

CDS-I 2019

Elementary Mathematics

(Set-C)

Direction: Consider the following for the next three (03) items :

A cube is inscribed in a sphere. A right circular cylinder is within the cube touching all the vertical faces. A right circular cone is inside the cylinder. Their heights are same and the diameter of the cone is equal to that of the cylinder.

1. What is the ratio of the volume of the sphere to that of cone?

- A. $6\sqrt{3}:1$
C. $3\sqrt{3}:1$
- B. $7:2$
D. $5\sqrt{3}:1$

Direction: Consider the following for the next three (03) items :

A cube is inscribed in a sphere. A right circular cylinder is within the cube touching all the vertical faces. A right circular cone is inside the cylinder. Their heights are same and the diameter of the cone is equal to that of the cylinder.

2. What is the ratio of the volume of the cube to that of the cylinder?

- A. 4 : 3
C. 14 : 11
- B. 21 : 16
D. 45 : 32

Direction: Consider the following for the next three (03) items :

A cube is inscribed in a sphere. A right circular cylinder is within the cube touching all the vertical faces. A right circular cone is inside the cylinder. Their heights are same and the diameter of the cone is equal to that of the cylinder.

3. Consider the following statements:

- 1) The surface area of the sphere is $\sqrt{5}$

Times the curved surface area of the cone.

- 2) The surface area of the cube is equal to the curved surface area of the cylinder.

Which of the above statements is/are correct?

- A. 1 only
B. 2 only
C. Both 1 and 2
D. Neither 1 nor 2

Direction: Consider the following for the next three (03) items:

ABCD is a quadrilateral with $AB = 9$ cm, $BC = 40$ cm, $CD = 28$ cm, $DA = 15$ cm and angle ABC is a right – angel

4. What is the area of triangle ADC?

- A. 126 CM² B. 124 CM²
C. 122 CM² D. 120 CM²

Direction: Consider the following for the next three (03) items:

ABCD is a quadrilateral with $AB = 9$ cm, $BC = 40$ cm, $CD = 28$ cm, $DA = 15$ cm and angle ABC is a right - angel

5. What is the area of quadrilateral ABCD?

- A. 300 CM²
B. 306 CM²
C. 312 CM²
D. 316 CM²

Direction: Consider the following for the next three (03) items:

ABCD is a quadrilateral with $AB = 9$ cm, $BC = 40$ cm, $CD = 28$ cm, $DA = 15$ cm and angle ABC is a right - angel

6. What is the difference between perimeter of triangle ABC and perimeter of triangle ADC?

- A. 4 cm
B. 5 cm
C. 6 cm
D. 7 cm

Direction: Consider the following for the next two (02) items:

An equilateral triangle ABC is inscribed in a circle of radius $20\sqrt{3}$

7. What is the length of the side of the triangle?

- A. 30 cm
B. 40 cm
C. 50 cm
D. 60 cm

17. If $3^x = 4^y = 12^z$, then z is equal to
- A. xy B. $x + y$
 C. $\frac{xy}{x + y}$ D. $4x + 3y$
18. If $(4a + 7b)(4c - 7d) = (4a - 7b)(4c + 7d)$, then which one of the following is correct ?
- A. $\frac{a}{b} = \frac{c}{d}$ B. $\frac{a}{d} = \frac{c}{b}$
 C. $\frac{a}{b} = \frac{d}{c}$ D. $\frac{4a}{7b} = \frac{c}{d}$
19. Given that the polynomial $(x^2 + ax + b)$ leaves that same remainder when by $(x - 1)$ or $(x + 1)$ What are the values of a and b respectively?
- A. 4 and 0 B. 0 and 3
 C. 3 and 0 D. 0 and any interger
20. Tushar takes 6 hours to complete a piece of work, while Amar completes the same work in 10 hours. If both of them work together, then what is the time required to complete the work?
- A. 3 hours B. 3 hours 15 minutes
 C. 3 hours 30 minutes D. 3 hours 45 minutes
21. What is the value of $2 + \sqrt{2 + \sqrt{2 + \sqrt{\dots}}}$?
- A. 1 B. 2
 C. 3 D. 4
22. In an examination, 52% candidates failed in English and 42% failed in Mathematics. If 17% failed in both the subjects, then what percent passed in both the subjects?
- A. 77 B. 58
 C. 48 D. 23
23. A man who recently died left a sum of Rs. 3,90,000 to be divided among his wife, five sons and four daughters. He directed that each son should receive 3 times as much as each daughter receives and that each daughter receives and that each daughter should receive twice as much as their mother receives. What was the wife's share?
- A. Rs. 14,000 B. Rs. 12,000
 C. Rs. 10,000 D. Rs. 9,000
24. What is the least number of complete years in which a sum of money put out at 40% annual compound interest will be more than trebled?
- A. 3 B. 4
 C. 5 D. 6
25. A person divided a sum of Rs. 17,200 into three parts and invested at 5%, 6% and 9% per annum simple interest. At the end of two years, he got the same interest on each part of money. What is the money invested at 9%?
- A. Rs. 3,200 B. Rs. 4,000
 C. Rs. 4,800 D. Rs. 5000
26. The corners of a square of side 'a' are cut away so as to form a regular octagon. What is the side of the octagon?
- A. $a(\sqrt{2} - 1)$ B. $a(\sqrt{3} - 1)$
 C. $\frac{a}{\sqrt{2} + 2}$ D. $a/3$

27. Three consecutive integers form the lengths of a right-angled triangle. How many sets of such three consecutive integers is/are possible?
 A. Only one
 B. Only two
 C. Only three
 D. Infinitely many
28. Two circles are drawn with the same centre. The circumference of the smaller circle is 44 cm and that of the bigger circle is double the smaller one. What is the area between these two circles?
 A. 154 square cm
 B. 308 square cm
 C. 462 square cm
 D. 616 square cm
29. A rectangular red carpet of size 6 ft \times 12 ft has a dark red border 6 inches wide. What is the area of the dark red border?
 A. 9 square feet
 B. 15 square feet
 C. 17 square feet
 D. 18 square feet
30. The perimeter of a right-angled triangle is k times the shortest side. If the ratio of the other side to hypotenuse is 4 : 6, then what is the value of k ?
 A. 2
 B. 3
 C. 4
 D. 5
31. A 12 m long wire is cut into two pieces, one of which is bent into a circle and the other into a square enclosing the circle. What is the radius of the circle?
 A. $\frac{12}{\pi + 4}$
 B. $\frac{6}{\pi + 4}$
 C. $\frac{3}{\pi + 4}$
 D. $\frac{6}{\pi + 2\sqrt{2}}$
32. The angles of a triangle are in the ratio 1 : 1 : 4. If the perimeter of the triangle is k times its largest side, then what is the value of k ?
 A. $1 + \frac{2}{\sqrt{3}}$
 B. $1 - \frac{2}{\sqrt{3}}$
 C. $2 + \frac{2}{\sqrt{3}}$
 D. 2
33. The hypotenuse of a right-angled triangle 10 cm and its area is 24 cm². If the shorts side is halved and the longer side is double, the new hypotenuse becomes
 A. $\sqrt{245}$ cm
 B. $\sqrt{255}$ cm
 C. $\sqrt{265}$ cm
 D. $\sqrt{275}$ cm
34. In a circle of radius 8 cm, AB and AC are two chords such that AB = AC = 12 cm. What is the length of chord BC?
 A. $2\sqrt{6}$ cm
 B. $3\sqrt{6}$ cm
 C. $3\sqrt{7}$ cm
 D. $6\sqrt{7}$ cm
35. Consider the following statements:
 1) An isosceles trapezium is always cyclic.
 2) Any cyclic parallelogram is a rectangle.
 Which of the above statements is/are correct?
 A. 1 only
 B. 2 only
 C. Both 1 and 2
 D. Neither 1 nor 2

36. A ladder is resting against a vertical wall and its bottom is 2.5 m away from the wall. If it slips 0.8 m down the wall, then its bottom will move away from the wall by 1.4 m. What is the length of the ladder?
- A. 6.2 m
B. 6.5 m
C. 6.8 m
D. 7.5 m
37. Two equal circles intersect such that each passes through the centre of the other. If the length of the common chord of the circles is $10\sqrt{3}$ cm, then what is the diameter of the circle?
- A. 10 cm
B. 15 cm
C. 20 cm
D. 30 cm
38. Consider the following statements:
1) The number of circles that can be drawn through three non-collinear points is infinity.
2) Angle formed in minor segment of a circle is acute.
Which of the above statements is/are correct?
- A. 1 only
B. 2 only
C. Both 1 and 2
D. Neither 1 nor 2
39. Consider the following inequalities in respect of any triangle ABC:
1) $AC - AB < BC$
2) $BC - AC < AB$
3) $AB - BC < AC$
Which of the above are correct?
- A. 1 and 2 only
B. 2 and 2 only
C. 1 and 3 only
D. 1, 2 and 3
40. Consider the following statements:
1) The perimeter of a triangle is greater than the sum of its three medians.
2) In any triangle ABC, if D is any point on BC, then $AB + BC + CA > 2AD$.
Which of the above statements is/are correct?
- A. 1 only
B. 2 only
C. Both 1 and 2
D. Neither 1 nor 2
41. Consider the following grouped frequency distribution:

x	f
0-10	8
10-20	12
20-30	10
30-40	P
40-50	9

- If the mean of the above data is 25.2, then what is the value of p?
- A. 9
B. 10
C. 11
D. 12

42. Consider the following frequency distribution:

x	f
8	6
5	4
6	5
10	8
9	9
4	6
7	4

What is the median for the distribution?

