a distance of 0.6 km. What was the speed of the car?
(1) 15 km/hr (2) 30 km/hr (3) 20 km/hr (4) 8 km/hr

87. If $a^x = b$, $b^y = c$ and $c^z = a$; then the value of xyz =
(1) 0 (2) 1 (3) – 1 (4) 2

88. If $x + \frac{1}{x} = 5$, then the value of $x^3 + \frac{1}{x^3}$ is :
(1) 125 (2) 110 (3) 45 (4) 75

89. Of the following quadratic equations, which is the one whose roots are 2 and – 15 ?
(1) $x^2 - 2x + 15 = 0$ (2) $x^2 + 15x - 2 = 0$
(3) $x^2 + 13x - 30 = 0$ (4) $x^2 - 30 = 0$

90. x and y vary inversely with each other. When x is 12, y is 9. The pair which is not a possible pair of corresponding values of x and y is :
(1) 9 and 12 (2) 18 and 6
(3) 24 and 18 (4) 36 and 3

91. Father is 5 years older than the mother and mother's age now is thrice the age of the daughter. The daughter is now 10 years old. What was father's age when the daughter was born?
(1) 20 years (2) 15 years
(3) 25 years (4) 30 years

92. A father told his son, "I was as old as you are at present, at the time of your birth," If the father is 38 years old now, what was the son's age five years back ?
(1) 19 years (2) 14 years
(3) 38 years (4) 33 years

93. The sum of digits of a two digit number is 15. If 9 be added to the number, then the digits are reversed. The number is :
(1) 96. (2) 87 (3) 78 (4) 69

94. What is the value of $\frac{P+Q}{P-Q}$, if $\frac{P}{Q} = 7$?
(1) $\frac{4}{3}$ (2) $\frac{2}{3}$ (3) $\frac{2}{6}$ (4) $\frac{7}{8}$

95. A's age is $\frac{1}{6}$ th of B's age. It will be twice of C's age after 10 years. If C's eighth birthday was celebrated two years ago, then the present age of A must be :
(1) 5 years (2) 10 years
(3) 15 years (4) 20 years

96. If a, b are the two roots of a quadratic equation such that a + b = 24 and a – b = 8, then the quadratic equation having a and b as its roots is :
(1) $x^2 + 2x + 8 = 0$ (2) $x^2 - 4x + 8 = 0$
(3) $x^2 - 24x + 128 = 0$ (4) $2x^2 + 8x + 9 = 0$

97. If $\left(a+\frac{1}{a}\right)^2 = 3$, then what is the value of $a^3+\frac{1}{a^3}$?

(1) $\frac{10\sqrt{3}}{3}$ (2) 0 (3) $3\sqrt{3}$ (4) $6\sqrt{3}$

98. The sum of the 6^{th} and 15^{th} terms of an arithmetic progression is equal to the sum of 7^{th}, 10^{th} and 12^{th} terms of the same progression. Which term of the series should necessarily be equal to zero ?

(1) 10^{th} (2) 8^{th}
(3) 1^{st} (4) None of these

99. $\frac{1}{2}\log_{10}25 - 2\log_{10}3 + \log_{10}18$ equals :

(1) 18 (2) 1
(3) $\log_{10}3$ (4) None of these

100. If $a - 8 = b$, then determine the value of $|a-b| - |b-a|$.

(1) 16 (2) 0 (3) 4 (4) 2

101. A club consists of members whose ages are in A.P., the common difference being 3 months. If the youngest member of the club is just 7 years old and the sum of the age of all the members is 250 years, then the number of members in the club are

(1) 15 (2) 20 (3) 25 (4) 30

102. Students of a class are made to stand in rows. It 4 students are extra in each row, then there would be 2 rows less. If 4 students are less in each row, then there would be 4 more rows. The number of students in the class is

(1) 90 (2) 94 (3) 92 (4) 96

103. Four different integers form an increasing AP. If one of these numbers is equal to the sum of the squares of the other three numbers, then the numbers are

(1) $-2, -1, 0, 1$ (2) $0, 1, 2, 3$
(3) $-1, 0, 1, 2$ (4) None of these

104. In a circle of radius 10 cm, a chord is drawn 6 cm from its centre. If an another chord, half the length of the original chord were drawn, its distance in centimetres from the centre would be :

(1) $\sqrt{84}$ (2) 9 (3) 8 (4) 3π

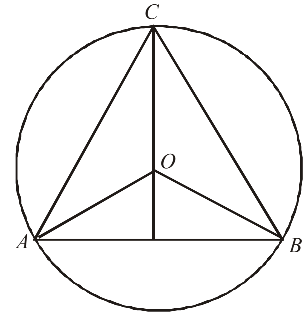
105. The locus of a point equidistant from the two fixed points is:

(1) Any straight line bisecting the segment joining the fixed points.
(2) Any straight line perpendicular to the segment joining the fixed points.
(3) The straight line which is perpendicular bisector of the segment joining the fixed points.
(4) Any straight line perpendicular to the line joining the fixed points.

106. In a triangle ABC, $\angle A = 90°$ and D is the mid-point of AC. The value of $BC^2 - BD^2$ is equal to :

(1) AD^2 (2) $2AD^2$ (3) $3AD^2$ (4) $4AD^2$

107. In the figure given below, O is the centre of the circle. If $\angle OBC = 37°$, then $\angle BAC$ is equal to :



(1) 74° (2) 106° (3) 53° (4) 37°

108. How many sides a regular polygon has with its sum of interior angles eight times its sum of exterior angles?

(1) 16 (2) 24 (3) 18 (4) 30

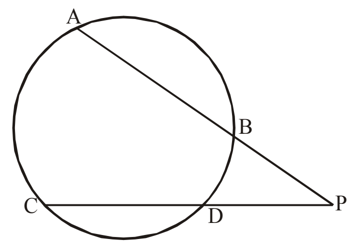
109. The perimeters of two similar triangles ABC and PQR are 36 cm, and 24 cm, respectively. If PQ = 10 cm, then the length of AB is :

(1) 16 cm (2) 12 cm (3) 14 cm (4) 15 cm

110. Two isosceles triangles have equal vertical angles and their areas are in the ratio 9 : 16. The ratio of their corresponding heights is :

(1) 3 : 4 (2) 4 : 3 (3) 2 : 1 (4) 1 : 2

111. If in the following figure, PA = 8 cm, PD = 4 cm, CD = 3 cm, then AB is equal to :

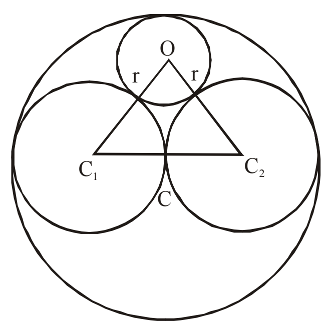


(1) 3.0 cm (2) 3.5 cm (3) 4.0 cm (4) 4.5 cm

112. Let ABC be an acute-angled triangle and CD be the altitude through C. If AB = 8 and CD = 6, then the distance between the mid-points of AD and BC is :

(1) 36 (2) 25 (3) 27 (4) 5

113. Two circles of unit radii touch each other and each of them touches internally a circle of radius two, as shown in the following figure. The radius of the circle which touches all the three circles is:



(1) 5 (2) $\frac{3}{2}$

(3) $\frac{2}{3}$ (4) None of these

114. ABCD is a square, F is the mid-point of AB and E is a point on BC such that BE is one-third of BC. If area of $\Delta FBE = 108\ m^2$, then the length of AC is :

(1) 63m (2) $36\sqrt{2}$ m (3) $63\sqrt{2}$ m (4) $72\sqrt{2}$ m

115. If P and Q are the mid-points of the sides CA and CB, respectively of a triangle ABC, right angled at C, then the value of $4\ (AQ^2 + BP^2)$ is equal to :

(1) $4BC^2$ (2) $5AB^2$ (3) $2AC^2$ (4) $2BC^2$

116. If one of the diagonals of a rhombus is equal to its side, then the diagonals of the rhomhus are in the ratio :

(1) $\sqrt{3}:1$ (2) $\sqrt{2}:1$ (3) 3 : 1 (4) 2 : 1

117. A triangle and a parallelogram are constructed on the same base such that their areas are equal. If the altitude of the parallelogram is 100 m, then the altitude of the triangle is :

(1) 100m (2) 200m (3) $100\sqrt{2}$ m (4) $10\sqrt{2}$ m

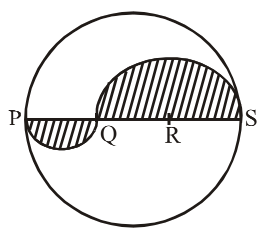
118. Two small circular parks of diameters 16 m, 12 m are to be replaced by a bigger circular park. What would be the radius of this new park, if the new park has to occupy the same space as the two small parks?

(1) 15 m (2) 10 m (3) 20 m (4) 25 m

119. The length of a rectangular field is double its width. Inside the field there is a square-shaped pond 8 m long. If the area of the pond is 1/8 of the area of the field, what is the length of the field?

(1) 32m (2) 16m (3) 64m (4) 20m

120. PQRS is a diameter of a circle whose radius is r. The lengths of PQ, QR and RS are equal. Semi-circles are drawn on PQ and QS to create the shaded figure below :
The perimeter of the shaded figure is :



(1) πr (2) $\frac{4\pi r}{3}$ (3) $\frac{5\pi r}{3}$ (4) $\frac{3\pi r}{2}$

121. If the length of a certain rectangle is decreased by 4 cm and the width is increased by 3 cm, a square with the same area as the original rectangle would result. The perimeter of the original rectangle (in centimetres) is :

(1) 44 (2) 46 (3) 48 (4) 50

122. A cylindrical vessel of radius 4 cm contains water. A solid sphere of radius 3 cm is lowered into the water until it is completely immersed. The water level in the vessel will rise by :

(1) $\frac{9}{2}$ cm (2) $\frac{9}{4}$ cm (3) $\frac{4}{9}$ cm (4) $\frac{2}{9}$ cm

123. A cylinder is circumscribed about a hemisphere and a cone is inscribed in the cylinder so as to have its vertex at the centre of one end, and the other end as its base. The volume of the cylinder, hemisphere and the cone are, respectively in the ratio :

(1) 2 : 3 : 2 (2) 3 : 2 : 1 (3) 3 : 1 : 2 (4) 1 : 2 : 3

124. A conical cavity is drilled in a circular cylinder of height 15 cm and base radius 8 cm. The height and the base radius of the cone are also the same. Then the whole surface of the remaining solid is :

(1) $440\pi\ cm^2$ (2) $240\pi\ cm^2$
(3) $640\ cm^2$ (4) $960\pi\ cm^2$

125. A cylindrical bath tub of radius 12 cm contains water to a depth of 20 cm. A spherical iron ball is dropped into the tub and thus the level of water is raised by 6.75 cm. What is the radius of the ball?

(1) 8 cm (2) 9 cm (3) 12 cm (4) 7 cm

126. A solid cylinder and a solid cone have equal base and equal height. If the radius and the height be in the ratio of 4 : 3, the total surface area of the cylinder to that of the cone are in the ratio of :

(1) 10 : 9 (2) 11 : 9 (3) 12 : 9 (4) 14 : 9

127. If the volume of a sphere is divided by its surface area, then the result is 27 cm. The radius of the sphere is :

(1) 9 cm (2) 27 cm (3) 81 cm (4) 243 cm

128. A horse is tethered to one corner of a rectangular grassy field 40 m by 24 m with a rope 14 m long. Over how much area of the field can it graze?

(1) $154\ m^2$ (2) $308\ m^2$
(3) $150\ m^2$ (4) None of these

129. An edge of a cube measures 10 cm. If the largest possible cone is cut out of this cube, then the volume of the cone is:

(1) $260\ cm^3$ (2) $260.9\ cm^3$
(3) $261.9\ cm^3$ (4) $262.7\ cm^3$

130. The radius of the circumcircle of an equilateral triangle of side 12 cm is :

(1) $\frac{4}{3}\sqrt{3}$ cm (2) $4\sqrt{3}$ cm (3) $4\sqrt{2}$ cm (4) $\frac{4}{3}\sqrt{2}$ cm

131. A wire is in the form of a circle of a radius 35 cm. If it is bent into the shape of a rhombus, then what is the side of the rhombus?

(1) 32 cm (2) 70 cm (3) 55 cm (4) 17 cm

132. The dimensions of a rectangular box are in the ratio 1 : 2 : 4 and the differences between the costs of covering it with the cloth and sheet at the rate of Rs 20 and Rs 20.5 per square metre, respectively, is Rs 126. Find the dimensions of the box.

(1) 3m, 6m, 12m (2) 6m, 12m, 24m
(3) 1m, 2m, 4m (4) None of these

133. The height of a bucket is 45 cm. The radii of the two circular ends are 28 cm and 7 cm, respectively. The volume of the bucket is :

(1) $38610\ cm^3$ (2) $48600\ cm^3$
(3) $48510\ cm^3$ (4) None of these

134. A metallic sheet is of rectangular shape with dimensions $28\ m \times 36\ m$. From each of its corners, a square is cut off so as to make an open box. The volume of the box is $X\ m^3$. If the length of side of the square is 8 m, the value of X is :

(1) 5120 (2) 8960 (3) 4830 (4) 5130

135. A hemispherical bowl is made of steel 0.5 cm thick. The inside radius of bowl being 4 cm. The volume of the steel used in making the bowl is :

(1) $55.83\ cm^2$ (2) $56.83\ cm^2$
(3) $57.83\ cm^2$ (4) $58.83\ cm^2$

136. The length of a cold storage is double its breadth. Its height is 3 metres. The area of its four walls (including the doors) is $108\ m^2$. Find its volume.

(1) $215\ m^3$ (2) $216\ m^3$ (3) $217\ m^3$ (4) $218\ m^3$

137. A rectangular tank measuring 5m × 4.5 m × 2.1 m is dug in the centre of the field measuring 13.5 m × 2.5 m. The earth dug out is spread evenly over the remaining portion of a field. How much is the level of the field raised ?
(1) 4.0m (2) 4.1m (3) 4.2m (4) 4.3m

138. Find the number of coins, 1.5 cm in diameter and 0.2 cm thick, to be melted to form a right circular cylinder of height 10 cm and diameter 4.5 cm :
(1) 430 (2) 440 (3) 450 (4) 460

139. How many metres of cloth 5 m wide will be required to make a conical tent, the radius of whose base is 7 m and whose height is 24 cm ? $\left(\pi = \frac{22}{7}\right)$
(1) 108m (2) 110m (3) 112m (4) 115m

140. A hollow sphere of internal and external diameters 4 cm and 8 cm respectively is melted into a cone of base diameter 8 cm. The height of the cone is
(1) 12 cm (2) 14 cm (3) 15 cm (4) 18 cm

141. A semicircular sheet of paper of diameter 28 cm is bent to cover the exterior surface of an open conical ice-cream cup. The depth of the ice-cream cup is
(1) 10.12 cm (2) 8.12 cm
(3) 12.12 cm (4) None of these

142. If a bucket is 80% full, then it contains 2 litres more water than when it is $66\frac{2}{3}\%$ full. What is the capacity of the bucket?
(1) 10 litres (2) $16\frac{2}{3}$ liters
(3) 15 litres (4) 20 litres

143. The number of bricks, each measuring 25 cm × 12.5 cm × 7.5 cm, required to construct a wall 6 m long, 5 m high and 0.5 m thick, while the mortar occupies 5% of the volume of the wall, is :
(1) 5740 (2) 6080 (3) 3040 (4) 8120

144. In a swimming pool measuring 90 m by 40 m, 150 men take a dip. If the average displacement of water by a man is 8 cubic metres, what will be the rise in water level?
(1) 33.33 cm (2) 30 cm (3) 20 cm (4) 25 cm

145. The distance between the tops of two trees 20 m and 28 m high is 17m. The horizontal distance between the two trees is :
(1) 9m (2) 11m (3) 15m (4) 31m

146. If sin A : cos A = 4 : 7, then the value of $\frac{7\sin A - 3\cos A}{7\sin A + 2\cos A}$ is:
(1) $\frac{3}{14}$ (2) $\frac{3}{2}$ (3) $\frac{1}{3}$ (4) $\frac{1}{6}$

147. The angle of elevation of the sun when the length of the shadow of a pole is $\sqrt{3}$ times of its height of the pole is :
(1) 30° (2) 45° (3) 60° (4) 75°

148. A tree 6 m tall casts a 4 m long shadow. At the same time, a flag staff casts a shadow 50 m long. How long is the flag staff ?
(1) 75m (2) 100m (3) 150m (4) 50m

149. The reduced form of $\cos^6 x + \sin^6 x + 3\cos^2 x \sin^2 x$ is equal to
(1) 2 (2) 0
(3) $\sin^3 x + \cos^3 x^2$ (4) 1

150. If the elevation of the sun changes from 30° and 60°, then the difference between the lengths of shadows of a pole 15 m high at these two elevations of the sun is :
(1) 7.5m (2) 15m (3) $10\sqrt{3}$m (4) $\frac{15}{\sqrt{3}}$m

151. A person standing on the bank of a river finds that the angle of elevation of the top of a tower on the opposite bank is 45°. Which of the following statements is correct ?
(1) Breadth of the river is twice the height of the tower.
(2) Breadth of the river is half of the height of the tower.
(3) Breadth of the river and the height of the tower are the same.
(4) None of these.

152. A portion of a 30 m long tree is broken by a tornado and the top strikes the ground making an angle of 30º with the ground level. The height of the point where the tree is broken is equal to
(1) 10m (2) $\frac{30}{\sqrt{3}}$ m (3) $30\sqrt{3}$ m (4) 60m

153. A man is standing on the 8 m long shadow of a 6 m long pole. If the length of the shadow of a man is 2.4 m, then the height of the man is :
(1) 1.4m (2) 1.8 m (3) 1.6m (4) 2.0m

154. A tree is broken by the wind. The top struck the ground at an angle 30° and at a distance of 30 m from the root. The whole height of the tree is approximately
(1) 52m (2) 17m (3) 34m (4) 30m

155. From amongst 36 teachers in a school, one principal and one vice-principal are to be appointed. In how many ways can this be done ?
(1) 1260 (2) 1250 (3) 1240 (4) 1800

156. In how many ways can 7 persons be seated at a round table if 2 particular persons must not sit next to each other ?
(1) 5040 (2) 240 (3) 480 (4) 720

157. There are three prizes to be distributed among five students. If no student gets more than one prize, then this can be done in :
(1) 10 ways (2) 30 ways
(3) 60 ways (4) 80 ways

158. Two dice are tossed. The probability that the total score is a prime number is :
(1) $\frac{1}{6}$ (2) $\frac{5}{12}$ (3) $\frac{1}{2}$ (4) $\frac{7}{9}$

159. Suppose six coins are tossed simultaneously. Then the probability of getting at least one tail is :
(1) $\frac{71}{72}$ (2) $\frac{53}{54}$ (3) $\frac{63}{64}$ (4) $\frac{1}{12}$

160. If the probability that A will live 15 years more is $\frac{7}{8}$ and that B will live 15 years more is $\frac{9}{10}$, then what is the probability that both will survive after 15 years?
(1) $\frac{1}{20}$ (2) $\frac{63}{80}$
(3) $\frac{1}{5}$ (4) None of these

161. A six-sided die with faces numered 1 through 6 is rolled three times. What is the probability that the face with the number 6 on it will not face upward on all the three rolls ?

(1) 1/216 (2) 1/6 (3) 2/3 (4) 215/216

162. A brother and sister appear for an interivew against two vacant posts in an office. The probability of the brother's selection is $\frac{1}{5}$ and that of the sister's selection is $\frac{1}{3}$. What is the probability that one of them is selected ?

