C.D.S.
Combined Defence Services

EXAM II 2024

Elementary Mathematics

Time Allowed: 2 Hours   **Maximum Marks: 100**

1. A real number x is such that the sum of the number and four times its square is the least. What is that number?
(a) –0.625   (b) –0.125   (c) 0.125   (d) 1

2. The difference of the square of two natural numbers m and n $(m > n)$ is 72. How many pairs of natural numbers will satisfy?
(a) 3   (b) 4   (c) 5   (d) 6

3. Let N be a 5-digit number. When N is divided by 6, 12, 15, 24, it leaves respectively 2, 8, 11, 20 as remainders. What is the greatest value of N?
(a) 99960   (b) 99956   (c) 99950   (d) 99946

4. What is the remainder when $111^{222} + 222^{333} + 333^{444}$ is divided by 5?
(a) 1   (b) 2   (c) 3   (d) 4

5. What are the last three digits in the multiplication of $4321012345 \times 98766789$?
(a) 1, 0, 5   (b) 2, 0, 5   (c) 2, 1, 5   (d) 3, 0, 5

6. p varies directly as $(x^2 + y^2 + z^2)$. When $x = 1$, $y = 2$, $z = 3$, then $p = 70$. What is the value of p when $x = -1$, $y = 1$, $z = 5$?
(a) 100   (b) 125   (c) 135   (d) 140

7. Let N be the least positive multiple of 11 that leaves a remainder of 5 when divided by 6, 12, 15, 18. Which one of the following is correct?
(a) $900 < N < 1000$ (b) $1000 < N < 1100$
(c) $1100 < N < 1200$ (d) $1200 < N < 1300$

8. What is $\dfrac{1}{\sqrt{10} + \sqrt{9}} + \dfrac{1}{\sqrt{11} + \sqrt{10}} + \dfrac{1}{\sqrt{12} + \sqrt{11}} + ... + \dfrac{1}{\sqrt{196} + \sqrt{195}}$ equal to?
(a) 17   (b) 14   (c) 11   (d) 10

9. Train X crosses a man standing on the platform in 24 seconds and train Y crosses a man standing on the platform in 18 seconds. They cross each other while running in opposite directions in 20 seconds. What is the ratio of speed of X to speed of Y?
(a) $1 : 2$ (b) $2 : 3$ (c) $1 : 3$ (d) $3 : 4$

10. Let p, q be the roots of the equation $x^2 + mx - n = 0$ and m, n be the roots of the equation $x^2 + px - q = 0$ (m, n, p, q are non-zero numbers). Which of the following statements is/are correct?
I. $m(m + n) = -1$ II. $p + q = 1$
Select the answer using the code given below:
(a) I only   (b) II only
(c) Both I and II   (d) Neither I nor II

11. What is the maximum value of $8\sin\theta - 4\sin^2\theta$?
(a) 3   (b) 4   (c) 8   (d) 12

12. What is $(1 + \tan\alpha \tan\beta)^2 + (\tan\alpha - \tan\beta)^2$ equal to?
(a) $\tan^2\alpha \tan^2\beta$ (b) $\sec^2\alpha \sec^2\beta$
(c) $\tan^2\alpha \cot^2\beta$ (d) $\sec^2\alpha \tan^2\beta$

13. Consider the following statements:
    I. $\tan 50° - \cot 50°$ is positive.
    II. $\cot 25° - \tan 25°$ is negative.
    Which of the statements are correct?
    (a) I only   **(b)** II only
    (c) Both I and II   **(d)** Neither I nor II

14. If $0 \le (\alpha - \beta) \le (\alpha + \beta) < \dfrac{\pi}{2}$, $\tan(\alpha + \beta) = \sqrt{3}$
    and $\tan(\alpha - \beta) = \dfrac{1}{\sqrt{3}}$, then what is $\tan\alpha.\cot 2\beta$
    equal to?
    (a) 1   **(b)** $\sqrt{2}$ **(c)** $\sqrt{3}$ **(d)** $\dfrac{1}{\sqrt{3}}$

15. What is the value of $\sin^2\theta \cos^2\theta (\sec^2\theta + \csc^2\theta)$
    equal to?
    (a) 0   **(b)** 1   **(c)** 2   **(d)** 4

16. If $64^{\sin^2\theta} + 64^{\cos^2\theta} = 16$ where $0 \le \theta \le \dfrac{\pi}{2}$, then
    what is the value of $\tan\theta + \cot\theta$?
    (a) 1   **(b)** 2   **(c)** 3   **(d)** 4