- A. 6
B. 7
C. 8
D. 9
43. The average of 50 consecutive natural numbers is x . What will be the average when the next four natural numbers are also included?
A. $x + 1$
B. $x + 2$
C. $x + 4$
D. $x + (x/54)$
44. Consider two-digit numbers which remain the same when the digits interchange their positions. What is the average of such two-digit numbers?
A. 33
B. 44
C. 55
D. 66
45. Diagrammatic representation of data includes which of the following?
1) Bar diagram
2) Pie-diagram
3) Pictogram
Select the correct answer using the code given below:
A. 1 and 2 only
B. 2 and 3 only
C. 1 and 3 only
D. 1, 2 and 3
46. The data collected from which one of the following methods is *not* a primary data?
A. By direct personal interviews
B. By indirect personal interviews
C. By schedules sent through enumerators
D. From published thesis
47. The monthly expenditure of a person is Rs. 6000. The distribution of expenditure on various items is as follows:

Item of expenditure	Amount (in Rs.)
Food	2000
Clothing	660
Fuel and rent	1200
Education	480
Miscellaneous	1660

If the above data is represented by a percentage bar diagram of height 15 cm, then what are the lengths of the two segments of the bar diagram corresponding to education and miscellaneous respectively?

- A. 1.25 cm and 5 cm
B. 1.2 cm and 4.15 cm
C. 1.2 cm and 3.5 cm
D. 4.15 cm and 6 cm

48. If the mean of m observations out of n observations is n and the mean of remaining observations is m , then what is the mean of all n observations?
A. $2m - \frac{m^2}{n}$
B. $2m + \frac{m^2}{n}$
C. $m - \frac{m^2}{n}$
D. $m + \frac{m^2}{n}$
49. Which one of the following pairs is correctly matched?
A. Median — Graphical location
B. Mean — Graphical location
C. Geometric mean — Ogive
D. Mode — Ogive
50. The following pairs relate to frequency distribution of a discrete variable and its frequency polygon. Which one of the following pairs is *not* correctly matched?
A. Base line of the — X-axis polygon
B. Ordinates of the — Class frequencies vertices of the polygon
C. Abscissa of the vertices of the polygon — Class marks of the frequency distribution
D. Area of the polygon — Total frequency of the distribution
51. In a rectangle, length is three times its breadth. If the length and the breadth of the rectangle are increased by 30% and 100% respectively, then its perimeter increases by
A. $\frac{40}{3}\%$
B. 20%
C. 25%
D. 27%
52. What is the percentage decrease in the area of a triangle if its each side is halved?
A. 75%
B. 50%
C. 25%
D. No change
53. The volume of a spherical balloon is increased by 700%. What is the percentage increase in its surface area?
A. 300%
B. 400%
C. 450%
D. 500%
54. If the lengths of two parallel chords in a circle of radius 10 cm are 12 cm and 16 cm, then what is the distance between these two chords?
A. 1 cm or 7 cm
B. 2 cm or 14 cm
C. 3 cm or 21 cm
D. 4 cm or 28 cm
55. Considering two opposite vertices of a square of side 'a' as centres, two circular arcs are drawn within the square joining the other two vertices, thus forming two sectors. What is the common area in these two sectors?
A. $a^2(\pi + \frac{1}{2})$
B. $a^2(\pi - \frac{1}{2})$
C. $a^2(\frac{\pi}{2} - 1)$
D. $a^2(\frac{\pi}{2} + 1)$
56. What is $\frac{(x-y)^3 + (y-z)^3 + (z-x)^3}{3(x-y)(y-z)(z-x)}$ equal to ?
A. 1
B. 0
C. $\frac{1}{3}$
D. 3

57. If $a^x = b^y = c^z$ and $b^2 = ac$, then what is $\frac{1}{x} + \frac{1}{z}$ equal to ?
A. $\frac{1}{y}$
B. $-\frac{1}{y}$
C. $\frac{2}{y}$
D. $-\frac{2}{y}$
58. If p and q are the roots of the equation $x^2 - 15x + r = 0$ and $p - q = 1$, then what is the value of r ?
A. 55
B. 56
C. 60
D. 64
59. For the inequation $x^2 - 7x + 12 > 0$, which one of the following is correct ?
A. $3 < x < 4$
B. $-\infty < x < 3$ only
C. $4 < x < \infty$ only
D. $-\infty < x < 3$ or $4 < x < \infty$
60. The expression $52n - 23n$ has a factor?
A. 3
B. 7
C. 17
D. None of the above
61. If $\tan x = 1$, $0 < x < 90^\circ$, then what is the value of $2 \sin x \cos x$?
A. $\frac{1}{2}$
B. 1
C. $\frac{\sqrt{3}}{2}$
D. $\sqrt{3}$
62. What is the value of $\sin 46^\circ \cos 44^\circ + \cos 46^\circ \sin 44^\circ$?
A. $\sin 2^\circ$
B. 0
C. 1
D. 2
63. Suppose $0 < \theta < 90^\circ$, then for every θ $4 \sin^2 \theta + 1$ is greater than or equal to ?
A. 2
B. $4 \sin \theta$
C. $4 \cos \theta$
D. $4 \tan \theta$
64. Consider a regular hexagon ABCDEF. Two towers are situated at B and C. The angle of elevation from A to the top of the tower at B is 30° , and the angle of elevation to the top of the tower at C is 45° . What is the ratio of the height of towers at B and C?
A. $1 : \sqrt{3}$
B. 1 : 3
C. 1 : 2
D. $1 : 2\sqrt{3}$
65. What is the value of $\tan 1^\circ \tan 2^\circ \tan 3^\circ \dots \tan 89^\circ$?
A. 0
B. 1
C. 2
D. ∞
66. There are two parallel streets each directed north to south. A person in the first street travelling from south to north wishes to take the second street which is on his right side. At some place, he makes a 150° turn to the right and he travels for 15 minutes at the speed of 20 km/hr. After that he takes a left turn of 60° and travels for 20 minutes at the speed of 30 km/hr in order to meet the second street. What is the distance between the two streets?
A. 7.5 km
B. 10.5 km
C. 12.5 km
D. 15 km

67. If $3 \tan \theta = \cot \theta$ where $0 < \theta < \frac{\pi}{2}$, then what is the value of θ ?

- A. $\frac{\pi}{6}$ B. $\frac{\pi}{4}$
C. $\frac{\pi}{3}$ D. $\frac{\pi}{2}$

68. What is the value of $\sin^2 25^\circ + \sin^2 65^\circ$?

- A. 0 B. 1
C. 2 D. 4

69. What is the value of $\sin^6 \theta + \cos^6 \theta + 3 \sin^2 \theta \cos^2 \theta - 1$?

- A. 0 B. 1
C. 2 D. 4

70. Consider the following for real numbers α , β , γ and δ ?

- 1) $\sec \alpha = 1/4$
2) $\tan \beta = 20$
3) $\operatorname{cosec} \gamma = 1/2$
4) $\cos \delta = 2$

How many of the above statements are not possible?

- A. one B. two
C. three D. four

Direction: Consider the following for the next three (03) items:

In a certain town of population size 1,00,000 three types of newspapers (I, II and III) are available. The percentages of the people in the town who read these papers are as follows:

Newspaper	Proportion of readers
I	10%
II	30%
III	5%
Both I and II	8%
Both II and III	4%
Both I and III	2%
All the three (I, II and III)	1%

71. What is the number of people who read only one newspaper?

- A. 20,000 B. 25,000
C. 30,000 D. 35,000

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Both II and III	4%
Both I and III	2%
All the three (I, II and III)	1%

72. What is the number of people who read at least two newspaper?

- A. 12,000 B. 13,000
C. 14,000 D. 15,000

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III	5%
Both I and II	8%
Both II and III	4%
Both I and III	2%
All the three (I, II and III)	1%

73. What is the number of people who do not read any of these three newspapers?
 A. 62,000 B. 64,000
 C. 66,000 D. 68,000
74. What is the unit place digit in the expansion of 7^{73} ?
 A. 1 B. 3
 C. 7 D. 9
75. Suppose n is a positive integer such that $(n^2 + 48)$ is a perfect square. What is the number of such n ?
 A. One B. Two
 C. Three D. Four
76. For $x = \frac{4\sqrt{6}}{\sqrt{2} + \sqrt{3}}$, what is the value of $\frac{x + 2\sqrt{2}}{x - 2\sqrt{2}} + \frac{x + 2\sqrt{3}}{x - 2\sqrt{3}}$?
 A. 1 B. $\sqrt{2}$
 C. $\sqrt{3}$ D. 2
77. x , y and z are three numbers such that x is 30% of z and y is 40% of z . If x is $p\%$ of y , then what is the value of p ?
 A. 45 B. 55
 C. 65 D. 75
78. A plane is going in circles around an airport. The plane takes 3 minutes to complete one round. The angle of elevation of the plane from a point P on the ground at time t seconds is equal to that at time $(t + 30)$ seconds. At time $(t + x)$ seconds, the plane flies vertically above the point P . What is x equal to?
 A. 75 seconds B. 90 seconds
 C. 105 seconds D. 135 seconds
79. Consider the following statements in respect of two integers p and q (both > 1) which are relatively prime:
 1) Both p and q may be prime numbers.
 2) Both p and q may be composite numbers
 3) one of p and q may be prime and the other composite.
 Which of the above statements are correct?
 A. 1 and 2 only B. 2 and 3 only
 C. 1 and 3 only D. 1, 2 and 3
80. In a class of 100 students, the average weight is 30 kg. If the average weight of the girls is 24 kg and that of the boys is 32 kg, then what is the number of girls in the class?
 A. 25 B. 26
 C. 27 D. 28

81. For any two real numbers a and b .

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

- A. always zero
B. never zero
C. positive only if $a \neq b$
D. positive if and only if $a > b$

82. If $a : b = c : d = 1 : 6$, then what is the value of $\frac{a^2 + c^2}{b^2 + d^2}$?

- A. $\frac{1}{600}$
B. $\frac{1}{60}$
C. $\frac{1}{36}$
D. $\frac{1}{6}$

83. What is $0.\overline{53} + 0.\overline{53}$ equal to?

- A. $1.\overline{068}$
B. $1.0\overline{68}$
C. 1.068
D. 1.068

84. The inequality $3^N > N^3$ holds when

- A. N is any natural number
B. N is natural number greater than 2
C. N is a natural number greater than 3
D. N is a natural number except 3

85. Which one of the following is an irrational number?

- A. $\sqrt{59049}$
B. $\frac{231}{593}$
C. $0.45454545\dots$
D. $0.12112211122211112222\dots$

86. What is the remainder when $(17^{29} + 19^{29})$ is divided by 18?

- A. 6
B. 2
C. 1
D. 0

87. What is the largest value of n such that 10^n divides the product $2^5 \times 3^3 \times 4^8 \times 4^3 \times 6^7 \times 7^6 \times 8^{12} \times 9^9 \times 10^6 \times 15^{12} \times 20^{14} \times 22^{11} \times 25^{15}$?