(1) $\frac{1}{5}$ (2) $\frac{2}{5}$ (3) $\frac{1}{3}$ (4) $\frac{2}{3}$

163. An article manufactured by a company consists of two parts *X* and *Y*. In the process of manufacture of part *X*, 9 out of 104 parts may be defective. Similarly, 5 out of 100 are likely to be defective in the manufacture of the part *Y*. The probability that the assembled product will not be defective, is:

(1) $\frac{253}{416}$ (2) $\frac{361}{416}$

(3) $\frac{322}{416}$ (4) None of these

164. The number of ways in which 6 men and 5 women can dine at a round table if no two women are to sit together is given by :

(1) $6! \times 5!$ (2) 30 (3) $5! \times 4!$ (4) $7! \times 5!$

165. Seven women and seven men are to sit around a circular table such that there is a man on either side of every woman. The number of seating arrangements is:

(1) $(7!)^2$ (2) $(6!)^2$ (3) $6! \times 7!$ (4) $7!$

166. A bag contains 10 mangoes out of which 4 are rotten. Two mangoes are taken out together. If one of them is found to be good, then the probability that other is also good is:

(1) $\frac{1}{3}$ (2) $\frac{8}{15}$ (3) $\frac{5}{18}$ (4) $\frac{2}{3}$

167. *A* and *B* play a game where each is asked to select a number from 1 to 5. If the two numbers match, both of them win a prize. The probability that they will not win a prize in a single trial is

(1) 1/25 (2) 24/25

(3) 2/25 (4) none of these

168. An examination paper contains 8 questions of which 4 have 3 possible answers each, 3 have 2 possible answers each and the remaining one question has 5 possible answers. The total number of possible answers to all the questions is:

(1) 2880 (2) 78 (3) 94 (4) 3240

169. A box contains 5 brown and 4 white socks. A man takes out two socks. The probability that they are of the same colour is

(1) 1/6 (2) 5/108 (3) 5/18 (4) 4/9

170. A fair coin is tossed repeatedly. If Head appears on the first four tosses, then the probability of appearance of Tail on the fifth toss is

(1) 1/2 (2) 1/7 (3) 3/7 (4) 2/3

171. The number of observations in a group is 40. If the average of first 10 is 4.5 and that of the remaining 30 is 3.5, then the average of the whole group is

(1) $\frac{1}{5}$ (2) $\frac{15}{4}$ (3) 4 (4) 8

172. In a class of 100 students there are 70 boys whose average marks in a subject are 75. If the average marks of the complete class are 72, then the average marks of the girls

(1) 73 (2) 65 (3) 68 (4) 74

173. If three sets of data had means of 15, 22.5 and 24 based on 6, 4, and 5 observations respectively, then the mean of these three sets combined is

(1) 20.0 (2) 20.5 (3) 22.5 (4) 24.0

174. Consider the following statements

(A) Mode can be computed from histogram

(B) Median is not independent of change of scale

(C) Variance is independent of change of origin and scale.

Which of these is/are correct ?

(1) (A), (B) and (C) (2) Only (B)

(3) Only (A) and (B) (4) Only (A)

175. The average marks, in a class of 30 students, are found to be 45. On checking two mistakes were found. After correction, if one student got 45 marks more and another students got 15 marks less, then the correct average marks are

(1) 45 (2) 44 (3) 47 (4) 46

176. If the arithmetic mean of n numbers of a series is $\overline{x}$ and the sum of the first $(n-1)$ numbers is k, then the nth number is

(1) $n+k$ (2) $n\overline{x}+k$ (3) $n\overline{x}-k$ (4) $n-k$

177. The mean of a set of 20 observation is 19.3. The mean is reduced by 0.5 when a new observation is added to the set. The new observation is

(1) 19.8 (2) 8.8 (3) 9.5 (4) 30.8

178. If $\overline{x}$ is the mean of $x_1, x_2, ..., x_n$ then for $a \neq 0$, the mean of $ax_1, ax_2, ..., ax_n, \frac{x_1}{a}, \frac{x_2}{a}, ..., \frac{x_n}{a}$ is

(1) $\left(a+\frac{1}{a}\right)\overline{x}$ (2) $\left(a+\frac{1}{a}\right)\frac{\overline{x}}{2}$

(3) $\left(a+\frac{1}{a}\right)\frac{\overline{x}}{n}$ (4) $\frac{\left(a+\frac{1}{a}\right)\overline{x}}{2n}$

179. In a morning walk, I took 20 rounds of a park. During this period I came across person A, person B, person C and person D, 11 times, 7 times, 10 times and 5 times respectively. I want to represent this data graphically. Which of the following is the best representation?

(1) Bar graph

(2) Histogram with unequal widths

(3) Histogram with equal widths

(4) Frequency polygon

180. The mean of six numbers is 30. If one number is excluded, the mean of the remaining numbers is 29. The excluded number is

(1) 29 (2) 30 (3) 35 (4) 45

181. If bisectors of ∠A and ∠B of a quadrilateral ABCD intersect each other at P, that of ∠B and ∠C at Q, that of ∠C and ∠D at R, and that of ∠D and ∠A at S, then PQRS is a :

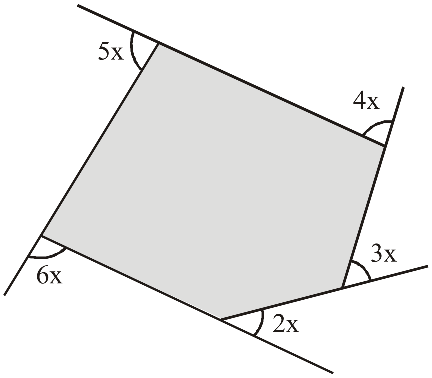
(1) rectangle

(2) rhombus

(3) parallelogram

(4) quadrilateral whose opposite angles are supplementary

182. The following figure shows a polygon with all its exterior angles.



The value of x is :

(1) $10°$ (2) $18°$ (3) $20°$ (4) $36°$

183. The domain of the function

$f(x) = \left(\sqrt{x-1}\right)\left(\sqrt{4-x}\right)$

(1) $1 \le x \le 4$ (2) $1 < x < 4$
(3) R (4) $R - \{1, 4\}$

184. The domain of the function

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

(1) R (2) $A = \{-1, 1\}$
(3) $R - \{1\}$ (4) $R - \{-1\}$

185. The domain of the function $\dfrac{1}{x^2 - 5x + 6}$

(1) $R - \{2\}$ (2) $R - \{2, 3\}$
(3) $\{R - 2\}$ (4) $R - \{-2, -3\}$

186. The value of x from $1 < |x| < 2$

(1) $1 < x < 2$
(2) $\{-2 < x < -1\} \cup \{1 < x < 2\}$
(3) $-2 < x < -1$
(4) None of these

187. $\sqrt{a} > \sqrt{b} > \sqrt{c} > \sqrt{d}$ where d, c, b, a are consecutive natural numbers. Then which of the following is true?

(1) $\sqrt{a} - \sqrt{b} > \sqrt{c} - \sqrt{d}$ (2) $\sqrt{c} - \sqrt{d} > \sqrt{a} - \sqrt{b}$
(3) $\sqrt{a} - \sqrt{c} > \sqrt{b} - \sqrt{d}$ (4) None of these

188. If $x = 2 - \sqrt{3}$ then the value of $x^2 + \dfrac{1}{x^2}$ and $x^2 - \dfrac{1}{x^2}$ is

(1) $14,\ 8\sqrt{3}$ (2) $-14,\ -8\sqrt{3}$
(3) $14,\ -8\sqrt{3}$ (4) $-14,\ 8\sqrt{3}$

189. If $x = 3 + \sqrt{8}$ then $x^3 + \dfrac{1}{x^3} =$

(1) 216 (2) 198 (3) 192 (4) 261

190. If $x = \dfrac{\sqrt{a}+\sqrt{b}}{\sqrt{a}-\sqrt{b}}$, $y = \dfrac{\sqrt{a}-\sqrt{b}}{\sqrt{a}+\sqrt{b}}$ then the value of $x^2 + xy + y^2$ is

(1) $\dfrac{4(a-b)}{(a+b)}$ (2) $\dfrac{4(a+b)}{(a-b)}$
(3) $\dfrac{2(a+b)}{a-b}$ (4) $\dfrac{2(a-b)}{a+b}$

191. The value of $\sqrt{5\sqrt{5\sqrt{5\sqrt{5......}}}}$ is

(1) 0 (2) 5
(3) can't be determined (4) none

192. If A : if the denominator of a rational number has 2 as a prime factor, then that rational number can be expressed as a terminating decimal and R : $\dfrac{83}{64}$ is a terminating decimal, then which of the following statements is correct?

(1) A is False and R is True
(2) A is True and R is False
(3) A is True and R is an example of A
(4) A is False and R is an example supporting A

193. If x and y are two rational numbers, then which of the following statements is wrong?

(1) $|x + y| \le |x| + |y|$ (2) $|x \times y| = |x| \times |y|$
(3) $|x - y| \le |x| - |y|$ (4) None of these

194. Three cylinders each of height 16 cm and radius of base 4 cm are placed on aplane so that each cylinder touches the other two. Then the volume of region enclosed between the three cylinders in cm^3 is

(1) $98\left(4\sqrt{3} - \pi\right)$ (2) $98\left(2\sqrt{3} - \pi\right)$
(3) $98\left(\sqrt{3} - \pi\right)$ (4) $128\left(2\sqrt{3} - \pi\right)$

195. In triangle ABC, $\overline{AB} = 12$, $\overline{AC} = 7$, and $\overline{BC} = 10$. If sides AB and AC are doubled while BC remains the same, then :

(1) the area is doubled
(2) the altitude is doubled
(3) the area is four times sthe original area
(4) the area of the triangle is 0

196. A point is selected at random inside an equilateral triangle. From this point perpendiculars are dropped to each side. The sum of these perpendiculars is :

(1) least when the point is the centre of gravity of the triangle
(2) greater than the altitude of the triangle
(3) equal to the altitude of the triangle
(4) one-half the sum of the sides of the triangle

197. If r and s are the roots of the equation $ax^2 + bx + c = 0$, the value of $\dfrac{1}{r^2} + \dfrac{1}{s^2}$ is :

(1) $b^2 - 4ac$ (2) $\dfrac{b^2 - 4ac}{2a}$
(3) $\dfrac{b^2 - 4ac}{c^2}$ (4) $\dfrac{b^2 - 2ac}{c^2}$

198. If $x = \sqrt{1 + \sqrt{1 + \sqrt{1 + \sqrt{1 + ...}}}}$, then :

(1) $x = 1$ (2) $0 < x < 1$
(3) $1 < x < 2$ (4) x is infinite

199. If $\dfrac{x^2 - bx}{ax - c} = \dfrac{m-1}{m+1}$ has roots which are numerically equal but of opposite signs, the value of m must be :

(1) $\dfrac{a-b}{a+b}$ (2) $\dfrac{a+b}{a-b}$
(3) c (4) $\dfrac{1}{c}$

200. If a and b are two unequal positive numbers, then :

(1) $\sqrt{ab} > \frac{2ab}{a+b} > \frac{a+b}{2}$ (2) $\frac{2ab}{a+b} > \frac{a+b}{2} > \sqrt{ab}$

(3) $\frac{a+b}{2} > \frac{2ab}{a+b} > \sqrt{ab}$ (4) $\frac{a+b}{2} > \sqrt{ab} > \frac{2ab}{a+b}$

201. log p + log q = log (p + q) only if :

(1) p = q = zero (2) $p = \frac{q^2}{1-q}$

(3) p = q = 1 (4) $p = \frac{q}{q-1}$

202. The price of an article was increased p%. Later the new price was decreased p%. If the last price was Re. 1, the original price was :

(1) $\frac{\sqrt{1-p^2}}{100}$ (2) 1 Re.

(3) $1 - \frac{p^2}{10,000 - p^2}$ (4) $\frac{10,000}{10,000 - p^2}$

203. The base of an isosceles triangle is 6 cm and one of the equal sides is 12 cm. The radius of the circle through the vertices of the triangle is :

(1) $4\sqrt{3}$ (2) $3\sqrt{5}$

(3) $6\sqrt{3}$ (4) None of these

204. A girls' camp is located 300 m from a straight road. On this road, a boys' camp is located 500 m from the girls' camp. It is desired to build a canteen on the road which shall be exactly the same distance from each camp. The distance of the canteen from each of the camp is :

(1) 250 m (2) 87.5 m

(3) 200 m (4) None of these

205. If one side of a triangle is 12 cm and the opposite angle is 30 degrees, then the diameter of the circumscribed circle is :

(1) 18 cm (2) 30 cm (3) 24 cm (4) 20 cm

206. If f(a) = a – 2 and F(a, b) = b^2 + a, then F[3, f(4)] is :

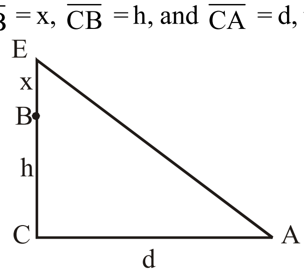
(1) $a^2 - 4a + 7$ (2) 28

(3) 7 (4) 8

207. If the larger base of an isosceles trapezoid equals a diagonal and the smaller base equals the altitude, then the ratio of the smaller base to the larger base is:

(1) 1/2 (2) 2/3 (3) 3/4 (4) 3/5

208. In the right triangle shown the sum of the distance $\overline{BM}$ and $\overline{MA}$ is equal to the sum of the distances $\overline{BC}$ and $\overline{CA}$. If $\overline{MB}$ = x, $\overline{CB}$ = h, and $\overline{CA}$ = d, then x equals :



(1) $\frac{hd}{2h+d}$ (2) d – h

(3) $\frac{1}{2}d$ (4) $h + d - \sqrt{2d}$

209. The hypotenuse of a right triangle is 10 cm and the radius of the inscribed circle is 1 cm. The perimeter of the triangle in centimetre is :

(1) 15 (2) 22 (3) 24 (4) 26

210. The straight line AB is divided at C so that $\overline{AC} = 3\overline{CB}$. Circles are described on AC and CB as diameters and a common tangent meets AB produced at D. Then $\overline{BD}$ equals:

(1) the diameter of the smaller circle

(2) the radius of the smaller circle

(3) the radius of the larger circle

(4) $\overline{CB}\sqrt{3}$

211. A circle is inscribed in a triangle with sides 8, 15 and 17. The radius of the circle is :

(1) 6 (2) 2 (3) 5 (4) 3

212. Represent the hypotenuse of a right triangle by c and the area by A. The altitude on the hypotenuse is :

(1) $\frac{A}{c}$ (2) $\frac{2A}{c}$ (3) $\frac{A}{2c}$ (4) $\frac{A^2}{c}$

213. How many hours does it take a train travelling at an average rate of 40 mph between stops to travel a miles if it makes n stops of m minutes each?

(1) $\frac{3a+2mn}{120}$ (2) 3a + 2mn

(3) $\frac{3a+2mn}{12}$ (4) $\frac{a+mn}{40}$

214. The length of rectangle R is 10 per cent more than the side of square S. The width of the rectangle is 10 per cent less than the side of the square. The ratio of the areas, R : S, is :

(1) 99 : 100 (2) 101 : 100

(3) 1 : 1 (4) 199 : 200

215. The fraction $\frac{5x-11}{2x^2+x-6}$ was obtained by adding the two fractions $\frac{A}{x+2}$ and $\frac{B}{2x-3}$. The values of A and B must be:

(1) A = 5x, B = – 11 (2) A = – 11, B = 5x

(3) A = – 1, B = 3 (4) A = 3, B = – 1

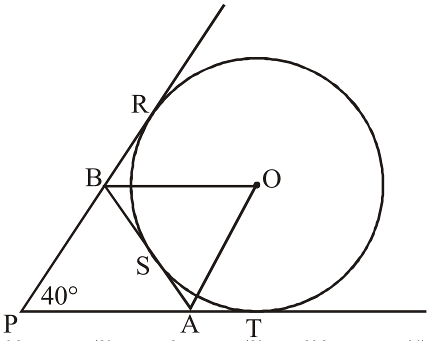
216. Two candles of the same height are lighted at the same time. The first is consumed in 4 hours and the second in 3 hours. Assuming that each candle burns at a constant rate, in how many hours after being lighted was the first candle twice the height of the second?

(1) $\frac{3}{4}$ hr. (2) $1\frac{1}{2}$ hr. (3) 2 hr. (4) $2\frac{2}{5}$ hr.

217. If an angle of a triangle remains unchanged but each of its two including sides is doubled, then the ara is multiplied by:

(1) 2 (2) 3 (3) 4 (4) 6

218. Triangle PAB is formed by three tangents to circle) and $\angle APB = 40°$; then angle AOB equals:



(1) 50° (2) 55° (3) 60° (4) 70°

219. In a group of cows and chickens, the number of legs was 14 more than twice the number of heads. The number of cows was :

(1) 5 (2) 7 (3) 10 (4) 12

220. If $(0.2)^x = 2$ and log 2 = 0.3010, then the value of x to the nearest tenth is :

(1) – 10.0 (2) – 0.5 (3) – 0.4 (4) – 0.2

221. Mr. J left his entire estate to his wife his daughter, his son, and the cook. His daughter and son got half the estate, sharing in the ratio of 4 to 3. His wife got twice as much as the son. If the cook received a bequest of Rs. 500, then the entire estate was :

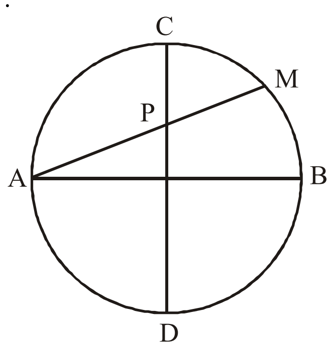
(1) Rs. 3500 (2) Rs. 5500
(3) Rs. 6500 (4) Rs. 7000

222. The relation $x^2 (x^2 - 1) \geq 0$ is true only for :

(1) $x \geq 1$ (2) $-1 \leq x \leq 1$
(3) $x = 0, x = 1, x = -1$ (4) $x = 0, x \leq -1, x \geq 1$

where $x \geq a$ means that x can take on all values greater than a and the value equal to a, while $x \leq a$ has corresponding meaning with “less than.”

223. Circle O has diameters AB and CD perpendicular to each other. AM is any chord interesting CD at P. Then $\overline{AP}.\overline{AM}$ is equal to :



(1) $\overline{AO}.\overline{OB}$ (2) $\overline{AO}.\overline{AB}$
(3) $\overline{CP}.\overline{CD}$ (4) $\overline{CP}.\overline{PD}$

224. Consider the following statements relating to parallel lines in a plane :

A. If lines L_2 and L_3 are both parallel to L_1, then they are parallel to each other
B. If lines L_2 and L_3 are both perpendicular to L_1, then they are parallel to each other
C. If the acute angle between L_1 and L_2 is equal to the acute angle between L_1 and L_3, then L_2 and L_3 are parallel to each other

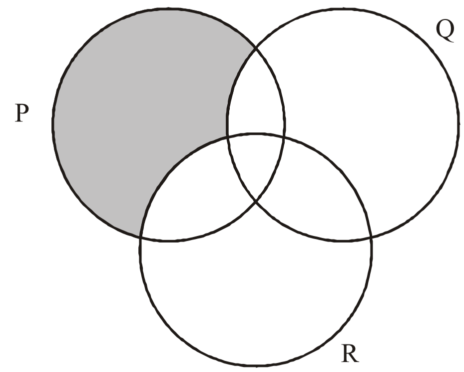
which of the above statements are correct?