- A. 65
B. 55
C. 50
D. 45

88. How many pairs (A, B) are possible in the number 479865AB if the number is divisible by 9 and it is given that the last digit of the number is odd?

- A. 5
B. 6
C. 9
D. 11

89. Consider the multiplication $999 \times abc = def132$ in decimal notation, where a, b, c, d, e and f are digits. What are the values of a, b, c, d, e and f respectively?

- A. 6, 6, 8, 6, 8, 7
B. 8, 6, 8, 6, 7, 8
C. 6, 8, 8, 7, 8, 6
D. 8, 6, 8, 8, 6, 7

90. Three cars A, B and C started from a point at 5 pm, 6 pm and 7 pm respectively and travelled at uniform speeds of 60 km/hr, 80 km/hr and x km/hr respectively in the same direction. If all the three met at another point at the same instant during their journey, then what is the value of x ?

- A. 120
B. 110
C. 105
D. 100

91. Priya's age was cube of an integral number (different from 1) four years ago and square of an integral number after four years. How long should she wait so that her age becomes square of a number in the previous year and cube of a number in the next year?
- A. 7 years
B. 12 years
C. 14 years
D. 21 years
92. Which of the following statements is *not* true?
- A. The difference of two prime numbers, both greater than 2, is divisible by 2.
B. For two different integers m , n and a prime number p , if p divides the product $m \times n$, then p divides either m or n .
C. If a number is of the form $6n - 1$ (n being a natural number), then it is a prime number.
D. There is only one set of three prime numbers such that there is a gap of 2 between two adjacent prime numbers.
93. For $x > 0$, what is the minimum value of $x + \frac{x+2}{2x}$?
- A. 1
B. 2
C. $2\frac{1}{2}$
D. Cannot be determined
94. If $\frac{1+px}{1-px} \sqrt{\frac{1-qx}{1+qx}} = 1$, then what are the non-zero solutions of x ?
- A. $\pm \frac{1}{p} \sqrt{\frac{2p-q}{q}}$, $2p \neq q$
B. $\pm \frac{1}{pq} \sqrt{p-q}$, $p \neq q$
C. $\pm \frac{p}{q} \sqrt{p-q}$, $p \neq q$
D. $\pm \frac{p}{q} \sqrt{2p-q}$, $2p \neq q$
95. In a hostel the rent per room is increased by 20%. If number of rooms in the hostel is also increased by 20% and the hostel is always full, then what is the percentage change in the total collection at the cash counter?
- A. 30%
B. 40%
C. 44%
D. 48%
96. Radha and Hema are neighbours and study in the same school. Both of them use bicycles to go to the school. Radha's speed is 8 km/hr whereas Hema's speed is 10 km/hr. Hema takes 9 minutes less than Radha to reach the school. How far is the school from the locality of Radha and Hema?
- A. 5 km
B. 5.5 km
C. 6 km
D. 6.5 km
97. Which of the following pair of numbers is the solution of the equation $3^{x+2} + 3^{-x} = 10$?
- A. 0, 2
B. 0, -2
C. 1, -1
D. 1, 2
98. It is given that $\log_{10} 2 = 0.301$ and $\log_{10} 3 = 0.477$. How many digits are there in $(108)^{10}$?
- A. 19
B. 20
C. 21
D. 22

99. The sum of three prime numbers is 100. If one of them exceeds another by 36, then one of the numbers is
- A. 17
B. 29
C. 43
D. None of the above

100. If a, b and c are positive integers such that $\frac{1}{a + \frac{1}{b + \frac{1}{c + \frac{1}{2}}}} = \frac{16}{23}$, then what is the mean of a, b and c?
- A. 1
B. 2
C. 1.33
D. 2.33

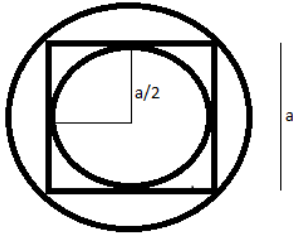
Solution

1-3

1.

Ans. A

Solution



The top view of the given assembly will look like the figure above

Outermost is the sphere. Inside that there is a cube and within that there is a cone and cylinder with same radius.

Here side of cube = a

Diameter of Sphere = body diagonal = $\sqrt{3} a$

Radius of sphere = $\sqrt{3} a/2 = r_1$

Height of Cylinder = Height of cone = side of cube = a = h

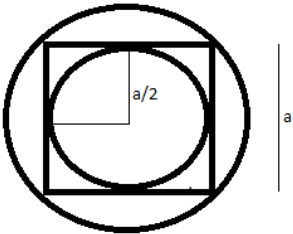
Radius of cylinder = Radius of cone = side of cube/2 = $a/2 = r_2$ (as shown in the figure)

$$\text{Volume of sphere/volume of cone} = \frac{V_{\text{sphere}}}{V_{\text{cone}}} = \frac{\frac{4}{3}\pi r_1^3}{\frac{1}{3}\pi r_2^2 h} = 6\sqrt{3}:1$$

2.

Ans. C

Solution



The top view of the given assembly will look like the figure above

Outermost is the sphere. Inside that there is a cube and within that there is a cone and cylinder with same radius.

Here side of cube = a

Diameter of Sphere = body diagonal = $\sqrt{3} a$

Radius of sphere = $\sqrt{3} a/2 = r_1$

Height of Cylinder = Height of cone = side of cube = a = h

Radius of cylinder = Radius of cone = side of cube/2 = $a/2 = r_2$ (as shown in the figure)

$$= \frac{V_{\text{cube}}}{V_{\text{cylinder}}} = \frac{a^3}{\pi r_2^2 h} = \frac{a^3}{\pi(a^2/4)a}$$

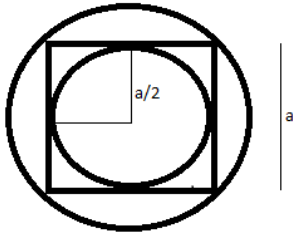
Put $\pi = 22/7$

= 14/11

3.

Ans. D

Solution



The top view of the given assembly will look like the figure above

Outermost is the sphere. Inside that there is a cube and within that there is a cone and cylinder with same radius.

Here side of cube = a

Diameter of Sphere = body diagonal = $\sqrt{3} a$

Radius of sphere = $\sqrt{3} a/2 = r_1$

Height of Cylinder = Height of cone = side of cube = $a = h$

Radius of cylinder = Radius of cone = side of cube/2 = $a/2 = r_2$ (as shown in the figure)

Surface area of Sphere = $4\pi r_1^2 = 3\pi a^2$

Curved Surface area of cone = $\pi r_2 L = \pi r_2 (h^2 + r_2^2)^{1/2} = \sqrt{5} \pi a^2 / 4$

Surface area of cube = $6a^2$

Curved Surface area of cylinder = $2\pi r_2 h = \pi a^2$

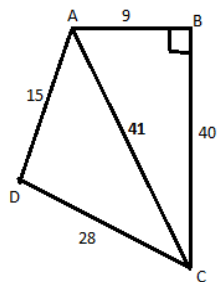
Thus neither 1 nor 2 are true

4-6

4.

Ans. A

Solution



Area of triangle ADC = $(s(s-a)(s-b)(s-c))^{1/2}$

Where s is the semi perimeter of triangle = $(AD + DC + CA) / 2 = 15 + 28 + 41 / 2 = 42$ cm

Area = $(42(42 - 15)(42 - 28)(42 - 41))^{1/2}$

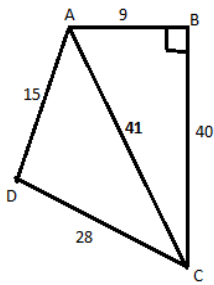
= $(42 * 27 * 14 * 1)^{1/2}$

= 126 cm^2

5

Ans B

Solution

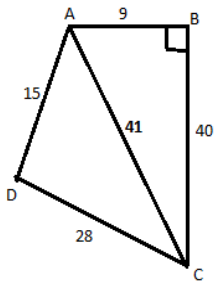


Area of quadrilateral ABCD = area of triangle ADC + area of triangle ABC
 $= 126 + \frac{1}{2} * 9 * 40 = 306 \text{ cm}^2$

6.

Ans. C

Solution



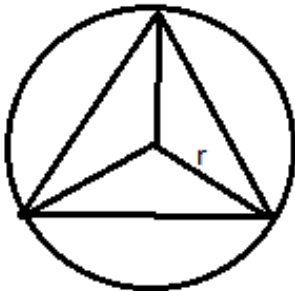
Perimeter of triangle ABC – Perimeter of triangle ADC = $(9+40+41)-(15+28+41) = 6\text{cm}$

7-8

7

Ans. D

Solution



Radius of circumcircle of an equilateral triangle = side / $\sqrt{3}$

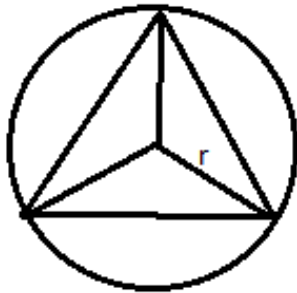
$R = a/\sqrt{3}$

$a = R\sqrt{3} = 20\sqrt{3} * \sqrt{3} = 60\text{cm}$

8

Ans. C

Solution



For equilateral triangle circumcenter and centroid are the same points
So distance from vertex = radius of circumcircle = $20\sqrt{3}$

9-10

9

Ans. A

Solution

Let lengths, breadth and height of cuboid be l , b and h respectively

According to question

$$l+b+h = 22\text{cm} \dots (i)$$

$$\text{and } \sqrt{l^2+b^2+h^2} = 14\text{cm} \dots (ii)$$

$$\text{Surface area of cuboid} = 2(lb+bh+lh)$$

Squaring eq (i) gives

$$l^2+b^2+h^2 + 2(lb+bh+lh) = 484$$

Substituting $l^2+b^2+h^2$ from eq (ii)

$$2(lb+bh+lh) = 484-196 = 288 \text{ cm}^2$$

10

Ans. C

Solution

Let lengths, breadth and height of cuboid be l , b and h respectively

According to question

$$l+b+h = 22\text{cm} \dots (i)$$

$$\text{and } \sqrt{l^2+b^2+h^2} = 14\text{cm} \dots (ii)$$

$$S = l^2+b^2+h^2 \text{ and } V = lbh$$

$$S-3V = l^2+b^2+h^2 - 3lbh = (l+b+h)(l^2+b^2+h^2-[lb+bh+lh]) \dots (iii)$$

As we know

Squaring eq (i) gives

$$l^2+b^2+h^2 + 2(lb+bh+lh) = 484$$

Substituting $l^2+b^2+h^2$ from eq (ii)

$$2(lb+bh+lh) = 484-196 = 288 \text{ cm}^2$$

$$lb+bh+lh = 144 \text{ cm}^2$$

Putting this in eq (iii) we get

$$22(196-144) = 22 \times 52 = 1144 \text{ cm}^2$$

11.

Ans. B

Solution

$$\text{Average speed} = \text{Total Distance} / \text{Total time} = \frac{9 \times \frac{50}{60} + 8 \times \frac{80}{60} + 7.5 \times \frac{100}{60}}{\frac{50}{60} + \frac{80}{60} + \frac{100}{60}}$$
$$= (45+64+75)/23 = 184/23$$
$$= 8 \text{ kmph}$$

12.

Ans. C

Solution

$$a/(b+c) = b/(c+a) = c/(a+b)$$

Taking reciprocal and adding 1 to each ratio we get;

$$(b+c)/a + 1 = b/(c+a) + 1 = c/(a+b) + 1$$

$$\text{Or } (a+b+c)/a = (a+b+c)/b = (a+b+c)/c$$

So this can only be equal when $a=b=c$ or $a+b+c = 0$

When $a=b=c$ we get $a/(b+c) = \frac{1}{2}$

When $a+b+c = 0$ we get $b+c = -a$

So $a/(b+c) = -1$

So the ratios are $\frac{1}{2}$ or -1

13.

Ans. B

Solution

$$3^{521}/8$$

As we know $3^2=9$ will leave remainder = 1 when divided by 8

So $3^{521}/8 = [(3^2)^{260} * 3]/8 = 1*3/8 = 3/8$ Thus remainder is 3

14

Ans. D

Solution

For prime no units place cannot be occupied by even number except for 2

Thus no of digits occupying unit digit of prime numbers = 6 (1,2,3,5,7,9)

Example 2,3,5,7,11,19 in itself are prime numbers

15.

Ans. D

Solution

Let CP be Rs x

Then

$$1.06x - 0.94x = 6$$

So x = Rs 50

16.

Ans. C

Solution

12 men or 18 women can complete in 14 days

8 men and 16 women can complete in how many days

12men = 18 women (Comparing efficiencies)

1men = $18/12 = 1.5$ women

8 men and 16 women = 12women + 16 women = 28 women

18 women completes in 14 days

1 woman completes in 14×18 days

28 women completes in $(14 \times 18)/28$ days = 9 days

17.

Ans. C

Solution

$$3^x = 4^y = 12^z$$

Taking log of all 3 we get

$$x \ln 3 = y \ln 4 = z \ln 12 = k$$

$$z = k / \ln 12 = k / \ln(3 \times 4) = k / (\ln 3 + \ln 4) = k / (k/x + k/y) = xy / (x+y)$$

18.

Ans. C

Solution

$$(4a+7b)(4c-7d) = (4a-7b)(4c+7d)$$

$$(4a+7b)/(4a-7b) = (4c+7d)/(4c-7d)$$

Using componendo and dividendo

$$(4a+7b)+(4a-7b) / (4a+7b)-(4a-7b) = (4c+7d)+(4c-7d) / (4c+7d)-(4c-7d)$$

$$\text{Or } 8a/14b = 8c/14d$$

$$\text{Or } a/b = c/d$$

19.

Ans. D

Solution

Since $x^2 + ax + b$ when divided by $x-1$ or $x+1$ leaves the same remainder

So on putting $x=1$ and $x=-1$ we get the same value

$$1+a+b = 1-a+b$$

$$2a=0$$

$$a=0$$

here b can take any value as it will always get cancelled out

20

Ans. D

Solution

Let them take x hours working together

$$1/x = 1/10 + 1/6 = 8/30$$

$$X = 30/8 \text{ hours} = 15/4 \text{ hours} = 3 \text{ hours } 45 \text{ minutes}$$

21.

Ans D

Solution

$$2 + \sqrt{2 + \sqrt{2 + \sqrt{2 + \dots}}} = t \text{ (let)}$$

$$2 + \sqrt{t} = t$$

$$\text{Or } t - 2 = \sqrt{t}$$

Squaring both sides

$$t = t^2 - 4t + 4$$

$$\text{or } t^2 - 5t + 4 = 0$$

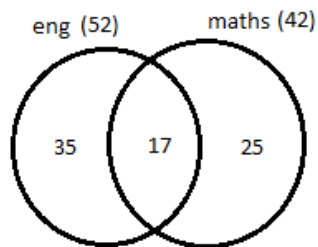
Or $t = 4, 1$ Now t cannot be equal to 1 as it is clear that it is always greater than 2

$$\text{So } t = 4$$

22.

Ans D

Solution



venn diagram of no of failed students

$$\text{No of students failed in English only} = 52 - 17 = 35$$

$$\text{No of students failed in maths only} = 42 - 17 = 25$$

$$\text{Total no of failed students in either of the subjects} = 35 + 17 + 25 = 77$$

$$\text{No of passed student in both subjects} = 100 - 77 = 23$$

23.

Ans. C

Solution

Let his wife get a share of Rs x

Each of the 4 daughters get = Rs $2x$

Each of the 5 sons get = Rs $6x$

$$\text{So } x + 4 \cdot 2x + 5 \cdot 6x = 390000$$

$$\text{So } 39x = 390000$$

$$x = 10000 = \text{wife's share}$$

24.

Ans. B

Solution

$$A = P(1 + R/100)^t$$

$$3P < P(1 + 40/100)^t$$

$$3 < (1.4)^t$$

$$\text{When } t = 3; 1.4^3 = 2.744$$

$$\text{And when } t = 4; 1.4^4 = 3.8416$$

$T=4$ is the answer

25.

Ans. B

Solution

Let sum invested @ 5% be P_1 , @ 6% be P_2 then @ 9% = $17200 - (P_1 + P_2)$

So according to question

$$P_1 \cdot 5 \cdot 2 / 100 = P_2 \cdot 6 \cdot 2 / 100 \text{ or } P_1 = (6/5) P_2$$

$$\text{Also } P_2 \cdot 6 \cdot 2 / 100 = [17200 - (P_1 + P_2)] \cdot 9 \cdot 2 / 100$$

$$\text{Or } 2 P_2 = [17200 - (11/5)P_2] \cdot 3$$

$$\text{Or } (2 + 33/5)P_2 = 17200 \cdot 3$$

$$P_2 = 17200 \cdot 3 \cdot 5 / 43 = 6000$$

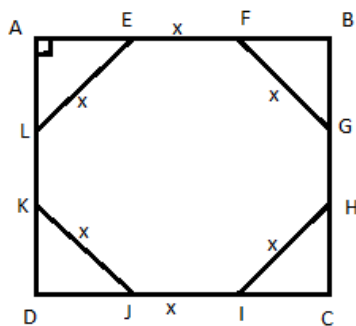
$$\text{So } P_1 = 6/5 P_2 = 7200$$

$$\text{So Sum invested @ 9\%} = 17200 - (6000 + 7200) = \text{Rs } 4000$$

26

Ans. A

Solution



Let side of hexagon be x

$$AE^2 + AL^2 = LE^2$$

Since we are forming a regular octagon so $AE = AL = FB = BG$ and so on

$$\text{So } AE = AL = x/\sqrt{2}$$

$$AE + EF + FB = \text{side of square} = a \text{ (Given)}$$

$$\text{So } x/\sqrt{2} + x + x/\sqrt{2} = a$$

$$x = a/(\sqrt{2} + 1) = a(\sqrt{2} - 1)$$

27.