(1) A, B and C (2) A and B
(3) A and C (4) B and C

225. Assertion (A) : For a ΔABC, AB = AC; and E, F are the midpoints of sides AC and AB respectively. Then ΔBEC and ΔBFC are congruent.
Reason (R) : If two triangles have two angles of the one equal to two angles of the other each to each and also one side of the one equal to the corresponding side of the other, then the two triangles are congruent. Of these statements :

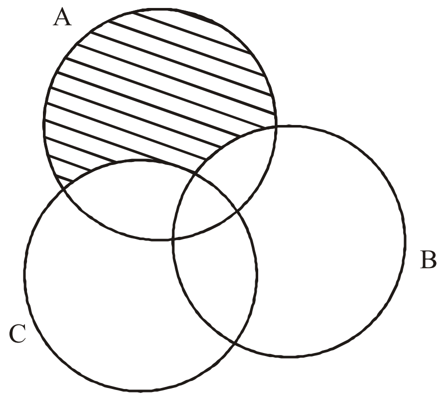
(1) both A and R are true and R is the correct explanation of A
(2) both A and R are true but R is not the correct explanation of A
(3) A is true but R is false
(4) A is false but R is true

226. The shaded region is :



(1) P – Q (2) $(P - Q) \cap (P - R)$
(3) P – R (4) $P - (Q \cap R)$

227. The shaded region in the given figure is :



(1) $A \cap (B \cup C)$ (2) $A \cup (B \cap C)$
(3) $A \cap (B - C)$ (4) $A - (B \cup C)$

228. If $\sin\theta + \sqrt{\sin\theta + \sqrt{\sin\theta + \sqrt{\sin\theta ......\infty}}} = \sec^4\alpha$, then $\sin\theta$ is equal to

(1) $\sec^2\alpha$ (2) $\tan^2\alpha$
(3) $\sec^2\alpha \tan^2\alpha$ (4) $\cos^2\alpha$

229. If P, Q, R, T are points in a plane and PQ = 5, QR = 3, QT = 7, PT = 12, PR = 2, then consider the following statements:
Assertion (A) : P, Q, R, T are collinear.
Reason (R) : PQ + QT = PT and PR + RQ = PQ.
Of these statements: ∴

(1) both A and R are true and R is the correct explanation of A
(2) both A and R are true and R is not the correct explanation of A
(3) A is true, but R is false
(4) A is false, but R is true

230. If the three sides of a right-angled triangle are produced on either side, then which of the following statements relating to the figure so obtained is correct?

A. Of the twelve angles formed at the three vertices by adjoining lines, four are acute, four obtuse and four right angles

B. The mean measure of the above twelve angles is 90°.

C. The measures of the above twelve angles will generally have three or five distinct values.

Select the correct answer using the codes given below:

Codes:

(1) A, B and C (2) A and B

(3) A and C (4) B and C

231. If a person standing on the bank of river finds that the angle of elevation of the top of a tower on the other bank directly opposite to him is 45°, then

(1) the height of the tower is half the breadth of the river

(2) the height of the tower is twice the breadth of the river

(3) the height of the tower is the same as the breadth of the river

(4) the height of the tower is thrice the breadth of the river.

232. Consider the following statements :

A. In a bar graph not only height but also width of each rectangle matters.

B. In a bar graph height of each rectangle matters and not its width.

C. In a histogram the height as well as the width of each rectangle matters.

D. A bar graph is two dimensional

Of these statements:

(1) A alone is correct (2) C alone is correct

(3) B and C are correct (4) A and D are correct

233. If $0° < x < 45°$ then consider the following statements

Assertion (A) :

$$\frac{1}{1+\sin^2 x}-\frac{1}{1+\sec^2 x}\neq\frac{1}{1+\cos^2 x}-\frac{1}{1+\operatorname{cosec}^2 x}$$

Reason (R) : $\sin x \neq \cos x,\ x \neq \frac{\pi}{4},\ x \in \left(0, \frac{\pi}{2}\right)$

of these statements:

(1) both A and R are true and R is the correct explanation of A

(2) both A and R are true and R is NOT the correct explanation

(3) A is true, but R is false

(4) A is false, but R is true

234. Consider the following statements : The system of equations

$2x - y = 4$

$px - y = q$

A. has a unique solution if $p \neq 2$

B. has infinitely many solutions if $p = 2, q = 4$.

Of these statement

(1) A alone is correct (2) B alone is correct

(3) A and B are correct (4) A and B are false

235. Consider the following statments

A. $x - 2$ is a factor of $x^3 - 3x^2 + 4x - 4$

B. $x + 1$ is a factor of $2x^3 + 4x + 6$

C. $x - 1$ is a factor of $x^5 + x^4 - x^3 + x^2 - x + 1$.

Of these statements

(1) A and B are correct (2) A, B and C are correct

(3) B and C are correct (4) A and C are correct

236. The area of a field surveyed is 111,200 sq.m. the readings in the given field book are in meters.

	To D	
	200	
	160	'x' to C
To E 'x'	120	
	80	40 to B
To F 40	40	
	From A	

The value of x will be

(1) 20m (2) 30m (3) 40m (4) 50m

237. Consider the following statements relating to 3 lines L_1, L_2 and L_3 in the same plane

A. If L_2 and L_3 are both parallel to L_1, then they are parallel to each other

B. If L_2 and L_3 are both perpendicular to L_1, then they are parallel to each other

C. If the acute angle between L_1 and L_2 is equal to the acute angle between L_1 and L_3 then L_2 is parallel to L_1.

Of these statements

(1) A and B are correct (2) A and C are correct

(3) B and C are correct (4) A, B and C are correct

238. If AD, BE and CF are the medians of ΔABC, then which one of the following statements is correct?

(1) $(AD + BE + CF) < (AB + BC + CA)$

(2) $(AD + BE + CF) > 3/4\,(AB + BC + CA)$

(3) $(AD + BE + CF) < 3/4\,(AB + BC + CA)$

(4) $(AD + BE + CF) = 1/2\,(AB + BC + CA)$.

239. Given the following six statements :

A. All women are good drivers

B. Some women are good drivers

C. No men are good drivers

D. All men are bad drivers

E. At least one man is a bad driver

F. All men are good drivers.

The statement that negates statement (6) is:

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

240. Number of real solutions of $(x^2 - 7x + 11)^{x^2 - 11x + 30} = 1$ is :

(1) 4 (2) 5

(3) 6 (4) No solution

241. If $\tan^2\alpha.\tan^2\beta + \tan^2\beta.\tan^2\gamma + \tan^2\gamma.\tan^2\alpha + 2\tan^2\alpha.\tan^2\beta.\tan^2\gamma = 1$ then the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma$ is

(1) 0 (2) -1 (3) 1 (4) $\frac{1}{2}$

242. If $3\sin\theta + 5\cos\theta = 5$, then the value of $5\sin\theta - 3\cos\theta = ?$

(1) ±4 (2) ±3 (3) ±5 (4) ±2

243. If a, b, c are positive, then $\frac{a+c}{b+c}$ is

(1) always smaller than $\frac{a}{b}$

(2) Always greater than $\frac{a}{b}$

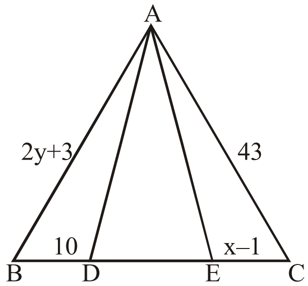
(3) greater than $\frac{a}{b}$ only if $a > b$

(4) Greater than $\frac{a}{b}$ only if $a < b$

244. $\sqrt[2010]{2\sqrt{7}-3\sqrt{3}} \times \sqrt[4020]{55+12\sqrt{21}} = ?$

(1) -1 (2) 1 (3) 0 (4) 2

245. In the given figure, AD = AE $\angle BAD = \angle EAC$, then



(1) x = 11 (2) x = 13 (3) y = 21 (4) y = 11

246. The length 'L' of a tangent, drawn from a point 'A' to a circle is $\frac{4}{3}$ of the radius 'r'. The shortest distance from A to the circle is :

(1) $\frac{1}{2}r$ (2) r (3) $\frac{1}{2}L$ (4) $\frac{2}{3}L$

247. Consider the points A(a, b + c), B(b, c + a), and C(c, a + b) be the vertices of ΔABC. The area of ΔABC is :

(1) $2(a^2+b^2+c^2)$ (2) $\frac{a^2+b^2+c^2}{6}$

(3) 2(ab + bc + ca) (4) None of these

248. The centre of a clock is taken as origin. At 4.30 pm, the equation of line along minute hand is x = 0. Therefore at this instant the equation of the line along the hour hand will be:

(1) x + y = 0 (2) x – y = 2

(3) $y = \sqrt{2}x$ (4) $y = \frac{x}{\sqrt{2}}$

249. A conical vessel of radius 6 cm and height 8 cm is completely filled with water. A metal sphere is now lowered into the water. The size of the sphere is such that when it touches the inner surface, it just gets immersed. The fraction of water that overflows from the conical vessel is :

(1) $\frac{3}{8}$ (2) $\frac{5}{8}$ (3) $\frac{7}{8}$ (4) $\frac{5}{16}$

250. If the eight digit number 2575d568 is divisible by 54 and 87, the value of the digit 'd' is :

(1) 4 (2) 7

(3) 0 (4) 8

251. $\left\{\frac{3\cos 43°}{\sin 47°}\right\}^2 \frac{\cos 37°.\operatorname{cosec}53°}{\tan 5°.\tan 25°.\tan 45°.\tan 65°.\tan 85°} = ?$

(1) 7 (2) 0

(3) 1 (4) 8

252. Which one of the following is a correct statement ?

(1) Dominant trait can be expressed in homozygoul condition only

(2) Recessive trait can be expressed in homozygoul condition only

(3) dominant trait cannot be expressed in heterozygoul condition

(4) Recessive trait cannot be expressed in heterozygoul condition

253. A shopkeeper mixes 80 kg sugar worth of ₹ 6.75 per kg with 120 kg of sugar worth of ₹ 8 per kg. He earns a profit of 20% by selling the mixture. He sells it at the rate

(1) ₹ 7.50 per kg (2) ₹ 9 per kg

(3) ₹ 8.20 per kg (4) ₹ 8.85 per kg

254. A shopkeeper prefers to sell his goods at the cost price but uses a weight of 800 gm instead of 1 kg weight. He earns a profit of

(1) 2% (2) 8% (3) 20% (4) 25%

255. The compound interest on a certain sum for two years is ₹ 618, whereas the simple interest on the same sum at the same rate for two years is Rs. 600. The ratio of interest per annum is

(1) 18% (2) 9% (3) 6% (4) 3%

256. If $x + \frac{1}{x} = 3$, then the value of $x^6 + \frac{1}{x^6}$ is

(1) 927 (2) 114 (3) 364 (4) 322

257. If $\log_{12}27 = a$, then $\log_6 16$ is

(1) $\frac{4(3-a)}{(3+a)}$ (2) $\frac{4(3+a)}{(3-a)}$

(3) $\frac{(3+a)}{4(3-a)}$ (4) $\frac{(3-a)}{4(3+a)}$

258. If the zeros of the polynomial $f(x) = k^2x^2 - 17x + k + 2, (k > 0)$ are reciprocal of each other. then the value of k is

(1) 2 (2) –1 (3) –2 (4) 1

259. A bag contains 20 balls out of which x are black. If 10 more black balls are put in the box, the probability of drawing a black ball is double of what it was before. The value of x is

(1) 0 (2) 5 (3) 10 (4) 40

260. for the distribution

Marks	Number of students
Below 5	10
Below 10	25
Below 15	37
Below 20	57
Below 25	66

the sum of the lower limits of the median class and the model class is

(1) 15 (2) 25 (3) 30 (4) 35

261. The sum of all two digit numbers each of which leaves remainder 3 when divided by 5 is

(1) 952 (2) 999 (3) 1064 (4) 1120

262. If $\cos A + \cos^2 A = 1$, then the value of $\sin^2 A + \sin^4 A$ is

(1) 1 (2) $\frac{1}{2}$ (3) 2 (4) 3

263. In right triangle ABC, BC = 7 cm, AC – AB = 1 cm and $\angle B = 90°$. The value of cos A + cos B + cos C is

(1) $\frac{1}{7}$ (2) $\frac{32}{24}$ (3) $\frac{31}{25}$ (4) $\frac{25}{31}$

264. The angles of elevations of the top of the tower from two points in the same straight line and at a distance of 9 m. and 16 m. from the base of the tower are complementary. The height of the tower is

(1) 18 m (2) 16 m (3) 10m (4) 12m

265. Four circular cardboard pieces. each of radious 7 cm. are placed in such a way that each piece touches the two other pieces. The area of the space enclosed by the four pieces is

(1) $21\ cm^2$ (2) $42\ cm^2$ (3) $84\ cm^2$ (4) $168\ cm^2$

266. $\Delta ABC \sim \Delta PQR$ and $\frac{\text{area } \Delta ABC}{\text{area } \Delta PQR} = \frac{16}{9}$. If PQ = 18 cm and BC = 12 cm. then AB and QR are respectively

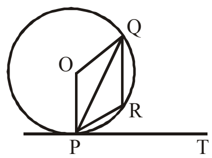
(1) 9 cm, 24 cm (2) 24 cm, 9 cm

(3) 32 cm, 6.75 cm (4) 13.5 cm, 16 cm

267. E and F are respectively, the mid points of the sides AB and AC of Δ ABC and the area of the quadrilateral BEFC is k times the area of Δ ABC. The value of k is

(1) $\frac{1}{2}$ (2) 3 (3) $\frac{3}{4}$ (4) 4

268. In the figure, PQ is a chord of a circle with centre O and PT is the tangent at P such that $\angle$QPT = 70°. Then the measure of $\angle$PRQ is equal to



(1) 135° (2) 150° (3) 120° (4) 110°

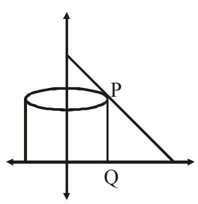
269. AB and CD are two parallel chords of a circle such that AB = 10 cm and CD = 24 cm. If the chords are on the opposite sides of the centre and the distance between them is 17 cm, the radius of the circle is

(1) 14 cm (2) 10 cm (3) 13 cm (4) 15 cm

270. From a 25 cm × 35 cm rectangular cardboard, an open box is to be made by cutting out identical squares of area 25 cm^2 from each comer and turning up the sides. The volume of the box is

(1) 3000 cm^3 (2) 1847 cm^3
(3) 21875 cm^3 (4) 1250 cm^3

271. Let P(4, k) be any point on the line y = 6 – x. If the vertical segment PQ is rotated about y-axis, volume of the resulting cylinder is



(1) 32Π (2) 16Π (3) $\frac{32}{3}\Pi$ (4) 8Π

272. Coordinates of P and Q are (4, – 3) and (–1, 7). The abscissa of a point R on the line segment PQ such that $\frac{PR}{PQ}=\frac{3}{5}$ is

(1) $\frac{18}{5}$ (2) $\frac{17}{5}$ (3) 1 (4) $\frac{17}{8}$

273. A has a pair of triangles with corresponding sides proportional, and B has a pair of pentagons with corresponding sides proportional.

$S_1 \equiv$ A's triangles must be similar

$S_2 \equiv$ B's pentagons must be similar

Which of the following statement is correct?

(1) S_1 is true, but S_2 is not true.
(2) S_2 is true, but S_1 is not true.
(3) Both S_1 and S_2 are true.
(4) Neither S_1 nor S_2 is true

274. ΔABC is an equilateral trinagle of side $2\sqrt{3}$ cms. P is any point in the interior of ΔABC. If x, y, z are the distances of P from the sides of the triangle, then x + y + z =

(1) 2 + $\sqrt{3}$ cms. (2) 5 cms.
(3) 3 cms. (4) 4 cms.

275. ABCD is a squre with side a. With centres A, B, C and D four circles are drawn such that each circle touches externally two of the remaining three circles. Let δ be the area of the region in the interior of the squae and exterior of the circles. Then the maximum values of δ is

(1) $a^2(1-\pi)$ (2) $a^2\left(\frac{4-\pi}{4}\right)$

(3) $a^2(\pi-1)$ (4) $\frac{\pi a^2}{4}$

276. $ax^2 + bx + c = 0$, where a, b, c are real, has real roots if

(1) a, b, c are integers. (2) $b^2 > 3ac$
(3) ac > 0 and b is zero (4) c = 0.

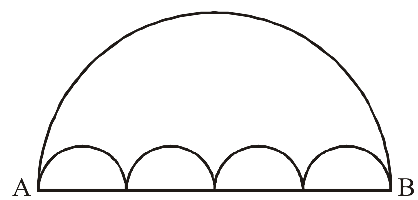
277. An open box A is made from a square piece of tin by cutting equal squares S at the corners and folding up the remaining flaps. Another open box B is made similarly using one of the squares S. If U and V are the volumes of A and B respectively, then which of the following is not possible?

(1) U > V
(2) V > U
(3) U = V
(4) minimum value of U > maximum value of V.

278. There are several human beings and several dogs in a room One tenth of the humans have lost a leg. The total number of feet are 77. Then the number of dogs is

(1) not determinable due to insufficient data
(2) 4
(3) 5
(4) 6

279. All the arcs in the following diagram are semi-circles. This diagram shows two paths connecting A to B. Path I is the single large semi-circle and Path II consists of the chain of small semi-circles.



(1) Path I is longer than path II
(2) Path I is of the same length as Path II
(3) Path I is shorter than Path II
(4) Path I is of the same length as Path II, only if the number of semi circles is not more than 4.

280. $\sqrt{(a-b)^2}+\sqrt{(b-a)^2}$ is

(1) Always zero
(2) Never zero
(3) Positive if and only if a > b
(4) Positive only if a $\neq$ b

281. A solid metal sphere of surface area S_1 is melted and recast into a number of smaller spheres. S_2 is the sum of the surface areas of all the smaller spheres. Then,

(1) $S_1 > S_2$
(2) $S_2 > S_1$
(3) $S_1 = S_2$
(4) $S_1 = S_2$ only if all the smaller spheres of equal radii

Hints SOLUTIONS

1. **(4)** Let us divide the different powers of 4 by 6 and find the remainder.
So remainder for $4^1 = 4, 4^2 = 4, 4^3 = 4, 4^4 = 4, 4^5 = 4, 4^6 = 4$ and so on.
Hence remainder for any power of 4 will be 4 only.

2. **(2)** By division Algorithm,
$49471 = 246 \times D + 25$
$\Rightarrow D = 201$

3. **(2)** Clearly, unit's digit in the given product = unit's digit in $7^{153} \times 1^{72}$.
Now, 7^4 gives unit digit 1.
$\therefore$ 7^{153} gives unit digit $(1 \times 7) = 7$. Also 1^{72} gives unit digit 1.
Hence, unit's digit in the product $= (7 \times 1) = 7$.

4. **(2)** Complete remainder $= d_1r_2 + r_1$
$= 4 \times 4 + 1 = 17$
Now, 17 when divided successively by 5 and 4
$\therefore$ The remainders are 2, 3.

5. **(2)** Number is of the form $= 7n + 3$; $n = 1$ to 13
So, $S = \sum_{n=1}^{13}(7n+3) = 7 \times 13 \times 7 + 39 = 676$

6. **(2)** Unit digit in 7^4 is 1. So, unit digit in 7^{92} is 1.
$\therefore$ Unit digit in 7^{95} is 3.
Unit digit in 3^4 is 1.
$\therefore$ Unit digit in 3^{56} is 1.
$\therefore$ Unit digit in 3^{58} is 9.
$\therefore$ Unit digit in $(7^{95} - 3^{58}) = (13 - 9) = 4$.

7. **(2)** As q is an integer, both p and p' must divide 1148. Now checking the options :
(1) 1148 is divisible by 82 and 28 but does not satisfy (i)
(2) 1148 is divisible by 41 and also by 14. It gives q = 28 and satisfies (i)
(3) 1148 is divisible by 56 and not by 65.
(4) 1148 is also divisible by 28 and 82 but does not satisfy (i).

8. **(1)** From option (b) of previous question, 28 is the quantity sold and the price is Rs 41.
Alternatively : q' = q + 54, which is only possible in case of 28 and 82 as given in options.
$\Rightarrow$ q = 28 and q' = 82. Therefore $p = \frac{1148}{28} = 41$.

9. **(3)** Let the numbers be x and 4x.
Then, $84 \times 21 = x \times 4x$
or $4x^2 = 1764$
or $x^2 = 441$ or $x = 21$
$\Rightarrow$ $4x = 4 \times 21 = 84$
Thus the larger number = 84

10. **(1)** $\frac{\sqrt{5}}{2} - \frac{10}{\sqrt{5}} + \sqrt{125} = \frac{\sqrt{5}}{2} - \frac{10}{\sqrt{5}} + \frac{5\sqrt{5}}{1}$
$= \frac{5 - 20\sqrt{5} + 10 \times 5}{2\sqrt{5}} = \frac{35\sqrt{5}}{10}$
$= 3.5 \times 2.236 = 7 + 3.5 \times 0.236$
$= 7 + 4 \times 0.236 - 0.236 \times 0.5$
$= 7 + 0.944 - 0.118 = 7.826$

11. **(2)** We have, $a = \frac{1}{100}$, $b = \frac{1}{5}$, $c = \frac{1}{10}$
or $a = 0.01$, $b = 0.2$, $c = 0.1$
Thus, $b > c > a$.
Therefore, option (b) is correct.

12. **(3)** The series progresses with following rule :
+ 16, + 18, + 20, + 22.
So, original series will be 56, 72, 90, 110, 132
Hence, 108 is the wrong number.

13. **(2)** Let the length of the piece of cloth be x metres.
Cost price = Rs 35
The price per metre = Rs $\frac{35}{x}$
Now, $(x+4)\left(\frac{35}{x} - 1\right) = 35$
$\Rightarrow x^2 + 4x - 140 = 0 \Rightarrow x = 10\,m$

14. **(1)** Let the number of students in each row is n and the number of row is *r*. Then the number of students in the class will be *nr*.
According to the question,
$(n+4)(r-2) = nr$ ....(1)
and $(n-4)(r+4) = nr$ ....(2)
on simplifying equations (1) and (2), we get the system of equations
$n - 2r + 4 = 0$ $n - r - 4 = 0$
On solving this system, we obtain $r = 8$; $n = 12$
Hence, $nr = 96$

15. **(2)** LCM of 6, 5, 7, 10 and 12 = 420 seconds
$= \frac{420}{60} = 7$ minutes.
Therefore, in one hour (60 minutes), then will fall together 8 times $\left(\frac{60}{7}\right)$ excluding the one at the start.

16. **(2)** $x + y > 5$ .... (i)
$x - y > 3$ .... (ii)
Adding inequations (i) and (ii), we get
$2x > 8$ i.e. $x > 4$

17. **(4)** $(n+1)^2 = n^2 + 2n + 1$

18. **(4)** $6n^2 + 6n = 6(n^2 + n) = 6n(n+1)$
$n(n+1)$ is always divisible by 2, as the product of two consecutive natural numbers is always divisible by 2.
$\Rightarrow$ $(6n^2 + 6n)$ is divisible by 6 and 12.
Hence, option (d) is correct.

19. **(4)** $W = \frac{M}{2}, M - 10 = W + 5$
[where M $\rightarrow$ men, W $\rightarrow$ women]
On solving, we get M = 30, W = 15.
$\therefore$ M + W = 45.

20. **(1)** Let initial number of friends to attend picnic = x.
$\therefore \frac{96}{x} + 4 = \frac{96}{x-4}$ ....(1)
where (x – 4) attended the picnic.
On solving with the help of options from (a) to (d) we find x = 12 suits the equation (1).
Hence the no. of friends who attended the picnic is 8.

21. **(1)** From option (a),
$2^{10} - 2^n = 960 \Rightarrow 1024 - 2^n = 960 \Rightarrow 2^n = 64$
$\therefore$ n = 6.
Similarly we can try for options (b) and (c). Hence, any other option does not satisfy the given equation.

22. **(3)** Cube of a number – Square of another number = 2
By trial and error, $3^3 - 5^2 = 2$
Hence 27 – 25 = 2
$\therefore$ the present age is 26 yrs.
$\therefore$ the age in which he is again a cube of number $= 4^3 = 64$.
$\therefore$ no. of years he must wait = 64 – 26 = 38 yrs.

23. **(3)** Let the total number of packages be x.
After uploading $\frac{2}{5}x$ packages remaining packages are $x - \frac{2}{5}x = \frac{3}{5}x$
According to the question,
When he uploaded another 3 packages then $\frac{1}{2}$ of original no. of packages remained.
$\therefore \frac{3x}{5} - 3 = \frac{x}{2}$
$\Rightarrow \frac{3}{5}x - \frac{1x}{2} = 3$
$\Rightarrow 6x - 5x = 30 \Rightarrow x = 30$
Hence, 30 packages were in the van before the first delivery.

24. **(2)** Seats in executive class = 50
Seats in chair cars = 450
Total booked seats = 425
Booked in executive class = 48
Therefore, seats booked in chair cars = (425 – 48) = 377
Empty seats in chair cars = 450 – 377 = 73

25. **(3)** Let quantity of water to be added be x ml.
Then, $(x + 48) \times \frac{25}{100} = 48$ or x = 144 ml.

26. **(3)** Total numbers of inhabitants = 1000
No. of males = 600
No. of females = 400
Number of literate males = 20% of 600 = 120
Total number of literates = 250
Total number of literate females = 130
$\therefore$ % of female literates $= \frac{130}{400} \times 100 = 32.5$

27. **(2)** Let the original number be 100.
Then, the new number = 100 × 1.1 × 0.9 = 99
i.e. the number decreases by 1%.

28. **(3)** Checking with options, we find that after 13 years, population of the village A = 6800 – 120 × 13 = 5240
And that of village B = 4200 + 80 × 13 = 5240

29. **(1)** We have, $(8\frac{1}{2} - 5)\%$ of x = Rs 350
$\Rightarrow$ 100% of $x = \frac{350}{3.5} \times 100$ = Rs 10000

30. **(3)** $\left.\begin{array}{l}20\% \text{ of } 75\% = 15\% \\ 80\% \text{ of } 25\% = 20\%\end{array}\right] \longrightarrow 35\%$ temporary.
$\therefore$ Total workers $= \frac{126}{35} \times 100 = 360$

31. **(1)** Let A lent Rs. x and B lent Rs. y
Since, A and B together lent out Rs. 81600
$\therefore$ x + y = 81,600
Now, given (r) Rate = 4%
$\therefore 1 + r = 1 + \frac{4}{100} = \frac{26}{25}$
According to the question, we have
$\frac{x}{y} = \left(\frac{26}{25}\right)^{3-2} = \frac{26}{25}$
$\therefore$ Investment made by B $= 81600 \times \frac{25}{51} = 40,000$

32. **(1)** Suppose her income is 5. So his expenditure after 12% increase becomes 3.36 and income after 10% increase becomes 5.5. Net increase in saving is 0.14. So percentage increase in savings is 7 per cent.

33. **(2)** Surface area with side 4 cm = $6 \times 4^2 = 96\ cm^2$
Now, surface area with side 1 cm = $6 \times 1^2 = 6\ cm^2$
Decrease = 96 – 6 = 90 cm^2
Decrease % $= \frac{90}{96} \times 100 = 94\%$

34. **(1)** Let the cost price be Rs x.
Then, SP at a loss of 19% = 0.81x.
Now, x × 1.17 = (0.81x + 162)
$\Rightarrow 1.17x - 0.81x = 162 \Rightarrow$ x = Rs 450

35. **(3)** Successive discounts of 10% and 20% on Rs 100
= Rs 100 × 0.9 × 0.8 = Rs 72
Alternatively :
Single discount $= 10 + 20 - \frac{10 \times 20}{100}$
= 30 – 2 = 28%
Therefore, the single discount = (100 – 72) = 28%

36. **(3)** Let the cost price be Rs 100.
Gain of 33% = Rs 33
$\Rightarrow$ SP = Rs 133
Let the marked price be Rs x. The SP of Rs 133 has been arrived after giving a discount of 5% on marked price.
i.e. x × 0.95 = Rs 133
$\Rightarrow x = \frac{133}{0.95}$ = Rs.140
Required increase = Rs 140 – Rs 100 = Rs 40
Hence required percentage = 40%.

$\therefore \quad x + 7\%$ of $x = 2568$

$$\Rightarrow x + \frac{7x}{100} = 2568 \Rightarrow x = 2400$$

Therefore, reduction required in the price of radio

$= (2568 - 2400) = $ Rs 168

38. **(4)** If any two transactions of SP is the same and also gain % and loss % are same then there is always a loss

$$\therefore \text{loss}\% = \left(\frac{\text{Common gain or loss\%}}{10}\right)^2 = \left(\frac{10}{10}\right)^2 = 1\%$$

39. **(1)** Let the cost price of geyser be Rs x. Then $x \times 1.1 \times 1.15 \times 1.25 = $ Rs 1265

$$\Rightarrow x = \frac{1265}{1.58125} = \text{Rs}.800$$

40. **(1)** Let the CP of the article be Rs x.

Then, SP = Rs $\frac{105x}{100}$

Now, new CP = Rs $\frac{95x}{100}$ and new SP = $\frac{105x}{100} - 1$

According to the question

$$\frac{105x}{100} - 1 - \frac{95}{100} = \frac{10 \times 95x}{100 \times 100}$$

$\therefore$ x = Rs 200

41. **(3)** Let the quantity of two varieties of tea be 5x kg and 4x kg, respectively.

Now, SP $= 23 \times 9x = 207x$

and CP $= 20 \times 5x + 25 \times 4x = 200x$

$$\text{Profit}\% = \frac{7x}{200x} \times 100 = 3.5\%$$

42. **(2)** The first type of alloy does not contain tin. Second type alloy contains tin. Therefore, quantity of tin in 2 units of the resulting alloy $= \frac{5}{13}$

$\Rightarrow$ Quantity of tin in 1 unit of the resulting alloy

$$= \frac{\frac{5}{13}}{2} = \frac{5}{26}$$

43. **(2)** Total weight of 45 students

$= 45 \times 52 = 2340$ kg

Total weight of 5 students who leave

$= 5 \times 48 = 240$ kg

Total weight of 5 students who join

$= 5 \times 54 = 270$ kg

Therefore, new total weight of 45 students

$= 2340 - 240 + 270 = 2370$

$\Rightarrow$ New average weight $= \frac{2370}{45} = 52\frac{2}{3}$ kg

44. **(2)** Let A, B and C be the first, second and third nos. respectively.

Then, $A : B = 2 : 3$ and $B : C = 5 : 8$

Consider, $A : B = 2 : 3 = 2 \times 5 : 3 \times 5 = 10 : 15$

$\therefore \quad A : B : C = 10 : 15 : 24$

Let the required number be $10x$, $15x$ and $24x$.

Given, sum of three numbers = 98

Then,

$\therefore \quad 10x + 15x + 24x = 98$

$\Rightarrow 49x = 98 \Rightarrow x = 2$

$\Rightarrow$ Second number $= 15x = 15 \times 2 = 30$

45. **(1)** Let the three numbers be x, y and z

$\therefore$ From given conditions, $x = 2y = 3z$

$$\Rightarrow y = \frac{x}{2} \qquad \text{and } z = \frac{x}{3}$$

Given, Average of these three nos. is 44

$$\therefore \frac{x + \frac{x}{2} + \frac{x}{3}}{3} = 44 \Rightarrow \frac{11x}{18} = 44 \Rightarrow x = 72$$

46. **(3)** Let the third type of tea is priced at Rs x per kg. Also suppose that the three types of tea mixed together are l, l and 2 kg, respectively.

$$\text{Now, } \frac{126 \times 1 + 135 \times 1 + 2x}{1 + 1 + 2} = 153$$

$$\Rightarrow \frac{261 + 2x}{4} = 153 \qquad \Rightarrow 261 + 2x = 612$$

$$\Rightarrow x = \frac{351}{2} = \text{Rs } 175.5 \text{ per kg.}$$

47. **(4)** Let the income of two persons be Rs 4x and Rs 5x

Let their expenses be Rs 7y and Rs 9y

$\therefore$ Saving $= 4x - 7y = 50$ .... (i)

and $5x - 9y = 50$ .... (ii)

on solving (i) and (ii), we get

$x = 100$ and $y = 50$

Thus, the income of the two persons are Rs 400 and Rs 500, respectively.

48. **(1)** Sum of 11 numbers $= 11 \times 10.9 = 119.9$

Sum of first 6 numbers $= 6 \times 10.5 = 63$

Sum of last 6 numbers $= 6 \times 11.4 = 68.4$

The middle number = Sum of the first six + Sum of the the last six – Sum of all the 11

$= 63 + 68.4 - 119.9$

$= 11.5$

49. **(3)** Let the total homework of Bio = 1

Homework done on Monday Night $= 1 \times \frac{3}{5} = \frac{3}{5}$

Homework done on Tuesday Night $= \left(1 - \frac{3}{5}\right) \times \frac{1}{3} = \frac{2}{15}$

$\therefore$ Homework done on wednesday Night

$$= 1 - \left(\frac{3}{5} + \frac{2}{15}\right)$$

$$= 1 - \frac{11}{15} = \frac{4}{15}$$

50. **(1)** Volume of the cube $= 10 \times 10 \times 10 = 1000\ cm^3$

Area of the sheet $= \frac{1000}{0.5} = 2000 cm^2$

Let the sides be x and 5x.

$\Rightarrow x \times 5x = 2000 \qquad \Rightarrow 5x^2 = 2000$

$\Rightarrow x^2 = 400 \Rightarrow x = 20$ cm

$\therefore$ Sides are 20 cm and 100 cm

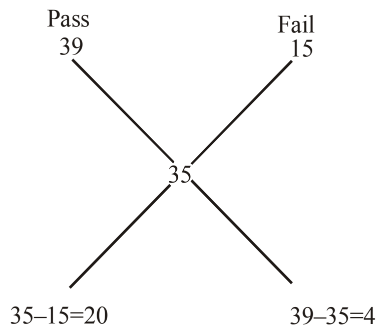
51. **(2)** Weight of dry grapes without water

$= 250 \times \frac{90}{100} = 225$ kg

Let weight of fresh grapes be x kg.
According to question,

$x \times \frac{20}{100} = 225 \Rightarrow x = \frac{225 \times 100}{20} = 1125$ kg

52. **(3)**



∴ Required ratio = 20 : 4 = 5 : 1
∴ Number of passed candidates

$= \frac{5}{(5+1)} \times 120 = 100$

53. **(3)** From the second condition all have the same amount = x (say)
i.e., Atul = x
Jai = x
and Robin = x
Thus, initially, Atul have x + 40, Robin have x – 40
Now using first condition,
$\Rightarrow$ Robin = x – 40 + 40, Jai = x – 40, Atul = x + 40
and thus, Jai $\Rightarrow$ x = 120
∴ Total = 3x = Rs 360

54. **(4)** Sumit's age = 8 years
Dolly's age = 8 – 4 = 4 years
Sonu's age = 4 × 5 = 20 years
Manu's age = 20 + 4 = 24 years

Hence, Manu's age is $\left(\frac{24}{6} = \right)$ 6 times old as Dolly's age.

55. **(3)** Let the distance between the school and the home be xkm.

Then, $\frac{x}{8} - \frac{2.5}{60} = \frac{x}{10} + \frac{5}{60}$ or $\frac{x}{8} - \frac{x}{10} = \frac{5}{60} + \frac{2.5}{60}$

or $\frac{2x}{80} = \frac{7.5}{60}$ or $x = \frac{7.5 \times 80}{2 \times 60} = 5$ km

56. **(3)** Relative speed of the cyclists = (8 – 7) = 1 m/s
Distance = 300 m

Time taken to cover this distance $= \frac{300}{1} = 300$ s

57. **(1)** The clock gains 15 min in 24 hours.
Therefore, in 16 hours, it will gain 10 minutes.
Hence, the time shown by the clock will be 4.10 am.

58. **(3)** Part of the tank filled in one hour $= \frac{1}{8} - \frac{1}{16} = \frac{1}{16}$

Hence, the tank will be filled in 16 hours.

59. **(3)** Relative speed of the trains = (40 + 20) = 60 m/s
Distance = (120 + 120) = 240 m
Time taken by trains to cross each other completely

$= \frac{240}{60} = 4$s

∴ Larger the no. of cogs (tooth of wheel) of wheel, lesser will be that no. of revolution made by it.

60. **(3)** Let the speed of trains be x km/h and y km/h, respectively.
When the trains cross each other, time taken by both the trains will be equal.

i.e. $\frac{110}{x} = \frac{90}{y} \Rightarrow \frac{x}{y} = \frac{110}{90} \Rightarrow x : y = 11 : 9$

61. **(2)** Let Sunil finishes the job in x hours.

Then, Ramesh will finish the job in $\frac{x}{2}$ hours.

We have, $x - \frac{x}{2} = 3 \Rightarrow x = 6$

Therefore, Sunil finishes the job in 6 hours and Ramesh in 3 hours.

Work done by both of them in 1 hour $= \frac{1}{6} + \frac{1}{3} = \frac{1}{2}$

They together finish the piece of work in 2 hours.

62. **(1)** Let originally there were x men in the group.
Therefore, (x – 12) men did the job in 32 days.
$\Rightarrow$ 20x = 32 (x – 12) or x = 32

63. **(2)** Let the usual speed be v and time taken be t. If new speed $= \frac{3}{4}$v, then new time would be $\frac{4}{3}$t $\left(\because s \propto \frac{1}{t}\right)$

We have, $\frac{4}{3}t - t = 20$ or $\frac{t}{3} = 20$

or t = 60 min = 1 hour

64. **(3)** Let the leak empties the tank in x hours.

Now, $\frac{1}{5} - \frac{1}{x} = \frac{1}{6}$ or $\frac{1}{x} = \frac{1}{5} - \frac{1}{6} = \frac{1}{30}$ or x = 30 hrs.

65. **(2)** As we know that, $M_1 \times T_1 \times W_2 = M_2 \times T_2 \times W_1$

$\Rightarrow 600 \times \frac{1}{2} \times x \times 10 \times 8 = 5.5 \times 4 \times 405 \times 2500 \times 6$

$x = \frac{133650000}{24000} = 5568\frac{3}{4}$ m

66. **(3)** Let the normal speed = x km/h
Then, the new speed = (x + 5) km/h.

Now, $\frac{300}{x} - 2 = \frac{300}{(x+5)}$ or $\frac{300}{x} - \frac{300}{(x+5)} = 2$

Checking with options, we see that x = 25 km/h.

67. **(2)** Let the length of the bridge be x m.

Now, $(x + 100) = 72 \times 25 \times \frac{5}{18} = 500$

$\Rightarrow$ x = 500 – 100 = 400 m

68. (3) Let the speed of the car be x km/h.

$\Rightarrow$ Speed of the train = x × 1.2x = $\frac{6x}{5}$ km/h

Now, $\frac{5}{6x}\times 75+\frac{25}{2\times 60}=\frac{75}{x}$

or $x=\frac{75\times 2\times 60}{6\times 25}=60\text{ km/h}$

69. (1) A covers 3.5 km before he meets B in

$(18\times 3.5+3)=66\text{ min}=\frac{66}{60}=\frac{11}{10}\text{h}$

Now, B covers a distance of 5.5 km in $\frac{11}{10}$ hours

$\Rightarrow$ B's speed = $\frac{11}{2}\times\frac{10}{11}=5\text{ km/h}$

70. (4) After one day, the proportion of the contents left = $\left(1-\frac{1}{3}\right)=\frac{2}{3}$

On the second day the proportion of the contents evaporated = $\frac{2}{3}\times\frac{3}{4}=\frac{6}{12}$

Proportion of the contents left after the second day = $\frac{2}{3}-\frac{6}{12}=\frac{8-6}{12}=\frac{2}{12}=\frac{1}{6}$

71. (1) Let the length of each train be x metres.
Then, the total distance covered = (x + x) = 2x m

Relative speed = (46 – 36) = 10 km/h = $\frac{10\times 5}{18}$ m/s

Now, $36=\frac{2x\times 18}{50}$

or x = 50 m

72. (2) Due to stoppges the train travels (45 – 36) = 9 km less in an hour than it could have travelled without stoppages.