Ans. A

Solution

let $n-1, n, n+1$ be 3 consecutive integers

So

$$(n+1)^2 = n^2 + (n-1)^2$$

$$(n+1)^2 - (n-1)^2 = n^2$$

$$4n = n^2$$

$$\text{So } n = 0 \text{ or } n = 4$$

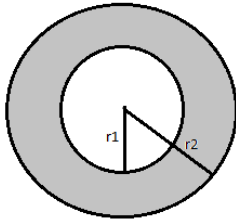
n can't be 0 as $n-1$ will be negative then

So 3, 4 and 5 is the only triplet formed

28.

Ans. C

Solution



$$\begin{aligned} \text{Given } C_1 &= 2\pi r_1 = 44 & C_2 &= 2\pi r_2 = 88 \\ r_1 &= 7 & r_2 &= 14 \end{aligned}$$

$$\begin{aligned} \text{Area between circles} &= \pi r_2^2 - \pi r_1^2 = 22/7(14^2 - 7^2) \\ &= 462 \text{ cm}^2 \end{aligned}$$

29.

Ans. C

Solution

Initially carpet is $6 \times 12 = 72$ sq feet

Since red border is 6 inches wide from all 4 side

So area without border $= 5 \times 11 = 55$ sq feet

Area of border $= \text{total} - \text{area without border} = 72 - 55 = 17$ sq feet

30.

Ans. C

Solution

Let other side and hypotenuse be $4x$ and $5x$ respectively

$$\text{Shortest side}^2 + (4x)^2 = (5x)^2$$

$$\text{Shortest side} = 3x$$

According to question

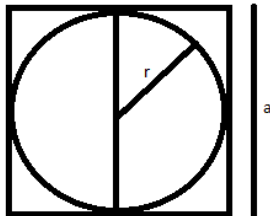
$$K \cdot 3x = 12x$$

$$\text{So } k = 4$$

31.

Ans. B

Solution



As it is clear that $2r = a$ where a is the side of the square and R is the radius of circle

It is given that $2\pi r + 4a = 12$

$$a = 12/(\pi + 4)$$

32.

Ans. A

Solution

$$4k + k + k = 6x = 180 \text{ degrees}$$

$$k = 30 \text{ degrees}$$

So triangle is 30,30 and 120 degrees

Let sides of triangle be x, x and y units with y being the largest side opposite to 120 degree angle

Using cosine law

$$\cos 120 = -\sin 30 = -1/2 = (2x^2 - y^2)/2x^2$$

$$\text{So } 3x^2 = y^2 \dots (i)$$

Given Perimeter = k (Largest side)

$$\text{Or } 2x + y = k$$

Putting value of x from eq (i)

$$2y/\sqrt{3} + y = k$$

$$K = 2/\sqrt{3} + 1$$

33.

Ans. C

Solution

$$\text{Hypotenuse} = 10 \text{ cm}$$

Let the other 2 perpendicular sides be a and b

$$\text{Area } \frac{1}{2} a \cdot b = 24$$

$$\text{So } a \cdot b = 48 \text{ cm}^2$$

Also using Pythagoras

$$a^2 + b^2 = 100$$

$$(a+b)^2 = a^2 + b^2 + 2ab = 100 + 96 = 196$$

$$a+b = 14$$

Similarly

$$a-b = 2$$

So

$$a=8 \text{ and } b=6$$

Now smaller side is halved and larger side is doubled

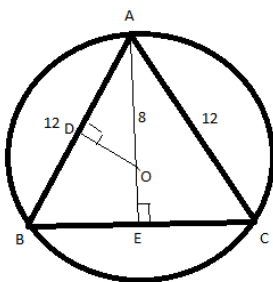
$$\text{So } a_1 = 16 \text{ and } b_1 = 3$$

$$\text{New hypotenuse} = \sqrt{16^2 + 3^2} = \sqrt{265}$$

34.

Ans. D

Solution



O is the center of circle

Here ABC forms an isosceles triangle as $AB=AC=12\text{cm}$

So AE (a perpendicular bisector) passes through O as OE also bisects chord BC at right angle

$$AD = DB = 6$$

In triangle ADO

$$AO^2 = AD^2 + DO^2$$

$$OD = \sqrt{64 - 36} = \sqrt{28}$$

Now using similarity

$$AEB \sim ADO$$

$$AB/AO = EB/DO$$

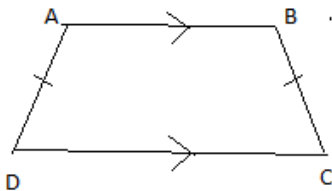
$$12/8 = (BC/2)/\sqrt{28}$$

$$BC=6\sqrt{7}$$

35.

Ans. C

Solution



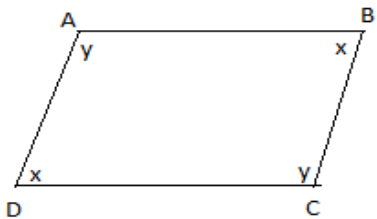
Since it is an isosceles trapezium

So angle C = angle D = x let

$$A = 180 - D = 180 - x \text{ (since AB is parallel to CD)}$$

$$B = 180 - x$$

$$A + C = 180 - x + x = 180 \text{ degrees (Property of cyclic quadrilateral)}$$



ABCD is cyclic parallelogram with $AB \parallel CD$ and $AD \parallel BC$

Considering angles

$$A = C = y \text{ (Property of parallelogram) and}$$

$$B = D = x$$

Also since it is cyclic

$$A + C = B + D = 180 \text{ degrees}$$

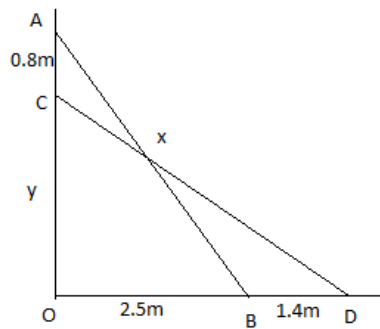
$$\text{So } x = y = 90 \text{ degrees}$$

And also opposite sides are equal being a parallelogram

Thus ABCD is a rectangle

36.

Ans. B



$AB = CD = x = \text{Length of ladder}$

Let $OC = y$ m

$$y^2 + 3.9^2 = x^2$$

$$(y+0.8)^2 + 2.5^2 = x^2$$

$$\text{So } y^2 + 3.9^2 = (y+0.8)^2 + 2.5^2$$

$$y = 5.2\text{m}$$

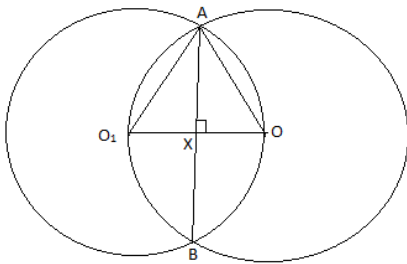
$$x = \sqrt{5.2^2 + 3.9^2}$$

$$x = 6.5\text{m}$$

37.

Ans. C

Solution



Let there be 2 circles with centre O_1 and O

AB is the common chord

Since both passes through the center of each other as shown in figure

So O_1O is the radius of both

Let $O_1O = r = AO_1 = AO$

$AX = AB / 2 = 5\sqrt{3}$ cm (since OX perpendicular to chord bisects it)

AOO_1 forms an equilateral triangle with on side = radius = r

$$\sin 60 = \sqrt{3}/2 = AX / AO = 5\sqrt{3}/r$$

So $r = 10\text{cm}$

So diameter = 20 cm

38

Ans. D

Solution

(1) Only one circle can be drawn through 3 non collinear points

Angle in the minor segment is always obtuse

39

Ans. D

Solution

$$AC - AB < BC \text{ Or } AB + BC > AC$$

$$BC - AC < AB \text{ Or } AB + AC > BC$$

$$AB - BC < AC \text{ Or } AC + BC > AB$$

Sum of 2 sides of triangle is always greater than the third side

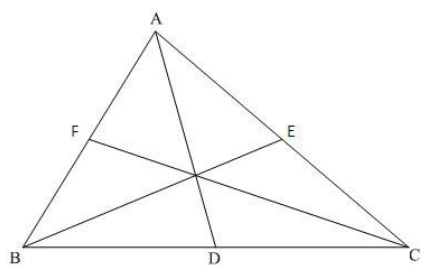
So all three statements are true

40.

Ans. C

Solution

1. Perimeter of triangle is greater than the sum of 3 medians



Let ABC be the triangle and D, E and F are midpoints of BC, CA and AB respectively.

Recall that the sum of two sides of a triangle is greater than twice the median bisecting the third side, (Theorem to be remembered)

Hence in $\triangle ABD$, AD is a median

$$\Rightarrow AB + AC > 2(AD)$$

Similarly, we get

$$BC + AC > 2CF$$

$$BC + AB > 2BE$$

On adding the above inequations, we get

$$(AB + AC) + (BC + AC) + (BC + AB) > 2AD + 2CD + 2BE$$

$$2(AB + BC + AC) > 2(AD + BE + CF)$$

$$\therefore AB + BC + AC > AD + BE + CF$$

2.

To prove: $AB + BC + CA > 2AD$

Construction: AD is joined

Proof: In triangle ABD,

$AB + BD > AD$ [because, the sum of any two sides of a triangle is always greater than the third side] ---- 1

In triangle ADC,

$AC + DC > AD$ [because, the sum of any two sides of a triangle is always greater than the third side] ---- 2

Adding 1 and 2 we get,

$$AB + BD + AC + DC > AD + AD$$

$$\Rightarrow AB + (BD + DC) + AC > 2AD$$

$$\Rightarrow AB + BC + AC > 2AD$$

Hence proved

41.