Thus train stops per hour for $\frac{9}{45}\times 60=12$ min

73. (2) $\left(3\times 1\frac{1}{4}\right)+2\frac{1}{4}=\frac{3\times 5}{4}+\frac{9}{4}=6$ inches

74. (2) Let the speed of the boat in still water be x km/hr
Speed of the stream = 2 km/ hr
∴ Speed of the boat downstream = (x + 2) km/hr
Speed of the boat upstream = (x – 2) km/hr

$\therefore \frac{8}{x+2}+\frac{8}{x-2}=1\frac{2}{3}=\frac{5}{3}$

$\Rightarrow 24x-48+24x+48=5(x^2-4)$

$\Rightarrow 5x^2-48x-20=0$

$\Rightarrow x=\frac{48\pm\sqrt{2304+400}}{10}=\frac{48\pm 52}{10}$

= 10, – 0.4 (Rejecting –ve value)

75. (3) Let the speed of the fast train = x km/hr.
∴ the speed of the slow train = $(x-10)$ km/hr.

According to the question, $\frac{600}{x-10}-\frac{600}{x}=3$

$\Rightarrow$ x = 50, – 40 (– 40 is not admissible)
∴ x = 50
∴ The speeds of the two trains are 40km/hr and 50 km /hr.

76. (4) Ship will get 3.75 × 5 – 12 = 6.75 tonnes of water in 1 hr.

Time to admit 60 tonnes of water $\frac{60}{6.75}$ hrs

∴ Required speed $=\frac{40\times 6.75}{60}=4\frac{1}{2}\text{ km/h}$

77. (2) Distance covered = 187.5m, Time = 9 secs

Relative speed = $\frac{187.5}{9}\times\frac{3600}{1000}$ = 75 km/hr

As the trains are travelling in opposite directions, speed of goods train = 75 – 50 = 25 km/hr.

78. (1) Let, time taken by bus in the journey = t hours
Then, time taken by train in the journey = (6 – t) hours
Now,
$40\times t+55(6-t)=285$
$40t+330-55t=285$
$15t=45 \Rightarrow t=3$
Hence, distance travel by train = 3 × 55 = 165 km

79. (3) The speed against the current of the stream = 2 km (in 1 hr)
The speed along the current of the stream

= 1km (in 10 min) = $\frac{1\times 60}{10}$ (in 1 hr) = 6 km (in 1 hr)

∴ Speed in stationary water = 6 – 2 = 4 km
Thus, speed in stationary water = 4km and distance = 5 km

As, we know, Time = $\frac{\text{Distance}}{\text{Speed}}$

∴ Time taken to cover the distance 5 km

$=\frac{5}{4}$ hour = 75 min

= 60 min + 15 min = 1 hour 15 minutes

80. (3) Let speed of water in pipe = 20 cm/sec.
Area of cross – section = 5 cm^2.
∴ Volume of water in 60 second
= 60 × 100 cm^3
= 6000 cm^3
≈ 6 litre
(∵ 1 litre = 1000 cm)

81. (3) Let the speed of train be x km/hr and the speed of second person be y km/hr.
Then, according to the question, we have

$(x-6)\times\frac{15}{2\times 60\times 60}=\frac{75}{1000}$

$\Rightarrow x-6=36 \Rightarrow x=42$ ...(1)

and $(x-y)\times\frac{27}{4\times 60\times 60}=\frac{75}{1000}$

$\Rightarrow x-y=40$
From (1), 42 – y = 40 $\Rightarrow$ y = 2.
Hence, speed of second person = 2 km/hr.

82. **(3)** 10 men finishes a work in 10 days
and 12 women finishes in 10 days.
$\therefore$ 10 men and 12 women finishes a work in 10 days
$\therefore$ 15 men and 6 women will complete the work in

$$\frac{10\times10\times12}{10\times6+15\times12}$$ days i.e, in 5 days.

83. **(3)** Average speed $=\frac{\text{Total distance}}{\text{Total time}}$

$$=\frac{400\times4\times9}{88+96+89+87}=\frac{400\times36}{360}=40$$

84. **(4)** Train takes 20 seconds to cover its length and 36 seconds to cross the platform, it mean it has taken 16 second at 54 km/hr to cross the length of platform.

$\therefore$ Length of the platform
$=$ Distance $\times$ Time
$= 54\times16$ km / hr

$= 54\times16\times\frac{5}{18}$ m/sec

$= 240$ m.

85. **(3)** Time taken to cross a pole $=\frac{50}{1000}\times\frac{1}{45}$ hr

$\therefore$ No. of counts $=\frac{4\times1000\times45}{50}=80\times45=3600.$

86. **(4)** Let speed of car = x km / hr
Let speed of pedestrian = y = 2km / hr
$\therefore$ Relative speed = (x – 2) km / hr
$\therefore$ According to the question,

$$(x-2)\times\frac{6}{60}=0.6\Rightarrow x-2=6\Rightarrow x=8\text{ km / h}$$

87. **(2)** $a^x=b, b^y=c$ and $c^z=a$

$\Rightarrow a^x b^y c^z = abc$
On comparing the powers of *a, b, c* we get $x = 1, y = 1$ and $z = 1 \Rightarrow xyz = 1$

ALTERNATIVE:
Given $a^x = b$
Taking logarithm both sides, we get

$$x\log a=\log b\Rightarrow x=\frac{\log b}{\log a}$$

Similarly, we can determined that

$$y=\frac{\log c}{\log b}, z=\frac{\log a}{\log c}$$

$$\therefore\ xyz=\frac{\log b}{\log a}\times\frac{\log c}{\log b}\times\frac{\log a}{\log c}=1$$

88. **(2)** Using $(a+b)^3=a^3+b^3+3ab(a+b)$

$$\left(x+\frac{1}{x}\right)^3=x^3+\frac{1}{x^3}+3\left(x+\frac{1}{x}\right)$$

$$\Rightarrow (5)^3=\left(x^3+\frac{1}{x^3}\right)+15$$

or $x^3+\frac{1}{x^3}=125-15=110$

89. **(3)** Sum of roots = 2 – 15 = – 13
Product of roots = 2 × (– 15) = – 30
Required equation

$= x^2 - x$ (sum of roots) + product of roots = 0

$\Rightarrow x^2+13x-30=0$

90. **(3)** $x\propto\frac{1}{y}\Rightarrow x=\frac{k}{y}$

Where *k* is a proportionality constant.
When $x = 12, y = 9$,
Now, $k = xy \Rightarrow k = 12\times9 = 108$
Similarly, when $x = 18$ and $y = 6$
When $x = 24$ and $y = 4.5$
Therefore, option (3) is incorrect.

91. **(3)** Let father's, mother's and daughter's present age be F, M, D respectively.
We have, F = M + 5, M = 3D and D = 10
$\Rightarrow$ M = 3 × 10 = 30 years and F = 30 + 5 = 35 years
The father's age at the time of birth of the daughter
= 35 – 10 = 25 years

92. **(2)** Let the present age of the son be *x* years, then
x = 38 – x or x = 19 years
Five years back, son's age = x – 5 = 19 – 5 = 14 years

93. **(3)** Let the two digit number be $10x + y$
We have $x + y = 15$ ....(i)
and $(10x + y) + 9 = (10y + x)$ or $9x - 9y = -9$
or $x - y = -1$ .... (ii)
From (i) and (ii) $x = 7$ and $y = 8$
The number is 10 × 7 + 8 = 78

94. **(1)** $\frac{P+Q}{P-Q}=\frac{\frac{P}{Q}+1}{\frac{P}{Q}-1}=\frac{7+1}{7-1}=\frac{8}{6}=\frac{4}{3}$

95. **(1)** Let A's, B's and C's ages be A, B and C respectively at present.

We have, $A=\frac{1}{6}B$ ....(i)
Present age of C = 10 years
And, (B + 10) = 2(C + 10) ....(ii)
From (ii), B + 10 = 40 or B = 30
$\Rightarrow$ From (i), we have A = 5 years.

96. **(3)** a + b = 24 and a – b = 8
$\Rightarrow$ a = 16 and b = 8 $\Rightarrow$ ab = 16 × 8 = 128
A quadratic equation with roots a and b is

$x^2-(a+b)x+ab=0$ or $x^2-24x+128=0$

97. **(2)** We have, $\left(a+\frac{1}{a}\right)^2=3$

Now, $a^3+\frac{1}{a^3}=\left(a+\frac{1}{a}\right)^3-3\left(a+\frac{1}{a}\right)$

$$=\left(a+\frac{1}{a}\right)\left[\left(a+\frac{1}{a}\right)^2-3\right]=\left(a+\frac{1}{a}\right)[3-3]=0$$

98. (2) Let the first term and common difference of the AP be a and d, respectively.
Now, $(a + 5d) + (a + 14d)$
$= (a + 6d) + (a + 9d) + (a + 11d)$
or $2a + 19d = 3a + 26d$
or $a + 7d = 0$
i.e. 8^{th} term is 0.

99. (2) $\frac{1}{2}\log_{10} 25 - 2\log_{10} 3 + \log_{10} 18$

$= \log_{10}(25)^{1/2} - \log_{10}(3)^2 + \log_{10} 18$

$= \log_{10} 5 - \log_{10} 9 + \log_{10}(9 \times 2)$

$= \log_{10} 5 - \log_{10} 9 + \log_{10} 9 + \log_{10} 2$

$= \log_{10} 5 + \log_{10} 2 = \log_{10}(5 \times 2)$

$= \log_{10} 10 = 1$

100. (2) $|a - b| = |8| = 8 \Rightarrow \quad |b - a| = |-8| = 8$

$\Rightarrow \quad |a - b| - |b - a| = 8 - 8 = 0$

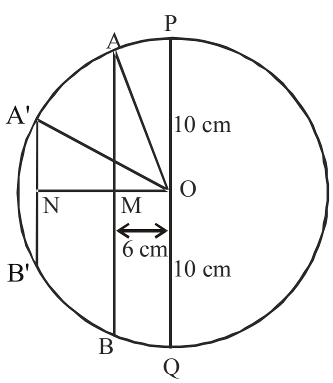
101. (3) Converting the ages into months, we get
Youngest member's age = 84 months = a (say)
Common difference = d = 3 months
Sum of all the ages = S = 250 × 12 months

$\therefore$ Applying $S = \frac{n}{2}[2a + (n-1)d]$
where n be the no. of members.
Putting the values of S, a, d, we get n = 25.
Hence, there are 25 members in the club.

102. (4) Let the actual number of rows and number of students in each row be R and N respectively. According to the question, $(N + 4)(R - 2) = (N - 4)(R + 4)$ ....(i)
And $nR = 96$ (Using (d) part) ....(ii)
Solving (i) & (ii), we get, n = 12, R = 8
Hence, option (4) is correct

103. (3) Solve through options, $2 = (-1)^2 + (0)^2 + (1)^2$

104. (1)



In a triangle ΔAMO,

$AM = \sqrt{(10)^2 - (6)^2} = 8$

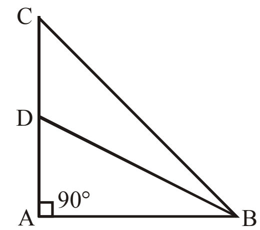
Therefore, the length of the another chord A'B′ = 8 cm.
Now, $A'N = 4$
In $\Delta OA'N$,

$ON^2 = (OA')^2 - (A'N)^2 = 10^2 - 4^2 = 100 - 16 = 84$

$\Rightarrow ON = \sqrt{84}$

105. (3) Locus is the perpendicular bisector of the line segment joining the two fixed points.

106. (3) We have, $AD = \frac{1}{2}AC$
(since D is the midpoint of side AC)



In a ΔABC and ΔABD, $BC^2 = AB^2 + AC^2$
and $BD^2 = AB^2 + AD^2$
Therefore, $BC^2 - BD^2$
$= AB^2 + AC^2 - AB^2 - AD^2 = AC^2 - AD^2$
$= (AC - AD)(AC + AD) = (2AD - AD)(2AD + AD)$
$= AD \times 3AD = 3AD^2$

107. (3) We have,
$\angle OBC = \angle OCB = 37°$
(equal angles of an isosceles triangle)
$\Rightarrow \angle COB = 180° - (37° + 37°) = 106°$

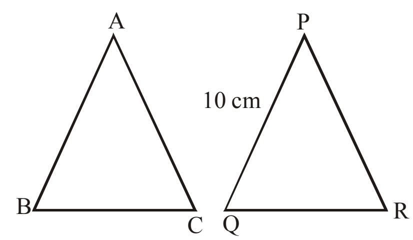
Therefore, $\angle BAC = \frac{1}{2}\angle COB = \frac{106°}{2} = 53°$

108. (3) Let n be the number of sides of the polygon.
As we know that in a regular polygon of n sides, the sum of interior angles and sum of exterior angles are $(2n - 4)\frac{\pi}{2}$ and 2π respectively.
Now, sum of interior angles = 8 × sum of exterior angles

i.e. $(2n - 4) \times \frac{\pi}{2} = 8 \times 2\pi$

or $(2n - 4) = 32$ or $n = 18$

109. (4)



ΔABC and ΔPQR are similar.

$\frac{AB}{PQ} = \frac{\text{Perimeter of } \Delta ABC}{\text{Perimeter of } \Delta PQR}$

$\Rightarrow \frac{AB}{PQ} = \frac{36}{24}$ or $AB = \frac{36}{24} \times 10 = 15$

110. (1) For the two similar triangles, we have

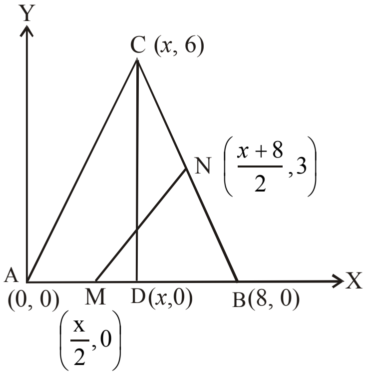
$\frac{h_1^2}{h_2^2} = \frac{\text{Area of 1st } \Delta}{\text{Area of IInd } \Delta} = \frac{9}{16} \Rightarrow h_1 : h_2 = 3 : 4$

111. (4) We know that
$PC \times PD = PA \times PB$

$\Rightarrow PB = \frac{28}{8} = 3.5\,\text{cm}$

Therefore, $AB = AP - BP = 8 - 3.5 = 4.5$ cm

112. (4)

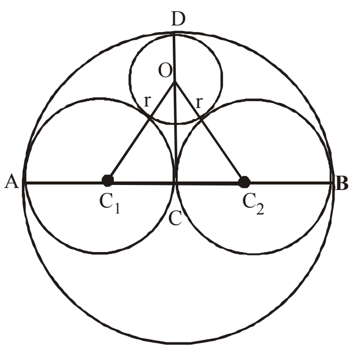


Let AD = x. Co-ordinates of all the points are as shown in the figure above. Now, required distance = MN

$$= \sqrt{\left(\frac{x}{2} - \frac{x+8}{2}\right)^2 + (0-3)^2}$$

$$= \sqrt{4^2 + 3^2} = \sqrt{16+9} = \sqrt{25} = 5\,\text{cm}$$

113. (3)



In ΔOCC_1, we have

$(OC_1)^2 = (OC)^2 + (CC_1)^2$

or $(r+1)^2 = (DC - OD)^2 + 1$

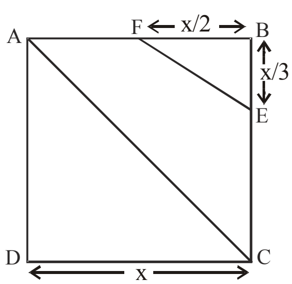
or $(r+1)^2 = (2-r)^2 + 1$

or $r^2 + 1 + 2r = 4 + r^2 - 4r + 1$

or $6r = 4$ or $r = \frac{2}{3}$

114. (2) Let the side of the square be x, then

$BE = \frac{x}{3}$ and $BF = \frac{x}{2}$



Area of $\Delta FEB = \frac{1}{2} \times \frac{x}{3} \times \frac{x}{2} = \frac{x^2}{12}$

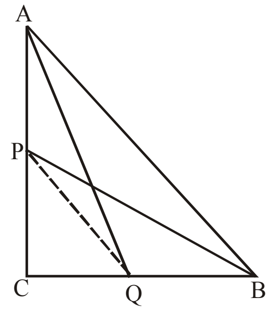
Now, $\frac{x^2}{12} = 108 \Rightarrow x^2 = 108 \times 12 = 1296$

In ΔADC, we have $AC^2 = AD^2 + DC^2$

$= x^2 + x^2 = 2x^2$

$= 2 \times 1296 = 2592$ or $AC = \sqrt{2592} = 36\sqrt{2}$

115. (2)



In ΔAQC, we have

$AQ^2 = AC^2 + CQ^2$ .... (i)

In ΔPCB,

$BP^2 = PC^2 + CB^2$ .... (ii)

From (i) + (ii),

$AQ^2 + BP^2 = AC^2 + CQ^2 + PC^2 + CB^2$

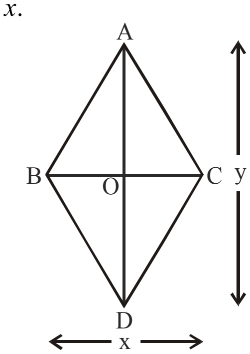
$= (AC^2 + CB^2) + (CQ^2 + PC^2)$

$= AB^2 + PQ^2 = AB^2 + \left(\frac{1}{2}AB\right)^2$

or $AQ^2 + BP^2 = \frac{4AB^2 + AB^2}{4}$

or $4(AQ^2 + BP^2) = 5AB^2$

116. (1) Let the diagonals of the rhombus be x and y and the its sides be x.



Now, $x^2 = \left(\frac{x}{2}\right)^2 + \left(\frac{y}{2}\right)^2$

or $x^2 - \frac{x^2}{4} = \frac{y^2}{4}$

or $3x^2 = y^2$

or $\frac{x}{y} = \frac{1}{\sqrt{3}}$

or $y : x = \sqrt{3} : 1$

117. (2) Let the common base be x m.

Now, area of the triangle = area of the parallelogram

$$\frac{1}{2} \times x \times Altitude = x \times 100$$

$\therefore$ Altitude of the triangle = 200 m

118. (2) Let the radius of park I = $\frac{16}{2} = 8m$

and radius of park II = $\frac{12}{2} = 6m$

$\therefore$ Area of park I = $\pi \times 8 \times 8$
$= 64\pi\ m^2$,

and Area of park II = $\pi \times 6 \times 6 = 36\pi\ m^2$

Let us assume Area of new park = πr^2

Since, new park occupies the same space as the two small parks. Therefore,

Area of I + Area of II = Area of new park

$64\pi + 36\pi = \pi r^2$

$100 = r^2 \Rightarrow r = 10\ m$

119. (1) Let width of the field = b m

$\therefore$ length = 2 b m

Now, area of rectangular field = $2b \times b = 2b^2$

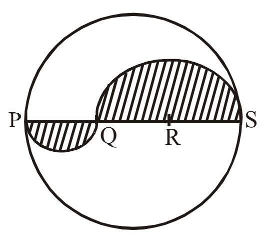
Area of square shaped pond = $8 \times 8 = 64$

According to the question,

$$64 = \frac{1}{8}(2b^2) \Rightarrow b^2 = 64 \times 4 \Rightarrow b = 16m$$

$\therefore$ length of the field = $16 \times 2 = 32$ m

120. (1) PS = Diameter = $2r$



Therefore, $PQ = QR = RS = \frac{2r}{3}$

Perimeter of the shaded region

$$= \overline{PQ} + \overline{QS} = \frac{1}{2}\left(2\pi \times \frac{r}{3}\right) + \frac{1}{2}\left(2\pi \times \frac{2r}{3}\right)$$

$$= \frac{\pi r}{3} + \frac{2\pi r}{3} = \pi r$$

121. (4) Let the length and breadth of the rectangle be x and y cm, respectively.