Ans. C

Solution

$$\text{Mean} = (\text{sum of } f_i x_i) / (\text{sum of } f) = (8*5 + 12*15 + 10*25 + P*35 + 9*45) / (8+12+10+P+9) = 25.2$$
$$(875 + 35P)/(39+P) = 25.2$$

$$P = 11$$

42.

Ans. C

Solution

$$\text{Summation of frequencies} = 6+4+5+8+9+6+4 = 42$$

Median = mid value = average of 21st and 22nd value

Arranging data in increasing order we get

x	f
4	6
5	4
6	5
7	4
8	6
9	9
10	8

So mid value i.e 21st and 22nd value = 8

43.

Ans. B

Solution

$$\text{Sum of } n \text{ consecutive natural numbers} = n(n+1)/2$$

$$\text{Average of } n \text{ consecutive natural numbers} = (n+1)/2$$

$$\text{For first 50 average} = 51/2 = x$$

$$\text{Last 50 average} = 55/2 = x+2$$

44.

Ans. C

Solution

All such 2 digit numbers are 11,22,33,44..... upto 99

Forms an AP

$$\text{So sum} = n/2(a+l)$$

$$= 9/2(11+99)$$

$$\text{Average} = \text{sum}/9 = \frac{1}{2}(11+99) = 55$$

45.

Ans. D

Solution

All three are types of data representation

Pictogram uses pictures so show different identities with different numbers

46.

Ans. D

Solution

Primary data is information that you collect specifically for the **purpose** of your research project. An advantage of primary data is that it is specifically tailored to your research needs. A disadvantage is that it is expensive to obtain.

47.

Ans. B

Solution

15 cm corresponds to 6000 rs

Education = $480/6000 * 15 \text{ cm} = 1.2 \text{ cm}$

Miscellaneous = $1660/6000 * 15 \text{ cm} = 4.15 \text{ cm}$

48.

Ans. A

Solution

Mean of m observations is n

Mean of n-m observations is m

So total = $nm + (n-m)m$

Total observations = n

Mean = Total / Total observations = $(2mn - m^2)/n = 2m - m^2/n$

49.

Ans. A

Solution

An ogive (oh-jive), sometimes called a cumulative frequency polygon, is a type of frequency polygon that shows cumulative frequencies. In other words, the cumulative percents are added on the graph from left to right. An ogive graph plots cumulative frequency on the y-axis and class boundaries along the x-axis. Only median can be traced using frequency polygon curve. Thus it has a graphical location on the curve. Hence the only option correctly matched is option A.

50.

Ans. D

Solution

Area of the polygon gives sum of $f_i x_i$ not summation of f_i

51.

Ans. C

Solution.

Let the breadth of the rectangle = x

Length of the the rectangle will be = 3 times of breadth = 3x

So the initial perimeter = $2(\text{length} + \text{breadth}) = 2(x + 3x) = 8x$

New breadth after increase = $x + 10x/100 = 1.1x$

New length after increase = $3x + 30*3x/100 = 3.9x$

New perimeter = $2(1.1x + 3.9x) = 10x$

Percentage change in perimeter = $(10x - 8x) * 100 / 8x = 25\%$

52.

Ans. A

Solution

Area of triangle of = $\frac{1}{2} * a * b * \sin \theta = A$

Where a and b are sides of the triangle and θ be the angle between them

After decreasing each side

New area = $\frac{1}{2} * (a/2) * (b/2) * \sin \theta = \frac{1}{4} A$

%decrease = $[(A - \frac{1}{4} A)/A] * 100 = 75\%$

53.

Ans. A

Solution

Let the volume of spherical balloon initially = V

New volume after increase = $V + 700 * V / 100 = 8V$

Since we know that volume of sphere is directly proportional to the radius of sphere

$$\frac{\text{initial volume}}{\text{final volume}} = \frac{(\text{initial radius})^3}{(\text{final radius})^3}$$

$$\frac{V}{8V} = \frac{(\text{initial radius})^3}{(\text{final radius})^3}$$

Final radius = 2 * initial radius

Since surface area of sphere is directly proportional to the square of the radius of sphere,()

$$\frac{\text{initial surface area}}{\text{final surface area}} = \frac{(\text{initial radius})^2}{(\text{final radius})^2}$$

$$\frac{\text{initial surface area}}{\text{final surface area}} = \frac{(R)^2}{(2R)^2}$$

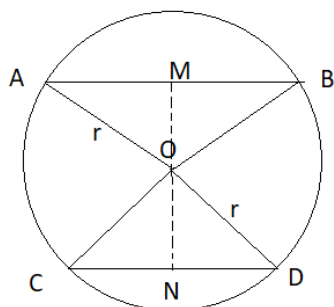
Final surface area = 4 * initial surface area

% change = $\frac{\text{Final area} - \text{initial area}}{\text{initial area}} \times 100 = 300\%$

54.

Ans. B

Solution.

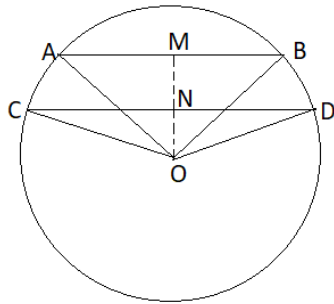


Case – 1

When both the chords are in two different halves of the circle

Distance between chords = $OM + ON = \sqrt{r^2 - ND^2} + \sqrt{r^2 - MB^2}$

$$= \sqrt{10^2 - \left(\frac{12}{2}\right)^2} + \sqrt{10^2 - \left(\frac{16}{2}\right)^2} = 8cm + 6cm = 14cm$$



Case – 2

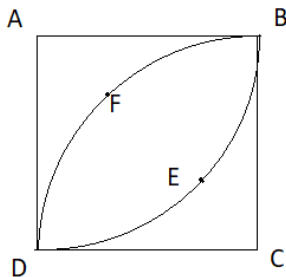
When both the chords are in two different halves of the circle

$$\begin{aligned} \text{Distance between chords} &= OM + ON = \sqrt{r^2 - ND^2} + \sqrt{r^2 - MB^2} \\ &= \sqrt{10^2 - \left(\frac{12}{2}\right)^2} + \sqrt{10^2 - \left(\frac{16}{2}\right)^2} = 8\text{cm} - 6\text{cm} = 2\text{cm} \end{aligned}$$

55.

Ans. C

Solution.



$$\begin{aligned} \text{Area of leaf BEDFB} &= \text{Area of two quarter circle} - \text{area of square} \\ &= 2\pi r^2/4 - a^2 \\ &= \pi a^2/2 - a^2 = a^2(\pi/2 - 1) \end{aligned}$$

56.

Ans. A

Solution.

We know that when $a+b+c = 0$, then

$$a^3 + b^3 + c^3 = 3abc$$

in the above question,

$$(x-y) + (y-z) + (z-x) = 0$$

Therefore,

$$(x-y)^3 + (y-z)^3 + (z-x)^3 = 3(x-y)(y-z)(z-x)$$

$$\frac{(x-y)^3 + (y-z)^3 + (z-x)^3}{3(x-y)(y-z)(z-x)} = 1$$

57.

Ans. C

Solution.

$$a^x = b^y = c^z = k$$

$$a = k^{1/x}$$

$$b = k^{1/y}$$

$$c = k^{1/z}$$

given $b^2 = ac$, putting the above values of a,b,c in the equation we get

$$k^{2/y} = k^{1/x} \cdot k^{1/z}$$

$$2/y = 1/x + 1/z$$

58.

Ans. B

Solution.

In the below equation,

$$x^2 - 15x + r = 0$$

$$\text{sum of roots} = p + q = -(-15)/1 = 15$$

$$\text{product of roots} = pq = r/1 = r$$

$$\text{given } p - q = 1$$

$$\text{also we know that } p + q = 15$$

subtracting the squares of both

$$(p+q)^2 - (p-q)^2 = 15^2 - 1$$

$$p^2 + q^2 + 2pq - p^2 - q^2 + 2pq = 225 - 1$$

$$4pq = 224$$

$$4r = 224$$

$$r = 56$$

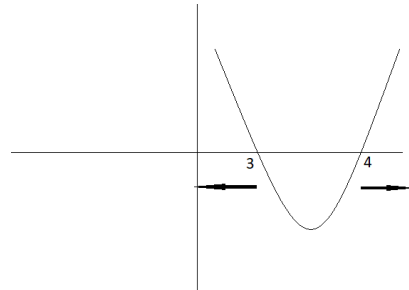
(sum of roots for equation $ax^2 + bx + c$ is $-b/a$)

(product of roots for equation $ax^2 + bx + c$ is c/a)

59.

Ans.D

Solution.



As we can see from the graph of the quadratic equation, that the value of the equation is greater than zero for the values of $x < 3$ and $x > 4$

60.

Ans. C

Solution.

$$5^{2n} - 2^{3n} = (5^2)^n - (2^3)^n = (25)^n - (8)^n$$

We know that $a^n - b^n$ always have a common factor $(a - b)$

Therefore one of the factor is $25 - 8 = 17$

61.

Ans. B

Solution.

$$\tan x = 1$$

then

$$x = 45^\circ$$

$$2\sin x \cdot \cos x = 2 \times \frac{1}{\sqrt{2}} \times \frac{1}{\sqrt{2}} = 1$$

62.