Then, $(x-4)(y+3) = xy$

$\Rightarrow 3x - 4y = 12$ .... (i)

Also, $(x-4) = (y+3)$ [sides of square]

$\Rightarrow x - y = 7$ .... (ii)

From (i) and (ii),

$x = 16$ and $y = 9$

Perimeter of the original rectangle = $2(x+y) = 50$ cm

122. (2) Volume of the sphere = volume of the water displaced.

Let the required height to which the level of water rises be h.

Then, $\pi r_1^2 h = \frac{4}{3}\pi r_2^3 \Rightarrow 16h = \frac{4 \times 27}{3} \Rightarrow h = \frac{9}{4}$ cm

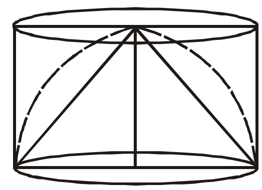
123. (2) We have,

radius of the hemisphere = raidus of the cone

= height of the cone = height of the cylinder

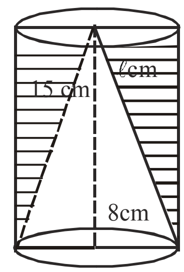
= r (say)

Then, ratio of the volumes of cylinder, hemisphere and cone



$$= \pi r^3 : \frac{2}{3}\pi r^3 : \frac{1}{3}\pi r^3 \qquad = 1 : \frac{2}{3} : \frac{1}{3} = 3 : 2 : 1$$

124. (1) $\ell = \sqrt{15^2 + 8^2} = 17$ cm



Total surface area of the remaining solid (Shaded portion)

$= 2\pi rh + \pi r^2 + \pi r\ell = 2\pi \times 8 \times 15 + \pi(8)^2 + \pi \times 8 \times 17$

$= 240\pi + 64\pi + 136\pi = 440\pi\ cm^2$

125. (2) Volume of the spherical ball = volume of the water displaced.

$$\Rightarrow \frac{4}{3}\pi r^3 = \pi(12)^2 \times 6.75$$

$$\Rightarrow r^3 = \frac{144 \times 6.75 \times 3}{4} = 729 \Rightarrow r = 9\text{ cm},$$

126. (4) Let the radius be $4x$ and height be $3x$.

Now the required ratio

$$= \frac{2\pi rh + 2\pi r^2}{\pi r\ell + \pi r^2} = \frac{2(h+r)}{\sqrt{r^2+h^2}+r}$$

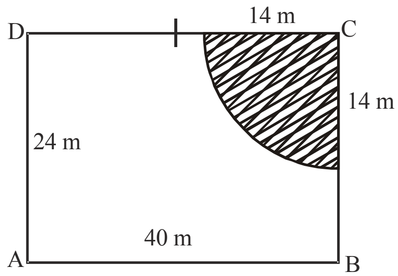
($\because \ell$ = slant height = $\sqrt{h^2+r^2}$)

$$= \frac{2(7x)}{\sqrt{16x^2+9x^2}+4x} = \frac{14x}{5x+4x} = \frac{14x}{9x} = \frac{14}{9}$$

127. (3) Let the radius of the sphere be r cm.

Then, $\frac{\frac{4}{3}\pi r^3}{4\pi r^2} = 27 \Rightarrow r = 27 \times 3 = 81$cm.

128. (1)



Area of the shaded portion $= \frac{1}{4} \times \pi (14)^2 = 154 \text{ m}^2$

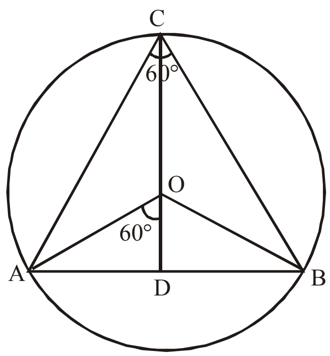
129. (3) Height of the cone = 10 cm ; Radius = 5 cm

$\therefore$ Required volume $= \frac{1}{3} \times \pi \times r^2 \times h = \frac{1}{3} \times \frac{22}{7} \times 25 \times 10$

$= 261.9 \text{ cm}^3$

130. (2) In ΔOAD

$$\sin 60° = \frac{AD}{AO} = \frac{6}{AO} \Rightarrow \frac{\sqrt{3}}{2} = \frac{6}{AO}$$



$$\Rightarrow AO = \frac{12}{\sqrt{3}} = 4\sqrt{3} \text{ cm}$$

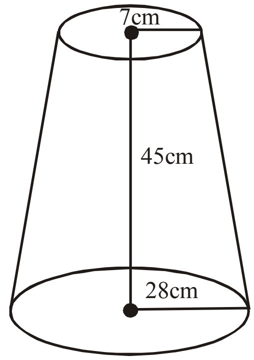
131. (3) Circumference of the circle = Perimeter of the rhombus.
Let a side of the rhombus be x cm.

We have, $2 \times \frac{22}{7} \times 35 = 4 \times x$

$\Rightarrow$ side of the rhombus $= x = \frac{2 \times 22 \times 5}{4} = 55 \text{ cm}$

132. (1) Let the length = x, breadth = $2x$ and height = $4x$
Then, area of the box = $2(lb + bh + hl)$
$= 2(2x^2 + 8x^2 + 4x^2) = 28x^2$
Now, $20.5 \times 28x^2 - 20 \times 28x^2 = 126$
$\Rightarrow 28x^2 \times 0.5 = 126 \Rightarrow x = 3.$
$\therefore$ Dimensions of the box are 3 m, 6 m and 12 m.

133. (3) Here $r_1 = 7$ cm, $r_2 = 28$ cm and $h = 45$ cm



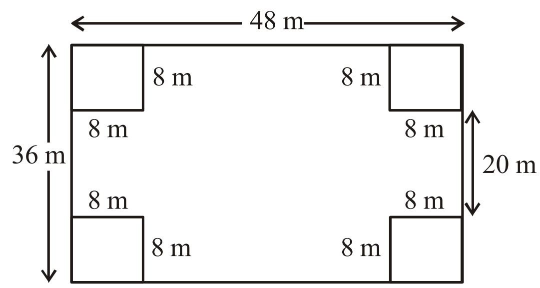
Volume of the bucket $= \frac{1}{3} \pi h (r_1^2 + r_2^2 + r_1 r_2)$

Hence, the required volume

$= \frac{1}{3} \times \frac{22}{7} \times 45(28^2 + 7^2 + 28 \times 7)$

$= 48510 \text{ cm}^3$

134. (1) After cutting the square, the dimensions of the box are 32 m, 20 m and 8 m.



Volume of the box $= 32 \times 20 \times 8 = 5120 \text{ m}^3$

135. (2) Volume of the steel used in the hemispherical bowl

$= \frac{2}{3} \pi \left[(4.5)^3 - 4^3 \right] = \frac{2}{3} \times \frac{22}{7} \times 27.125$

$= 56.83 \text{ cm}^3$

136. (2) Let ℓ be the length and b be the breadth of cold storage.
$\ell = 2b, h = 3$ metres
Area of four walls $= 2[\ell \times h + b \times h] = 108$
$\Rightarrow 6bh = 108 \Rightarrow b = 6$
$\therefore \ell = 12, b = 6, h = 3$
Volume $= 12 \times 6 \times 3 = 216 \text{ m}^3$

137. (3) Area of the field $= 13.5 \times 2.5 = 33.75 \text{ m}^2$
Area covered by the rectangular tank
$= 5 \times 4.5 = 22.50 \text{ m}^2$
Area of the field on which the earth dug out is to be spread $= 33.75 - 22.50 = 11.25 \text{ m}^2$
Let the required height be h.
Then, $11.25 \times h = 5 \times 4.5 \times 2.1 \Rightarrow h = 4.2$ m

138. (3) Number of coins $= \frac{\text{Volume of the cylinder}}{\text{Volume of a sphere coin}}$

Volume of sphere coin = Volume of cylinder
($\because$ thickness of coin is given)

$$= \frac{(2.25)^2 \times 10}{0.75^2 \times 0.2} = \frac{50.625}{0.1125} = 450$$

139. (2) Let the length of the cloth be x metres.

Cloth required = curved surface area of the conical tent

$= \pi \times r \times \ell$

$5x = \frac{22}{7} \times 7 \times \sqrt{7^2 + 24^2}$ $5x = 550$

$x = 110$ m

140. (2) Let h be the height of the cone.

$\therefore \quad \frac{1}{3}\pi \times (4)^2 \times h = \frac{4}{3}\pi(4^3 - 2^3)$

$\Rightarrow \quad 4h = 56 \Rightarrow h = 14$ cm.

141. (4) Circumference of the base of ice-cream cup

= Diameter of the sheet = 28 cm

$2\pi r = 28$

$r = \frac{14}{\pi}$ cm = 4.45 cm

Slant height of the cone = radius of the sheet = 14 cm

$\therefore \quad 14^2 = (4.45)^2 + h^2$

$h^2 = 196 - 19.80 = 176.20$

$\therefore \quad h = 13.27$ cm

142. (3) According to the question.

$80\% - 66\frac{2}{3} = 2$ litre

$= 80\% - \frac{200}{3}\%$

$= \frac{240 - 200}{3}\% = \frac{40}{3}\%$

Thus $\frac{40}{3}\% = 2$ litre.

The capacity of the bucket $= \frac{2 \times 3 \times 100}{40} = 15$ Litres

143. (2) Given, length of the wall = 6m ≡ 600 cm

Height of the wall = 5m ≡ 500 cm

and thickness of the wall = 0.5 m = 50 cm

Similarly, length of the brick = 25 cm

Height of the brick = 12.5 cm

and thickness of the brick = 7.5 cm

Since, a motar occupies 5% of the volume of the wall.

∴ We need the bricks for the entire space ex cept the space occupying by the mortar.

∴ Required number of bricks

$= \frac{600 \times 500 \times 50 \times 95}{100 \times 25 \times 12.5 \times 7.5} = 6080.$

144. (1) Let the rise in water level = x m

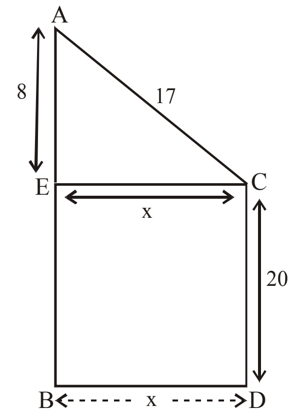
Now, volume of pool = 40 × 90 × x = 3600 x

When 150 men take a dip, then displacement of water = $8m^3$

$\therefore \quad \frac{3600x}{150} = 8 \quad \Rightarrow \quad \frac{900}{150}x = 2 \Rightarrow x = .33m$

$\Rightarrow \quad x = 33.33$ cm

145. (3)



In $\Delta ACE = (17)^2 = (8)^2 + (x)^2$

$\Rightarrow x^2 = 17^2 - 8^2 = 289 - 64 = 225$

$\therefore \; x = \sqrt{225} = 15$ m

$EC = BD = 15$ m

Hence, distance between the two trees is 15 m.

146. (4) $\frac{7\sin A - 3\cos A}{7\sin A + 2\cos A} = \frac{7\frac{\sin A}{\cos A} - 3}{7\frac{\sin A}{\cos A} + 2}$

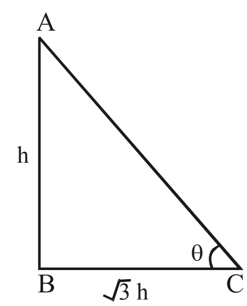
(Dividing num. & denom. by cos A)

$= \frac{7 \times \frac{4}{7} - 3}{7 \times \frac{4}{7} + 2}$ $\left[\frac{\sin A}{\cos A} = \frac{4}{7}\right]$

$= \frac{4 - 3}{4 + 2} = \frac{1}{6}$

147. (1) Let AB be a pole of height h and BC be its shadow.

Therefore, $BC = \sqrt{3}\,h$



Here, $\tan\theta = \frac{h}{\sqrt{3}h}$, or $\tan\theta = \frac{1}{\sqrt{3}}$

or $\theta = \tan^{-1}\frac{1}{\sqrt{3}} = 30°$

148. (1) Let h be the height. Then, $6 : 4 = h : 50$

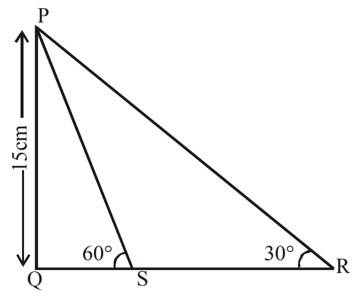
$\Rightarrow \; h = \frac{50 \times 6}{4} = 75$ m

149. (4) $\cos^6 x + \sin^6 x + 3\sin^2 x \cos^2 x$

$= (\cos^2 x)^3 + (\sin^2 x)^3 + 3\sin^2 x \cos^2 x (\sin^2 x + \cos^2 x)$

$= (\cos^2 x + \sin^2 x)^3 = 1$

150. (3)

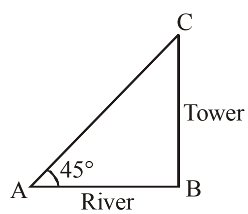


We have, $\tan 60° = \frac{15}{QS} \Rightarrow QS = \frac{15}{\sqrt{3}} = 5\sqrt{3}$ ....(i)

Again, $\tan 30° = \frac{15}{QR} \Rightarrow QR = 15\sqrt{3}$ ....(ii)

Therefore, $RS = QR - QS = 15\sqrt{3} - 5\sqrt{3} = 10\sqrt{3}$

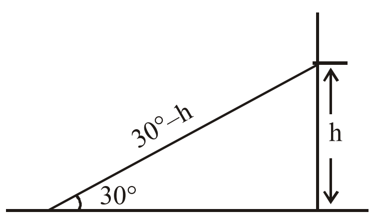
151. (3)



Let AB is the river and BC is the tower.

$\therefore \frac{BC}{AB} = \tan 45° = 1 \Rightarrow BC = AB$

152. (1)



Let the height of the point where the tree is broken be h.

Then $\sin 30° = \frac{h}{30-h} \Rightarrow \frac{1}{2} = \frac{h}{30-h}$

$\Rightarrow 30 - h = 2h \Rightarrow 3h = 30 \Rightarrow h = 10$ m

153. (2) Let the height of man be h meters

Since, length of the pole = 6 m and

length of the shadow = 8 m

Also, length of the shadow of a man = 2.4m

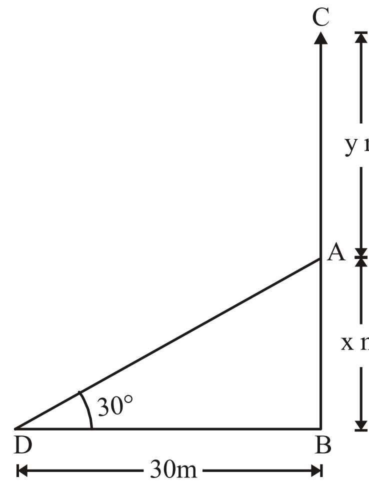
$\therefore \frac{6}{8} = \frac{h}{2.4}$

$\Rightarrow h = \frac{2.4 \times 6}{8} = 1.8$ meter

154. (1) Let CAB be the tree which breaks at A.

Let AB = x m, AC = y m $\Rightarrow$ AD = y m.

In rt ΔABD,



$\tan 30° = \frac{x}{30} \Rightarrow x = 10\sqrt{3}$m

and $\sec 30° = \frac{y}{30} \Rightarrow y = 20\sqrt{3}$m

$\therefore$ BC = x + y = $10\sqrt{3} + 20\sqrt{3}$

$= 30\sqrt{3}$m

$= 51.96$ m ≈ 52m.

155. (1) Principal can be appointed in 36 ways.

Vice principal can be appointed in the remaining 35 ways.

Total number of ways = 36 × 35 = 1260

156. (3) Total no. of unrestricted arrangements

$= (7-1)! = 6!$

When two particular person always sit together, the total no. of arrangements

$= 6! - 2 \times 5!$

Required no. of arrangements $= 6! - 2 \times 5!$

$= 5!\,(6-2) = 5 \times 4 \times 3 \times 2 \times 4 = 480$.

157. (3) It is a question of arrangement without repetitions.

Required no. of ways = 5 × 4 × 3 = 60

158. (2) Total no. of outcomes when two dices are thrown = n (S) = 36 and the possible cases for the event that the sum of numbers on two dice is a prime number, are (1, 1), (1, 2), (1, 4), (1, 6), (2, 1), (2, 3), (2, 5), (3, 2), (3, 4), (4, 1), (4, 3), (5, 2), (5, 6), (6, 1), (6, 5)

Number of outcomes favouring the event $= n(A) = 15$

Required probability $= \frac{n(A)}{n(S)} = \frac{15}{36} = \frac{5}{12}$

159. (3) If six coins are tossed, then the total no. of outcomes $= (2)^6 = 64$

Now, probability of getting no tail $= \frac{1}{64}$

Probability of getting at least one tail

$= 1 - \frac{1}{64} = \frac{63}{64}$

160. (2) Required Prob. $= \frac{7}{8} \times \frac{9}{10} = \frac{63}{80}$

161. (4) Probability of getting 6 at the top once = 1/6

Probability of getting 6 at the top three times

$$= \frac{1}{6} \times \frac{1}{6} \times \frac{1}{6} = \frac{1}{216}$$

$\therefore$ Probability of not getting 6 at the top any time

$$= 1 - \frac{1}{216} = \frac{215}{216}$$

162. (2) One of them can be selected in the following ways.

Brother is selected and sister is not selected.

or

Brother is not selected and sister is selected.

Required probability $= \frac{1}{5} \times \frac{2}{3} + \frac{4}{5} \times \frac{1}{3}$

$$= \frac{2}{15} + \frac{4}{15} = \frac{6}{15} = \frac{2}{5}$$

163. (2) Probability that the assembled part will not be defective

$$= \frac{95}{104} \times \frac{95}{100} = \frac{361}{416}$$

164. (1) No. of ways in which 6 men and 5 women can dine at a round table = 6! × 5!

165. (3) No. of seating arrangements

= No. of ways in which men sit

× No. of ways in which women sit

= 6 ! × 7 !

166. (1) The probability that when two mangoes are taken out

both the mangoes are good $= \frac{6}{10} \times \frac{5}{9} = \frac{1}{3}$

167. (4)

1, 1	1, 2	1, 3	1, 4	1, 5
2, 1	2, 2	2, 3	2, 4	2, 5
3, 1	3, 2	3, 3	3, 4	3, 5
4, 1	4, 2	4, 3	4, 4	4, 5
5, 1	5, 2	5, 3	5, 4	5, 5

No. of total events = 25.

Chance of winning in one trial

$$= \frac{5}{25} = \frac{1}{5}$$

Hence, chance of not winning

$$= 1 - \frac{1}{5} = \frac{4}{5}$$

168. (4) 4 questions having 3 answers, each can be answered in 3^4 ways.

Similarly, we have 2^3 and 5^1 ways.

i.e. total possible answers = $3^4 \times 2^3 \times 5^1 = 3240$

169. (4) A box contains 5 brown and 4 white socks.

Total no. of socks = 9

A man takes out 2 socks.

$\therefore$ P (both are of same colour) $= \frac{5}{9} \times \frac{4}{8} + \frac{4}{9} \times \frac{3}{8}$

$$= \frac{32}{72} = \frac{8}{18} = \frac{4}{9}.$$

170. (1) A coin is tossed repeatedly.

$\therefore$ P (head appears) $= \frac{1}{2}$

Similarly, P (tail appears) $= \frac{1}{2}$

171. (2)

172. (2) Let the average marks of the girl students be x, then

$$72 = \frac{70 \times 75 + 30 \times x}{100}$$

(Number of girls = 100 – 70 = 30)

i.e., $\frac{7200 - 5250}{30} = x$, $\therefore x = 65$

173. (1) **174. (4)** **175. (4)**

176. (3) **177. (2)**

178. (2) Given $\frac{x_1 + ... + x_n}{n} = \bar{x}$ ..... (1)

$$\Rightarrow \frac{ax_1 + ... + ax_n^n}{an} = \bar{x} \Rightarrow \frac{ax_1 + ... + ax_n}{n} = a\bar{x}$$

Also, from (1), we have

$$\frac{\frac{1}{a}x_1 + ... + \frac{1}{a}x_n}{\frac{1}{a}n} = \bar{x} \Rightarrow \frac{\frac{x_1}{a} + ... + \frac{x_n}{a}}{n} = \frac{\bar{x}}{a}$$

So, the mean of ax_1, ... ax_n, $\frac{x_1}{a}$, ..., $\frac{x_n}{a}$ is

$$\frac{a\bar{x} - \frac{\bar{x}}{a}}{2} = \frac{\bar{x}}{2}\left(a + \frac{1}{a}\right)$$ (from Ques, 4)

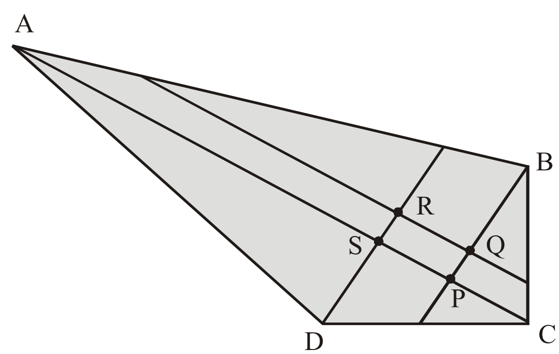
179. (1)

180. (3) Sum of 6 numbers = 30 × 6 = 180

Sum of remaining 5 numbers = 29 × 5 = 145

$\therefore$ Excluded number = 180 – 145 = 35.

181. (4)



As shown in above figure.

$\angle S = 180 - \left(\frac{\angle A}{2} + \frac{\angle D}{2}\right)$ and

$\angle Q = 180 - \left(\frac{\angle B}{2} + \frac{\angle C}{2}\right)$. Clearly

Clearly, $\angle S + \angle Q$

$$= 360 - \frac{(\angle A + \angle B + \angle C + \angle D)}{2}$$

$$= 360 - \frac{360}{2} = 360° - 180° = 180°.$$

182. (2) The sum of all exterior angles of a polygon = 360°

$\therefore \quad 2x+3x+4x+5x+6x=360°$

$20x=360°$

$x=\frac{360°}{20°}=18°$

183. (1) f(x) is a real valued function

$x-1\geq 0, \qquad 4-x\geq 0$

$x\geq 1 \qquad -x>-4$

$x\leq 4$

184. (1) since f(x) is real valued function,

$x^2+1\neq 0$

$x^2\neq -1$

$x\neq \pm\sqrt{-1}$

There is no real value of x such that $x^2+1=0$

185. (2) The factors of x^2-5x+6 are $(x-2)(x-3)$.

$f(x)=\frac{1}{x^2-5x+6}$ takes all the values except 2 and 3.

186. (2) $1<-x<2 \Rightarrow -2<x<-1$

$1<x<2 \Rightarrow 1<x<2$

$\therefore \quad \{-2<x<-1\}\cup\{1<x<2\}$

187. (2)

188. (3) $x^2+\frac{1}{x^2}=\left(x+\frac{1}{x}\right)^2-2;$

$x^2-\frac{1}{x^2}=\left(x+\frac{1}{x}\right)\left(x-\frac{1}{x}\right)$

$x=2-\sqrt{3}$

$\frac{1}{x}=\frac{1}{2-\sqrt{3}}=\frac{2+\sqrt{3}}{1}$

$x^2+\frac{1}{x^2}=16-2=14$

$x^2-\frac{1}{x^2}=4\left(-2\sqrt{3}\right)=-8\sqrt{3}$

189. (2) $x=3+\sqrt{8}, \ \frac{1}{x}=3-\sqrt{8};$

$x+\frac{1}{x}=6$

$x^3+\frac{1}{x^3}=(6)^3-3(6)$

$216-18=198$

190. (2) x^2+xy+y^2

$=(x+y)^2-xy$

$=\frac{4(a+b)}{(a-b)}$

$x^2+xy+y^2=\frac{4(a+b)}{(a-b)}$

191. (2) Let $x=\sqrt{5\sqrt{5\sqrt{5....}}}$

$x=\sqrt{5x}$

$x^2-5x=0$

$x(x-5)=0$

$x=0$ (or) $x=5$

$x=0$ is impossible.

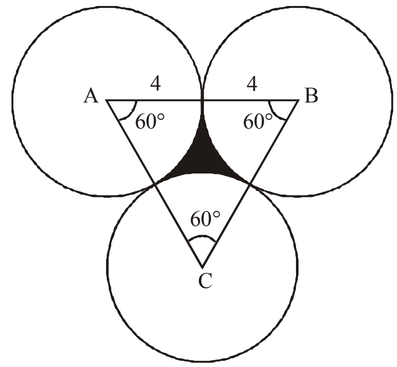
$\therefore$ x can only be 5.

192. (3) Since $64=2\times 2\times 2\times 2\times 2\times 2$, the only prime factor = 2.

$\therefore \quad \frac{83}{64}$ is a terminating decimal.

193. (3) Since $|x-y|\geq |x|-|y|$

194. (4)



Required area is darkened.

The required area

= area of ABC – 3 × area of 60° sectors

$=\frac{\sqrt{3}}{4}\times 8^2-3\times\frac{60}{360}\times\pi\times 4^2$

$=16\sqrt{3}-8\pi=8\left(2\sqrt{3}-\pi\right)$ cm²

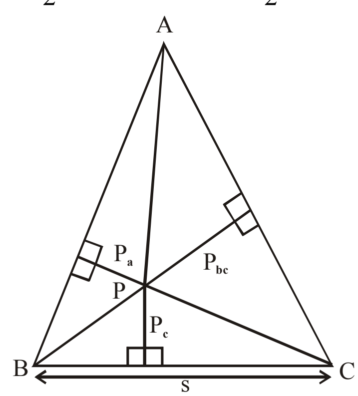
Hence, required volume

$=16(8)\left(2\sqrt{3}-\pi\right)=128\left(2\sqrt{3}-\pi\right)$ cm³.

195. (4) In the new triangle $\overline{AB}=\overline{AC}+\overline{BC}$, that is, C lies on the line AB. Consequently, the altitude from C is zero. Therefore, the area of the triangle is zero.

196. (3) Let P be an arbitrary point in the equilateral triangle ABC with sides of length s, and denote the perpendicular segments by p_a, p_b, p_c. Then Area ABC = Area APB + Area BPC + Area CPA

$=\frac{1}{2}(sp_a+sp_b+sp_c)=\frac{1}{2}s(p_a+p_b+p_c).$



Also, Area ABC = $\frac{1}{2}$ s. h, where h is the length of the altitude of ABC. Therefore, $h=p_a+p_b+p_c$ and this sum does not depend on the location of P.

197. (4) Since $\frac{1}{r^2}+\frac{1}{s^2}=\frac{r^2+s^2}{r^2s^2}=\frac{(r+s)^2-2rs}{(rs)^2}$, and since $r+s=-\frac{b}{a}$ and $rs=\frac{c}{a}$, we have $\frac{1}{r^2}+\frac{1}{s^2}=\frac{b^2-2ac}{c^2}$.

198. (3) $x = \sqrt{1+x}$, $x^2 = 1 + x$, $x^2 - x - 1 = 0$ and $x \sim 1.62$

$\therefore \quad 1 < x < 2.$

199. (1) The equation is equivalent to

$$x^2 - \left(b + \frac{(m-1)a}{m+1}\right)x + c\frac{m-1}{m+1} = 0.$$

Since the coefficient of x is equal to the sum of the roots, it must be zero.

We have $b + \frac{m-1}{m+1}a = 0$.

$\therefore \quad bm + b + ma - a = 0; \therefore \; m = \frac{a-b}{a+b}$

200. (4) The Arithmetic Mean is $(a+b)/2$, the Geometric Mean is $\sqrt{ab}$, and the Harmonic Mena is $2ab/(a+b)$. The proper order for decreasing magnitude is (e); or Since $(a-b)^2 > 0$, we have $a^2 + b^2 > 2ab$; $\therefore \; a^2 + 2ab + b^2 > 4ab$,

$a + b > 2\sqrt{ab}$ and $(a+b)/2 > \sqrt{ab}$.

Since $a^2 + 2ab + b^2 > 4ab$, we have $1 > 4ab/(a+b)^2$;

$\therefore \quad ab > 4a^2b^2/(a+b)^2$, and $\sqrt{ab} > 2ab/(a+b)$.

201. (4) $\log p + \log q = \log(pq)$. Thus we must have $pq = p + q$.

$\therefore \quad p = q/(q-1)$.

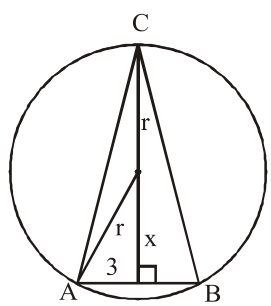
202. (4) Let the original price be P. Then $P_1 = \left(1 + \frac{p}{100}\right)P$.

$$P_2 = \left(1 - \frac{p}{100}\right)P_1 = \left(1 - \frac{p}{100}\right)\left(1 + \frac{p}{100}\right)P = 1$$

$$\therefore \quad P = \frac{1}{1 - (p^2/100^2)} = \frac{10{,}000}{10{,}000 - p^2}.$$

203. (4) Let x be the distance from the centre of the circle to the base and let

Then $h = r + x$ be the altitude of ΔABC.



$h^2 + 9 = 144. \therefore \; h = \sqrt{135}$

$r^2 = 3^2 + x^2$

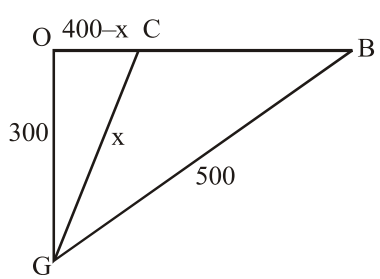
$= 3^2 + (h-r)^2 = 3^2 + h^2 - 2hr + r^2.$

$\therefore \quad r = (9 + h^2)/2h$

$= (9 + 135)/2\sqrt{135}$

$= 144\sqrt{135}/270 = 8\sqrt{15}/5.$

204. (4) $\overline{OB} = 400$ rods.



$x^2 = 300^2 + (400 - x)^2,$

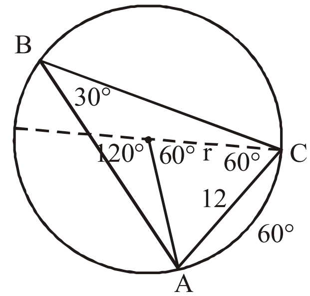
$800x = 250{,}000.$

$\therefore \quad x = 312\frac{1}{2}$ (rods);

$\therefore \quad$ (e) is the correct choice.

205. (3) Let 12-cm side be AC.

Since $\measuredangle B = 30°$, $\widehat{AC} = 60°$.

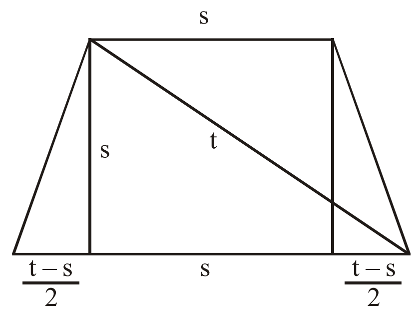


$\therefore \quad \overline{AC} = r;$

$\therefore \quad 2r = d = 24$ (cm).

206. (3) F[3, f(4)] means the value of $b^2 + a$ when $a = 3$ and $b = 2$, namely, 7.

207. (4)



$$t^2 = s^2 + \left(\frac{t+s}{2}\right)^2,$$

$5s^2 + 2ts - 3t^2 = 0 = (5s - 3t)(s + t);$

$\therefore \quad \frac{s}{t} = \frac{3}{5}.$

208. (1) $x + \sqrt{d^2 + (h+x)^2} = h + d$, $\sqrt{d^2 + (h+x)^2} = h + d - x$

$d^2 + h^2 + 2hx + x^2 = h^2 + d^2 + x^2 + 2hd - 2hx - 2dx,$

$2hx + dx = hd; \;\therefore\; x = hd/(2h + d).$

209. (2) $c = a - r + b - r. \qquad \therefore\; 10 = a + b - 2$

$\therefore\; P = a + b + c = 10 + 2 + 10 = 22$

210. (2) Let $x = \overline{BD}$ and let r be the radius of the small circle. Draw the line from the centre of each of the circles to the point of contact of the tangent and the circle. By similar triangle,

$$\frac{x+r}{r} = \frac{x+5r}{3r}. \;\therefore\; x = r.$$

211. (4) This is a right triangle. For any right triangle it can be shown that

$a - r + b - r = c \;\therefore\; 2r = a + b - c = 8 + 15 - 17 = 6$ and $r = 3$.

212. (2) Since $\frac{1}{2}hc = A$, $h = 2A/c$.

213. (1) The train is moving for $\frac{a}{40}$ hours and is at rest for nm minutes or $\frac{n.m}{60}$ hours. $\therefore \frac{a}{40}+\frac{nm}{60}=\frac{3a+2mn}{120}$.

214. (1) The dimensions of R are 1. 1s and 0.9s; its area is $0.99s^2$.

$\therefore$ $R/S = .99s^2/s^2 = 99/100$.

215. (4) $\frac{A(2x-3)+B(x+2)}{(x+2)(2x-3)}=\frac{5x-11}{2x^2+x-6}$;

$A(2x-3)+B(x+2)\equiv 5x-11$.

Equating the coefficients of like powers of x, we obtain $2A+B=5-3A+2B=-11$; $\therefore$ $A=3, B=-1$.

216. (4) Let the height in each case be 1. $1-\frac{1}{4}t=2(1-\frac{1}{3}t)$;

$\therefore$ $t=2\frac{2}{5}$.

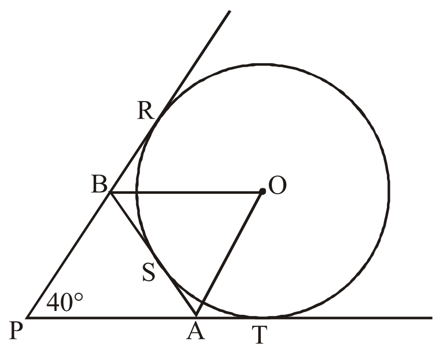
217. (3) The two triangles are similar and hence A(new)/A(old) $=(2s)^2/s^2=4$.

$\therefore$ (3) is the correct choice.

218. (4) $\measuredangle P=40°$; $\measuredangle PAB+\measuredangle PBA=180°-40°=140°$.

$\measuredangle TAS=180°-\measuredangle PAB$; $\measuredangle RBS=180°-\measuredangle PBA$;

$\measuredangle TAS+\measuredangle RBS=360°-140°=220°$.



Since OA and OB bisect angles TAS and RBS, respectively

$\measuredangle OAS+\measuredangle OBS=\frac{1}{2}(220°)=110$

$\therefore$ $\measuredangle AOB=180°-110°=70°$.

The number of degrees in $\measuredangle AOB$ is independent of tangent ASB.

219. (2) Let a be the number of cows and b the number of chickens. Then 4a + 2b is the total number of legs and

$4a+2b=14+2(a+b)$, $2a=14$, $a=7$ (cows).

Note : The number of chickens is indeterminate.

220. (3) $\left(\frac{2}{10}\right)^x=2$; $\therefore \log\left(\frac{2}{10}\right)^x=x\log\frac{2}{10}=x(\log 2-\log 10)$ $=\log 2$.

$\therefore$ $x=\frac{0.3010}{0.3010-1}\sim -0.4$

221. (4) Let 4x be the daughter's share, 3x the son's share. Then

$4x+3x=\frac{1}{2}$ estate and $6x+500=\frac{1}{2}$ estate.

$\therefore$ $7x=6x+500$;

$\therefore$ $x=500$; and $\therefore$ $13x+500=7000$ (dollars)

222. (4) First note that the equality $x^2(x^2-1)=0$ is satisfied by $0, 0, +1, -1$. Since x^2 is non-negative, then $x^2(x^2-1)>0$ implies $x^2-1>0$.

$\therefore$ $x^2>1$; $\therefore$ $|x|>1$, that is, $x>1$ or $x<-1$. Combining these, we have $x=0$, $x\le -1$, $x\ge 1$.

223. (2) ABM is a right triangle. By similar triangles, $\overline{AP}\,|\,\overline{AB}=\overline{AO}\,|\,\overline{AM}$.

$\therefore$ $\overline{AP}.\overline{AM}=\overline{AO}.\overline{AB}$

224. (1) All statements are correct.

225. (2) ΔBEC is not congruent to ΔBFC but R is true.

226. (2) Shaded region is $(P-Q)\cap(P-R)$.

227. (4) $A-(B\cup C)$ is the shaded region.

228. (3) Let $\sqrt{\sin\theta+\sqrt{\sin\theta+\sqrt{\sin\theta}}}\,.....=y$

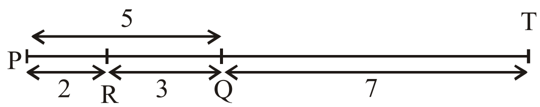
$\Rightarrow$ $\sin\theta+y=y^2\Rightarrow y^2-y=\sin\theta\Rightarrow y(y-1)-\sin\theta$

also $\sin\theta+y=\sec^2\alpha\Rightarrow y(y-1)+y=\sec^4\alpha$

$\Rightarrow$ $y^2=\sec^4\alpha\Rightarrow y=\pm\sec^2\alpha$

$\Rightarrow$ $\sin\theta=\sec^2\alpha(\sec^2\alpha-1)=\sec^2\alpha\tan^2\alpha$.

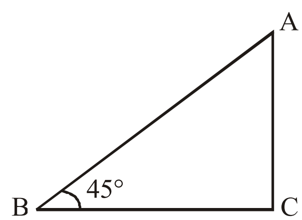
229. (1)



$\because$ $PT=5+7=12$

230. (1) All the statements given are true.

231. (3) $AC=BC$ ($\because AC=BC\tan 45°$)



$\therefore$ Height of tower = breadth of river

(A is top of water)

232. (3) Bar graph are 1-dimensional and also width of Bar doesn't matter.

233. (2) $\frac{1}{1+\sin^2 x}-\frac{1}{1+\sec^2 x}=\frac{1}{1+\sin^2 x}-\frac{\cos^2 x}{1+\cos^2 x}$

$=\frac{1-\cos^2 x\sin^2 x}{\left(1+\sin^2 x\right)\left(1+\cos^2 x\right)}$

Similarly

$\frac{1}{1+\cos^2 x}-\frac{1}{1+\operatorname{cosec}^2 x}=\frac{1-\sin^2 x\cos^2 x}{(1+\sin^2 x)(1+\cos^2 x)}$

$\therefore$ A is wrong but R is true.

234. (3) $2x-y=4$ No solution : $p=2$

$px-y=q$ Unique solution : $p\ne 2$

$-\ \ +\ \ -$ Infinite solution : $p=2$,

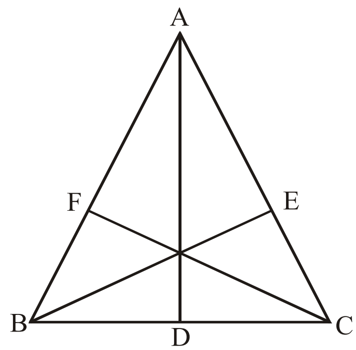
$q=4(2-p)x=4-q$

235. (1) By factor theorem $(x-2)$ is factor of x^3-3x^2+4x-4 also $x+1$ is factor of $2x^3+4x+6$.