Ans. C

Solution.

$$\sin 46^\circ \cdot \cos 44^\circ + \cos 46^\circ \cdot \sin 44^\circ$$

$$\sin 46^\circ \cdot \sin (90 - 44)^\circ + \cos 46^\circ \cdot \cos (90 - 44)^\circ$$

$$= \sin^2 46^\circ + \cos^2 46^\circ = 1$$

63.

Ans. B

Solution.

We know that,

Arithmetic mean \geq Geometric mean

$$(4\sin^2 \theta + 1)/2 \geq \sqrt{4\sin^2 \theta \cdot 1}$$

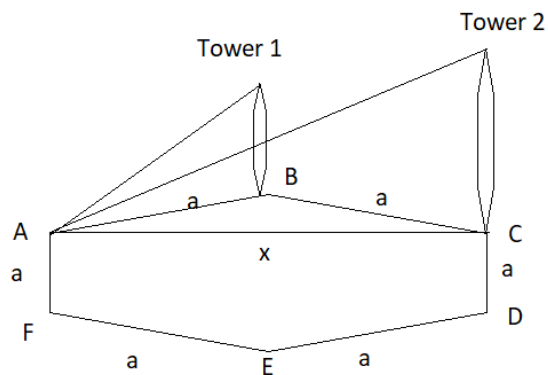
$$4\sin^2 \theta + 1 \geq 2 \cdot 2 \sin \theta$$

$$4\sin^2 \theta + 1 \geq 4\sin \theta$$

64.

Ans. B

Solution



Let the side of regular hexagon be 'a'

Let height of the tower1 be h_1 and tower 2 be h_2

$$\text{Height of tower 1} = h_1 = (\text{distance between A and B}) * (\tan 30^\circ) = a \cdot \frac{1}{\sqrt{3}}$$

$$\text{Distance between A and C} = 2 * \sqrt{3} \cdot a / 2 = \sqrt{3}a$$

$$\text{Height of tower 2} = h_2 = (\text{distance between A and C}) * (\tan 45^\circ) = \sqrt{3}a \cdot 1 = \sqrt{3}a$$

$$\text{Ratio of height of towers at B and C respectively} = \frac{\frac{a}{\sqrt{3}}}{\sqrt{3}a} = \frac{1}{3}$$

65.

Ans. B

Solution.

$$\tan 1^\circ \cdot \tan 89^\circ = \tan 1^\circ \cdot \cot 1^\circ = 1$$

similarly,

$$\tan 2^\circ \cdot \tan 88^\circ = \tan 2^\circ \cdot \cot 2^\circ = 1$$

$$\tan 3^\circ \cdot \tan 87^\circ = \tan 3^\circ \cdot \cot 3^\circ = 1$$

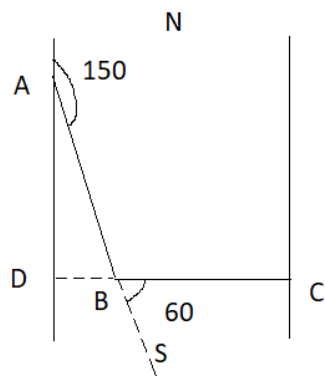
hence the equation will reduce to

$$\tan 45^\circ = 1$$

66.

Ans. C

Solution.



Initially the person is travelling from south to north i.e. D to A

He takes 150° right turn and moves AB distance and then he takes 60° left turn travels BC

$$AB = 20\text{km/hr} \cdot 15/60 \text{ hr} = 5\text{km}$$

$$BC = 30 \cdot 20/60 = 10 \text{ km}$$

We know that distance between both the streets is $DC = DB + BC$

$$DB = AB \cos 60^\circ = 5 \cdot \frac{1}{2} = 2.5 \text{ km}$$

So the distance between streets = 12.5 km

67.

Ans. A

Solution.

$$3\tan \theta = \cot \theta$$

$$3\tan \theta = 1/\tan \theta$$

$$\tan^2 \theta = 1/3$$

$$\tan \theta = 1/\sqrt{3}$$

$$\theta = \pi/6$$

68.

Ans.B

Solution.

$$\sin^2 25^\circ + \sin^2 65^\circ = \sin^2 25^\circ + \sin^2 (90 - 25)^\circ = \sin^2 25^\circ + \cos^2 25^\circ = 1$$

69.

Ans. A

Solution.

$$\sin^6 \theta + \cos^6 \theta + 3\sin^2 \theta \cdot \cos^2 \theta - 1$$

$$\sin^6 \theta + \cos^6 \theta + 3\sin^2 \theta \cdot \cos^2 \theta \cdot 1 - 1$$

$$\sin^6 \theta + \cos^6 \theta + 3\sin^2 \theta \cdot \cos^2 \theta \cdot (\sin^2 \theta + \cos^2 \theta) - 1$$

$$(\sin^2 \theta + \cos^2 \theta)^3 - 1 = 1 - 1 = 0$$

70.

Ans. C

Solution.

Sec of any number can never be less than 1

tan can take any value from $-\infty$ to $+\infty$

cosec of any number can never be less than 1

cos of any number can never be greater than 1

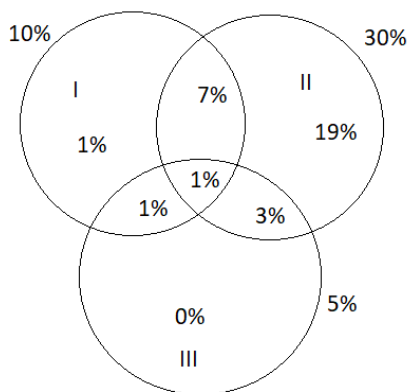
so option 1,3,4 are not possible

71 to 73

71.

Ans. A

Solution.

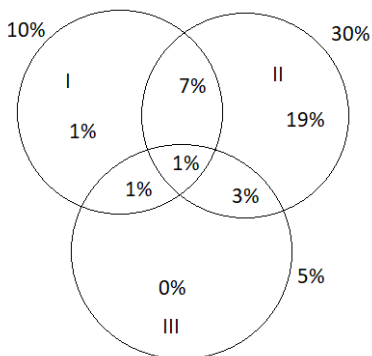


The number of people who read only I , only II and only III are

$$1\% + 19\% + 0\% = 20\% \text{ of total population} = 20/100 * 100000 = 20000$$

72.

Ans. A

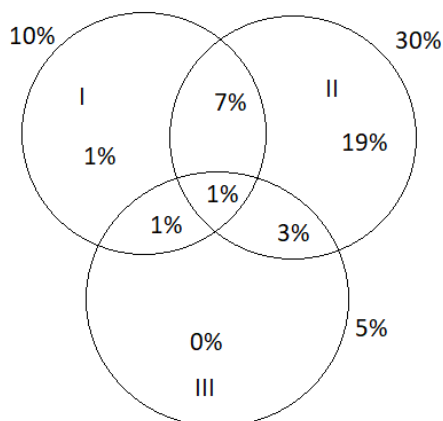


As we can see from the above venn diagram the number of people who read two or more newspapers are $1\% + 1\% + 3\% + 7\% = 12\% = \frac{12}{100} * 100000 = 12000$

73.

Ans. D

Solution.



Number of people who do not read any of these newspaper = total population – number of people who read atleast one of these newspapers.

number of people who read atleast one of these newspapers = $1\% + 1\% + 3\% + 1\% + 7\% + 19\% = 32\%$ of total population = 32000

required number of people = $100000 - 32000 = 68000$

74.

Ans.C

Solution.

power	Repetition values of unit digits according to their power								
	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9
2	1	4	9	6	5	6	9	4	1
3	1	8	7	4	5	6	3	2	9
4	1	6	1	6	5	6	1	6	1

From the above table we can see that the power 73 is of the form $4x + 1$

Therefore the unit digit according to the table = 7

75.

Ans.C

Solution.

$$N^2 + 48 = k^2$$

$$48 = k^2 - N^2$$

$$(k - N)(k + N) = 48$$

So the possible number of pairs of $(k - N)$ and $(k + N)$ are

$(1,48), (2,24), (3,16), (4,12), (6,8)$

On solving the above pairs for $(k - N)$ and $(k + N)$, we get the integer values of N and k as

$N=1, k= 7$

$$N=4, k=8$$

$$N=11, k=13$$

So the total possible values of N are three

76.

Ans. D

Solution.

$$x = \frac{4\sqrt{6}}{\sqrt{2}+\sqrt{3}}$$

on rationalizing,

$$x = \frac{4\sqrt{6}}{\sqrt{2}+\sqrt{3}} \times \frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}-\sqrt{2}}$$

$$x = 12\sqrt{2} - 8\sqrt{3}$$

putting the value of x in the equation

$$\frac{14\sqrt{2}-8\sqrt{3}}{10\sqrt{2}-8\sqrt{3}} + \frac{12\sqrt{2}-6\sqrt{3}}{12\sqrt{2}-10\sqrt{3}} = \frac{7\sqrt{2}-4\sqrt{3}}{5\sqrt{2}-4\sqrt{3}} + \frac{6\sqrt{2}-3\sqrt{3}}{6\sqrt{2}-5\sqrt{3}}$$

$$\frac{2\sqrt{2}}{5\sqrt{2}-4\sqrt{3}} + 1 + 1 + \frac{2\sqrt{3}}{6\sqrt{2}-5\sqrt{3}}$$

$$2 + \frac{2\sqrt{2}(6\sqrt{2}-5\sqrt{3})+2\sqrt{3}(5\sqrt{2}-4\sqrt{3})}{(5\sqrt{2}-4\sqrt{3})(6\sqrt{2}-5\sqrt{3})}$$

$$2 + \frac{24-10\sqrt{6}+10\sqrt{6}-24}{(5\sqrt{2}-4\sqrt{3})(6\sqrt{2}-5\sqrt{3})} = 2 + 0 = 2$$

77.