236. (3) Only $x = 40$ m will yield the total area to be 11200 sq.m.

237. (1) Only 1 and 2 are correct.

238. (1) $AB + AC > 2\ AD$ ($\because$ sum of two sides is greater than 2 times the median or third side)



$\Rightarrow\ AB + BC > 2BE$

Also $AC + BC > 2CF$

Adding the 3 equations, we get

$2(AB + BC + AC) > 2(AD + BE + CF)$

$\Rightarrow\ AB + BC + AC > AD + BE + CF.$

239. (4) To negate the given statement we say : It is false that all men are good drivers, that is, at least one man is a bad driver.

240. (1) $(x^2-7x+11)^{x^2-11x+30}=1$

If $x^2-7x+11=1$ or $x^2-11x+30=0$

$x^2-7x+10=0$

$x=2, 5$ $\qquad\qquad x=5, 6$

241. (3) $\tan^2\alpha\tan^2\beta+\tan^2\beta\tan^2\gamma+\tan^2\gamma\tan^2\alpha+2\tan^2\alpha\tan^2\beta\tan^2\gamma=1$

$$\Rightarrow \frac{\sin^2\alpha}{\cos^2\alpha}\times\frac{\sin^2\beta}{\cos^2\beta}+\frac{\sin^2\beta}{\cos^2\beta}\times\frac{\sin^2\gamma}{\cos^2\gamma}+\frac{\sin^2\gamma}{\cos^2\gamma}\times\frac{\sin^2\alpha}{\cos^2\alpha}$$

$$+2\frac{\sin^2\alpha}{\cos^2\alpha}.\frac{\sin^2\beta}{\cos^2\beta}.\frac{\sin^2\gamma}{\cos^2\gamma}=1$$

$\Rightarrow \sin^2\alpha\sin^2\beta\cos^2\gamma+\cos^2\alpha\sin^2\beta\sin^2\gamma+\sin^2\alpha\cos^2\beta\sin^2\gamma+2\sin^2\alpha\sin^2\beta\sin^2\gamma$
$=\cos^2\alpha\cos^2\beta\cos^2\gamma$

$\Rightarrow \sin^2\alpha\sin^2\beta(1-\sin^2\gamma)+(1-\sin^2\alpha)\sin^2\beta\sin^2\gamma+\sin^2\alpha(1-\sin^2\beta)\sin^2\gamma+2\sin^2\alpha\sin^2\beta\sin^2\gamma$
$=(1-\sin^2\alpha)(1-\sin^2\beta)(1-\sin^2\gamma)$

$\Rightarrow \sin^2\alpha+\sin^2\beta+\sin^2\gamma=1$

242. (2) $3\sin\theta+5\cos\theta=5$

$(3\sin\theta+5\cos\theta)^2=25$

$9\sin^2\theta+25\cos^2\theta+30\sin\theta\cos\theta=25$

$9(1-\cos^2\theta)+25(1-\sin^2\theta)+30\sin\theta\cos\theta=25$

$9\cos^2\theta+25\sin^2\theta-30\sin\theta\cos\theta=9$

$(5\sin\theta-3\cos\theta)^2=9$

$5\sin\theta-3\cos\theta=\pm 3$

243. (4) $\frac{a+c}{b+c}>\frac{a}{b}$

$\Rightarrow\ ab+bc>ab+ca$

$\Rightarrow\ bc>ca$

$\Rightarrow\ b>a \Rightarrow\ a<b.$

244. (2) $\sqrt[2010]{2\sqrt7-3\sqrt3}\times\sqrt[4020]{55+12\sqrt{21}}$

$=\sqrt[2010]{2\sqrt7-3\sqrt3}\times\sqrt[4020]{(2\sqrt7+3\sqrt3)^2}$

$=\sqrt[2010]{2\sqrt7-3\sqrt3}\times\sqrt[2010]{(2\sqrt7+3\sqrt3)}$

$=\sqrt[2010]{(2\sqrt7-3\sqrt3)(2\sqrt7+3\sqrt3)}=1$

245. (1) ΔADE is isosceles (as AD = AE given)

So $\angle ADE = \angle AED$

$180° - \angle ADE = 180° - \angle AED$

$\angle ADB = \angle AEC$

Now in Δ ADB and ΔAEC

$\angle BAD = \angle EAC$ (given)

AD = AE (given)

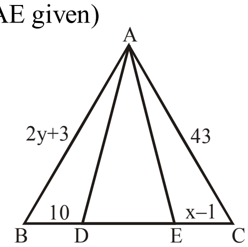
$\angle ADB = \angle AEC$ (proved)

$\therefore\ \Delta ADB \cong \Delta AEC$ (ASA congruence)

So AB = AC and BD = CE (cpct)

or $2y + 3 = 43$ and $x - 1 = 10$

so $y = 20$, $x = 11$.



246. (3) Given the length of tangent $L=\frac{4}{3}r$, where r is the radius.

or $r=\frac{3L}{4}$.

From the figure $L^2+\left(\frac{3L}{4}\right)^2=\left(x+\frac{3L}{4}\right)^2$

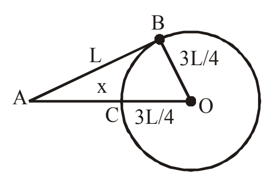
$L^2+\left(\frac{3L}{4}\right)^2=x^2+\left(\frac{3L}{4}\right)^2+2x\left(\frac{3L}{4}\right)$

$x^2+2\left(\frac{3L}{4}\right)x-L^2=0$

$2x^2+3Lx-2L^2=0$

or $(x+2L)(2x-L)=0$

$\Rightarrow\ x=-2L$ or $\frac{L}{2}$

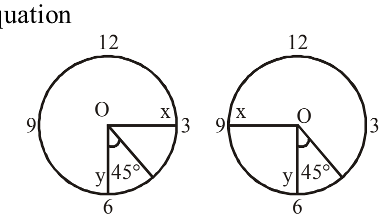


We reject $x = -2L$. Hence $x=\frac{L}{2}$.

247. (4) A(a, b + c), B(b, c + a), C(c, a + b)

Area $(\Delta ABC)=\frac{1}{2}|a(c+a)-b(b+c)+b(a+b)$
$-c(c+a)+c(b+c)-a(a+b)|=0$

248. (1) If the centre of the clock is origin and x = 0 or y-axis is along minute hand at 4:30 pm then hour hand can have equation



$y = x$

or $y = -x$

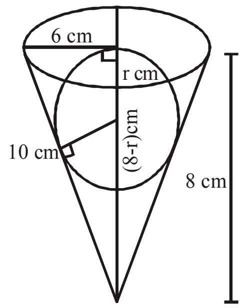
i.e. $x - y = 0$ or $x + y = 0$

249. (1) From the similarity of triangles $\frac{8-r}{10}=\frac{r}{6}$

$48-6r=10r$

$r=3.$

Fraction of water overflows



$$=\frac{\text{Volume of sphere}}{\text{Volume of cone}}$$

$$=\frac{\frac{4}{3}\pi(3)^3}{\frac{1}{3}\pi(6)^2(8)}$$

$$=\frac{3}{8}$$

250. (2) So that 2575 d 568 may be divisible by 54 and 87 it should be divisible by 2, 27 and 29. The number is always divisible by 2. So as to make it divisible by 27, it must be divisible by 3 at least. So d = 1, 4 or 7. Hence d = 7

251. (4) $\left(\frac{3\cos 43^\circ}{\sin 47^\circ}\right)^2-\frac{\cos 37^\circ \operatorname{cosec} 53^\circ}{\tan 5^\circ.\tan 25^\circ.\tan 45^\circ,\tan 65^\circ,\tan 85^\circ}$

$$=\left(\frac{3\sin 47^\circ}{\sin 47^\circ}\right)^2-\frac{\cos 37^\circ}{\sin 53^\circ}\times\frac{1}{\tan 5^\circ\tan 25^\circ(1)\cot 25^\circ\cot 5^\circ}$$

$$=3^2-\frac{\sin 53^\circ}{\sin 53^\circ}\times\frac{1}{\frac{\tan 5^\circ}{\tan 5^\circ}\times\frac{\tan 25^\circ}{\tan 25^\circ}}$$

$=9-1=8$

252. (2,4) According to Mendelian Inheritance an allele which cannot express itself in presence of other is recessive, hence can be expressed only in homozyhgous condition.

(2) Exceptions are there in non Mendelian in heritance (in complete dominance, co-dominance).

253. (2) Total cost = 80 × 6.75 + 120 × 8 = ₹ 1500

Total Selling price = $1500\times\frac{120}{100}$ = ₹ 1800

S.P. per kg = $\frac{1800}{200}$ = ₹ 9

254. (4) Let CP of 1 gm = ₹ 1

So CP of 800 gm = ₹ 800

SP of 800 gm = CP of 1000 gm = 1000 Rs.

Profit = 1000 – 800 = 200

Profit % = $\frac{200}{800}\times 100\%=25\%$

255. (4)

$$P\left(1+\frac{r}{100}\right)^2-P=618 \text{ and } \frac{P\times r\times 2}{100}=600$$

$$P\left[1+\frac{r^2}{100\times 100}+\frac{2r}{100}-1\right]=618 \text{ and } P=\frac{600\times 100}{2\times r}$$

$$\therefore \quad \frac{600\times 100}{2\times r}\times r\left[\frac{r}{100\times 100}+\frac{2}{100}\right]=618$$

$$\Rightarrow 300\left(\frac{r}{100}+2\right)=618,\ \Rightarrow\ 3r=18\%\ \Rightarrow\ r=6\%$$

256. (4) $x+\frac{1}{x}=3$

$$x^3+\frac{1}{x^3}+3\left(x+\frac{1}{x}\right)=27$$

$$x^3+\frac{1}{x^3}=27-9=18$$

$$\left(x^3+\frac{1}{x^3}\right)^2=x^6+\frac{1}{x^6}+2$$

$$\Rightarrow 324=x^6+\frac{1}{x^6}+2 \quad x^6+\frac{1}{x^6}=322$$

257. (1) $\log_{12}27=a$

$$\frac{\log 27}{\log 12}=a$$

$\Rightarrow 3\log 3=a[2\log 2+\log 3]$

$\Rightarrow 3\log 3-a\log 3=2a\log 2$

$$\Rightarrow \log 3=\frac{2a\log 2}{3-a} \qquad \text{...... (1)}$$

$$\text{Now } \log_6 16=\frac{\log 16}{\log 6}$$

$$=\frac{4\log 2}{\log 2+\log 3} \qquad \text{...... (2)}$$

$$=\frac{4\log 2}{\log 2+\frac{2a\log 2}{3-a}} \qquad \text{[using (1)]}$$

$$=\frac{4(3-a)}{3+a}$$

258. (1) $\alpha\times\frac{1}{\alpha}$ are the roots of $k^2x^2-17x+(k+2)$

$$\alpha,\frac{1}{\alpha}=\frac{k+2}{k^2}$$

$\Rightarrow k^2=k+2$

$\Rightarrow k^2-k-2=0$

$\Rightarrow k=2$ and $k=-1$ But $k>0$, $\therefore$ $k=2$

259. (2) Probability of black balls = $\frac{x}{20}$

Probability of black balls (New) = $\frac{x+10}{30}$

$$\frac{x+10}{30}=\frac{2x}{20} \text{ (Given)}$$

$\Rightarrow x=5$

260. (2)

Marks	f	cf
0 – 5	10	10
5 –10	15	25
10 – 15	12	37
15 – 20	20	57
20 – 25	9	66

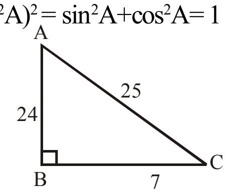
Median class is 10 – 15
Modal class is 15 – 20
Sum of lower limits = 25

261. (2) 13, 18 98
In this A.P. we have 18 terms

$$S_{18} = \frac{18}{2}[2 \times 13 + 17 \times 5] = 999$$

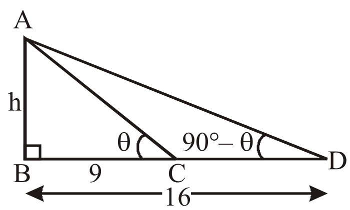
262. (1) $\cos A + \cos^2 A = 1$
$\cos A = 1 - \cos^2 A = \sin^2 A$
Now $\sin^2 A + \sin^4 A = \sin^2 A + (\sin^2 A)^2 = \sin^2 A + \cos^2 A = 1$

263. (3) $AC^2 = AB^2 + 49$
$(AC - AB)(AC + AB) = 49$
$AC + AB = 49$
$AC = 25, AB = 24$



$$\cos A + \cos B + \cos C = \frac{24}{25} + 0 + \frac{7}{25} = \frac{31}{25}$$

264. (4)

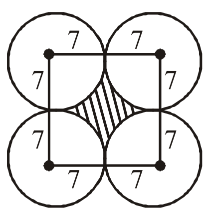


$$\tan\theta = \frac{h}{9}$$

$$\tan(90 - \theta) = \frac{h}{16}$$

$$\tan\theta \times \cot\theta = \frac{h^2}{9 \times 16} \Rightarrow h = 3 \times 4 = 12 \text{ m}$$

265. (2)



Area of space enclosed by the circles
= Area of square of side 14 cm
– 4 (Area of quardrant of radius 7 cm)

$$= (14)^2 - 4 \times \frac{1}{4} \times \frac{22}{7} \times 7 \times 7$$

$$= 196 - 154 = 42 \text{ cm}^2$$

266. (2) $\frac{16}{9} = \left(\frac{AB}{PQ}\right)^2 = \left(\frac{BC}{QR}\right)^2$

$$\Rightarrow \frac{16}{9} = \left(\frac{AB}{18}\right)^2 \text{ and } \frac{16}{9} = \left(\frac{12}{QR}\right)^2$$

$$\Rightarrow \frac{4}{3} = \frac{AB}{18} \text{ and } \frac{4}{3} = \frac{12}{QR}$$

$\Rightarrow AB = 24$ cm, $QR = 9$ cm

267. (3) $\Delta ABC \sim \Delta AEF$

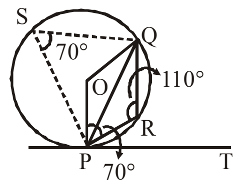
$$\frac{ar.(\Delta AEF)}{ar.(\Delta ABC)} = \left(\frac{AE}{AB}\right)^2 = \frac{1}{4}$$

$\Rightarrow$ Area of quadrilatral BEFC = ar (Δ ABC) – ar (Δ AEF)

$$= ar(\Delta ABC) = \frac{1}{4} ar(\Delta ABC)$$

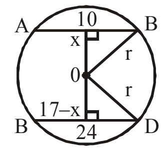
$$= \frac{3}{4} ar(\Delta ABC)$$

268. (4) $\angle PSQ = \angle QPT = 70°$
(Angles in alternate segment of circle are equal)

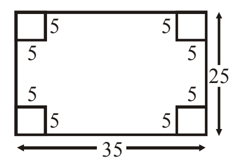


$\therefore \angle PRQ = 180° - \angle PSQ = 180° - 70° = 110°$

269. (3) $r^2 = x^2 + 25$
$r^2 = (17 - x)^2 + 144$
Now $x^2 + 25 = (17 - x)^2 + 144$
$\Rightarrow x = 12$
$r^2 = 144 + 25$
$r = 13$ cm

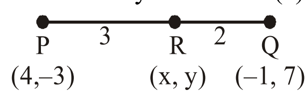


270. (2) Length of box = 25 cm
Breadth of box = 15 cm
Height of box = 5 cm
Volume of box = 15 × 25 × 5
= 1875 cm^3



271. (1) P(4, k) lies on $y = 6 - x$
$\therefore k = 2$
Volume of cylinder = $\pi \times (4)^2 \times 2 = 32\pi$

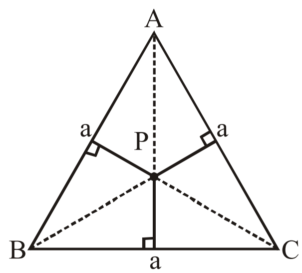
272. (3)



$$x = \frac{3x(-1) + 2 \times 4}{3 + 2} = 1$$

273. (4) For similarity of triangles we have SSS criteria. So S_1 is true.
But for polygon : two polygon to be similar if the corresponding sides are in same ratio then corresponding angle must be same. So S_2 is not correct.

274. (4)

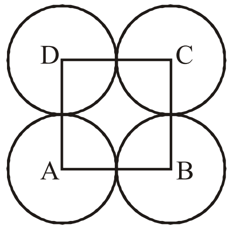


$a = 2\sqrt{3}$ cm

$$\frac{1}{2}a(x + y + z) = \frac{\sqrt{3}}{4}a^2$$

$$x + y + z = \frac{\sqrt{3}}{2}a\frac{\sqrt{3}}{2} \times 2\sqrt{3} = 3 \text{ cm}$$

275. (4)



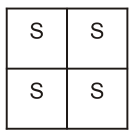
Area of interior region = $a^2 - \pi\left(\frac{a}{2}\right)^2$

$$= a^2 - \pi\frac{a^2}{2}$$

$$= a^2\left(\frac{4-\pi}{4}\right)$$

276. (4) $ax^2 + bx + c = 0$ will have real roots when $c = 0$.

277. (4)



If we cut square S from a piece of tin at that time the volume of open box is 0.

But the volume of open box made from S is always be greater than 0.

So according to this 4th option is not possible.

278. (4) Let there are x human being and y dogs

$\therefore$ Total legs = $2x + 4y$

one tenth of x human beings lost a leg.

$$\therefore (2x + 4y) - \frac{x}{10} = 77$$

$$\frac{19x}{10} + 4y = 77 \quad ...(1)$$

when $x = 10$, from (1)

$4y = 77 - 19 = 58$ (Which is not possible).

when $x = 30$, from (1)

$54 + 4y = 77$

$4y = 20$

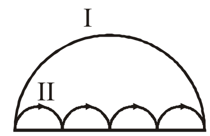
$y = 5$

$\therefore$ Number of dogs = 5

279. (4) Let there are n small semicircles with radii r.

$\therefore$ radius of single large semi circle

$$= \frac{n}{2}(2r) = nr$$



Path I = $n\pi r$

Path II = $n(\pi r) = n\,\pi\,r$

So Path I and II will always be equal.

280. (4) $\sqrt{(a-b)^2} + \sqrt{(b-a)^2} = |a-b| + |b-a|$

Let $a > b$	Let $a < b$
then	than
$\lvert a-b\rvert + \lvert b-a\rvert$	$\lvert a-b\rvert + \lvert b-a\rvert$
$= a - b + a - b$	$= b - a + b - a$
$= 2a - 2b$	$= 2b - 2a$
i.e. + ve	i.e. +ve

So answer is always +ve if $a \neq b$

281. (4) $\frac{4}{3}\pi R^3 = \frac{4}{3}\pi(r_1^3 + r_2^3 + r_3^3 + ... + r_n^3)$ ...(i)

$S_1 = 4\pi R^2$

$S_2 = 4\pi(r_1^2 + r_2^2 + r_3^3 + ... + r_n^2)$

From (i), we get

$R^3 = r_1^3 + r_2^3 + r_3^3 + ... + r_n^3$

If all smaller sphere are of equal radius i.e. r

then, $\frac{4}{3}\pi R^3 = \frac{4}{3}\pi \times nr^3$ [from (i)]

$R^3 = nr^3$

$$\frac{S_1}{S_2} = \frac{R^2}{n \times r^2} = \frac{(nr^3)^{2/3}}{nr^2} = \frac{n^{2/3} \times r^2}{nr^2}$$

$nS_1 = n^{2/3} S_2 \Rightarrow n^{1/3} S_1 = S_1 = S_2 \therefore S_2 > S_1$