Ans. D

Solution.

$$x = 30\% \text{ of } z = 30z/100 = 3z/10$$

$$y = 40\% \text{ of } z = 40z/100 = 4z/10$$

According to the question,

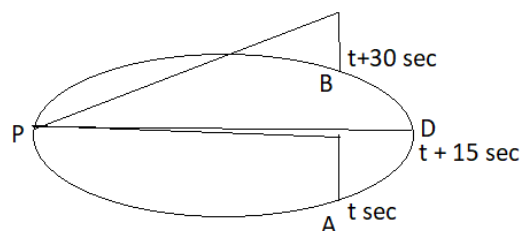
$$(x/y) * 100 = p\%$$

$$p\% = \frac{3z/100}{4z/100} \times 100 = 75\%$$

78.

Ans.C

Solution.



Let the plane be at point A at t seconds and at point B after t + 30 seconds

Since the motion is uniform, we can say that at time t+15 seconds, the plane is above the point is diametrically opposite to the point P from where the angle is same.

Now since the time taken to cover the full circle is 3 minutes (180 seconds), the time taken by the plane to reach the diametrically opposite point will be 90 seconds.

So the time after which the plane reaches the point P will be = t+ 15 + 90 seconds = (t + 105)seconds

79.

Ans.D

Solution.

All the given statements are true. The following are the examples for all the statements

Statement 1: Both p and q may be prime numbers. E.g. 3 and 5

Statement 2 : Both p and q may be composite numbers. E.g. 4 and 9

Statement 3 : One of p and q may be prime and the other composite. E.g. 7 and 12

80.

Ans. A

Solution.

By alligation,

girls boys

24 32

30

2 : 6

1 : 3

So the number of girls will be $= (1/(1+3)) * 100 = 25$

81.

Ans. C

Solution.

For the equation,

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

Where a and b are real numbers,

The roots of number is always positive and hence it can be zero only at $a=b$

So the above equation is positive only when $a=b$

82.

Ans. C

Solution.

Let $a = x$ then $b = 6x$

Also let $c = y$ then $d = 6y$

$$\frac{a^2+c^2}{b^2+d^2} = \frac{x^2+y^2}{(6x)^2+(6y)^2} = \frac{1}{36}$$

83.

Ans. A

Solution.

$$.\overline{53} + 0.5\overline{3}$$

$$= 0.5353535353.... + 0.5333333333....$$

$$= 1.068686868 = 1.0\overline{68}$$

84.

Ans. D

Solution.

$3^N > N^3$ holds for all the natural numbers except $N = 3$ at which $3^N = N^3$

85.

Ans. D

Solution.

A number that cannot be represented in the form p/q where p and q are two integers, is known as irrational number $\sqrt{59049} = 243$. Hence it is rational

$\frac{231}{593}$ is already in the form of rational number

$0.4545454545\ldots$ can be represented in the form of p/q as $5/9$

$0.1211221112221112222\ldots$ cannot be represented in the form of p/q as there is no recurring digits in the given number

86.

Ans. D

Solution.

The number $17^{29} = (18 - 1)^{29}$ when divided by 18 leaves the remainder $(-1)^{29} = 18 - 1 = 17$

The number $19^{29} = (18 + 1)^{29}$ when divided by 18 leaves the remainder $(1)^{29} = 1$

Then after adding these two the remainder will be $17 + 1 = 18$ which is divisible by 18

Hence the remainder will be 0

87.

Ans. A

Solution.

For the number to be divisible by 10^n , it must contain the same powers for 2 and 5

Power of 2 = $2^{5+2.8+7+3.12+6+2.14+11} = 2^{5+16+7+36+6+28+11} = 2^{109}$

Power of 5 = $5^{3+6+12+14+2.15} = 5^{65}$

Hence maximum possible power of 10 can be 65 only.

88.

Ans. A

Solution.

If the number is divisible by 9 the sum of all its digit is divisible by 9

$4+7+9+8+6+5+A+B = 39 + A + B$ is divisible by 9

Possible values of B are 1,3,5,7,9 as it is given that last digit is odd

For B = 1, A = 5

For B = 3 A = 3

For B = 5, A = 1

For B = 7, A = 8

For B = 9, A = 6

89.

Ans. D

Solution.

$999 \times abc = def132$

We can write the above equation as

$(1000 - 1) \times abc = def132$

$abc000 - abc = def000 + 132 = (def + 1) \times 1000 - 868$

on comparing the LHS and RHS, we get

$a = 8$, $b = 6$, and $c = 8$ and $d = a = 8$, $e = b = 6$ and $f = c - 1 = 8 - 1 = 7$

90.

Ans. A

Solution.

Distance covered by A till 6pm = 60 km

Distance covered by A till 7 pm = 120 km

Time taken by B to catch A = $60/(80-60) = 3$ hrs

So A and B will meet at 6pm + 3 hrs = 9pm

Since we know that all three met at the same time

The time taken by C to cover 120 km difference will be = 9pm – 7pm = 2hrs

Therefore, $(x - 60) \cdot 2 = 120$

$x = 120 \text{ km/hr}$

91.

Ans. C

Solution

Let present age of Priya be p

$$p-4 = n^3$$

$$p+4 = \sqrt{k}$$

since n is a no >1 on putting n= 2 we get p = 12

So p+4 = 16 which is square of an integral number thus consistent with given information

Now after how many years her age becomes such that age – 1 is a square and age + 1 is a cube

Using option if we add 14 years to current age , we get age = 26 years

Here 25 is a square and 27 is a cube thus making 14 the correct answer

92.

Ans. D

Solution

Option C is incorrect as $6n - 1$ form can be a prime number but it is not necessarily true.

Example 35 is of form $6n-1$ but is not a prime number

93.

Ans. C

Solution

For $x > 0$ Min of $x + (x+2)/2x = ?$

$$x + (x+2)/2x = x + \frac{1}{2} + \frac{1}{x}$$

So we have to find the minimum of $x + 1/x$ and add $\frac{1}{2}$ to it

As $AM > GM$

$$\text{So } (x + 1/x)/2 > \sqrt{(x \cdot 1/x)}$$

$$\text{Or } x + 1/x > 2$$

$$\text{So min of } x + (x+2)/2x = 2 + 1/2 = 5/2$$

94.

Ans. A

Solution.

$$\frac{1 + px}{1 - px} \sqrt{\frac{1 - qx}{1 + qx}} = 1$$

On squaring and cross multiplying, we get

$$\left(\frac{1+px}{1-px}\right)^2 = \left(\sqrt{\frac{1+qx}{1-qx}}\right)^2$$

$$\frac{1+p^2x^2+2px}{1+p^2x^2-2px} = \frac{1+qx}{1-qx}$$

On applying componendo and dividend

$$\frac{2(1+p^2x^2)}{-4px} = \frac{2}{-2qx}$$

On solving the above equation, we get

$$x = \pm \frac{1}{p} \sqrt{\frac{2p-q}{q}}$$

95.

Ans. C

Solution

Let initial rent be rs 10

And initial rooms be 10

So initial collection = $10 \times 10 = \text{Rs } 100$

Now new rent = $10 + 20\% \text{ of } 10 = 12$

New no of rooms = $10 + 20\% \text{ of } 10 = 12$

So new collection = $12 \times 12 = 144$

% change in collection = $(144-100)/100 \times 100 = 44\%$

96.

Ans. C

Solution

Let the distance between be D km

Time taken by radha – Time taken by Hema = 9 mins

So $D/8 - D/10 = 9/60$ hrs

D = 6km

97.

Ans. B

Solution

$$3^{x+2} + 3^{-x} = 10$$

Only powers of 3 that add upto 10 is

$$3^2 + 3^0 = 10$$

$$x+2 = 0$$

x = -2 solution is consistent

Or $x+2 = 2$

x = 0 solution is consistent

Thus x = 0, -2 are the solutions

Alternatively, we can put values from the options and check.

98.

Ans. C

Solution

No of digits in $(108)^{10}$

We have to find the log of the given number with base 10 and add one to its integral part to find the no of digits

$$\log (108)^{10} = 10 \log 108 = 10 \log(2^2 * 3^3) = 10[2\log 2 + 3\log 3] \\ = 10[2*0.301 + 3*0.477] = 20.33$$

Integral part = 20

No of digits = $20+1 = 21$

99.

Ans. D

Solution

Let the three prime numbers be x, y, y+36

$$x+y+y+36 = 100$$

$$x+2y = 64$$

2y is an even number always

We know that

Even + even = even or odd + odd = even

So x has to be even to satisfy $x+2y = 64$

The only even prime no is 2

Put $x=2$

$$2y = 62$$

$$\text{Or } y = 31$$

So the numbers are 2, 31, 67

Thus option D is the answer

100.

Ans. B

Solution

$$\frac{16}{23} = \frac{1}{\frac{23}{16}} = \frac{1}{1 + \frac{7}{16}} = \frac{1}{1 + \left(\frac{1}{\frac{16}{7}}\right)} = \frac{1}{1 + \frac{1}{2 + \left(\frac{2}{7}\right)}} = \frac{1}{1 + \left(\frac{1}{2 + \left(\frac{1}{\frac{7}{2}}\right)}\right)} = \frac{1}{1 + \left(\frac{1}{2 + \left(\frac{1}{3 + \frac{1}{2}}\right)}\right)}$$

On comparing equations we get $a = 1$, $b = 2$ and $c = 3$

$$\text{Mean} = \frac{a+b+c}{3} = \frac{6}{3} = 2$$