17. If $\csc\theta - \cot\theta = m$ and $\sec\theta - \tan\theta = n$, then
    what is $\csc\theta + \sec\theta$ equal to?
    (a) $\dfrac{1}{2}\left(m + n + \dfrac{1}{m} + \dfrac{1}{n}\right)$ **(b)** $\left(m + n + \dfrac{1}{m} + \dfrac{1}{n}\right)$
    (c) $\dfrac{1}{2}\left(m + n - \dfrac{1}{m} - \dfrac{1}{n}\right)$ **(d)** $\left(m + n - \dfrac{1}{m} - \dfrac{1}{n}\right)$

18. From a point X on a bridge across a river, the angles of depression of two points P and Q on the banks on opposite side of the river are α and β, respectively. If the point X is at a height h above the surface of the river, what is the width of the river if α and β are complementary?
    (a) $2h(\tan\alpha + \cot\alpha)$ **(b)** $h \tan\alpha \cdot \tan\beta$
    (c) $h \cot\alpha \cdot \cot\beta$ **(d)** $h \sec\alpha \cdot \csc\alpha$

19. In a triangle ABC, $\angle ABC = 60°$ and AD is the altitude. If AB = 6 cm and BC = 8 cm, then what is the area of the triangle?
    (a) 12 square cm   **(b)** $12\sqrt{3}$ square cm
    (c) 24 square cm   **(d)** $24\sqrt{3}$ square cm

20. If p and q are the roots of the equation $x^2 - \sin^2\theta x - \cos^2\theta = 0$, then what is the minimum value of $p^2 + q^2$?
    (a) $\dfrac{1}{2}$ **(b)** 1   **(c)** $\dfrac{3}{2}$ **(d)** 2

21. The arithmetic mean of n numbers is M. If the sum of first $(n-1)$ term is k, then what is the nth number?
    (a) M $- k$ **(b)** nM $- k$
    (c) n(M $- k$)   **(d)** M $- nk$

22. What is the geometric mean of
    3, 9, 27, 81, 243, 729, 2187?
    (a) 81   **(b)** 105   **(c)** 144   **(d)** 243

23. A person purchases 1 kg of tea powder from each of the four places A, B, C, D at the rate of ₹1,000 per 1 kg, 2 kg, 4 kg, 5 kg. If, on an average, he purchases x kg of tea powder per ₹1,000, then what is the approximate value of x?
    (a) 1.95   **(b)** 2.00   **(c)** 2.05   **(d)** 2.10

24. What is the sum of the largest and the smallest 4-digit numbers made by using single digit prime numbers (without repetition)?
    (a) 7887   **(b)** 7997   **(c)** 8998   **(d)** 9889

25. What is the remainder when 3^{255} is divided by 28?
    (a) 1   **(b)** 11   **(c)** 24   **(d)** 27

26. What is the value of $x(0 \le x \le 8)$ if $(100^{97} + 100^{54} + x + 1)$ leaves a remainder 0 when divided by 9?
    (a) 8   **(b)** 6   **(c)** 4   **(d)** 1

27. In a triangle ABC, D is a point on BC. If AB·DC = AC·BD, $\angle BAD = \alpha$ and $\angle CAD = \beta$ then which one of the following is correct?
    (a) $\alpha = \beta$ **(b)** $\alpha = 2\beta$
    (c) $2\alpha = \beta$ **(d)** $2\alpha = 3\beta$

28. Let N = 12345678AB be a 10-digit number, where A, B are digits. If N is divisible by 9, then which of the following statements is/are correct?
    I. (A +B) is divisible by 9.
    II. If A is odd, then B is odd.
    Select the answer using the code given below:
    (a) I only   **(b)** II only
    (c) Both I and II   **(d)** Neither I nor II

29. If $x^3 + \dfrac{1}{x^3} = \dfrac{65}{8}$ and $y^3 + \dfrac{1}{y^3} = \dfrac{730}{27}$, then which one of the following is a value of xy?
    (a) 3   **(b)** 6   **(c)** 8   **(d)** 9

30. If $11x + 5y$ is a prime number where x, y are natural numbers, then what is the minimum value of $(x + y)$?
    (a) 3   **(b)** 4   **(c)** 5   **(d)** 6

31. A 4-digit number N has exactly 15 distinct divisors. What is the total number of distinct divisors of N^2?
    (a) 16   **(b)** 30   **(c)** 45   **(d)** 225

32. If p, q and r are the lengths (in cm) of the sides of a right-angled triangle, then $(p - q - r)(q - r - p)(r - p - q)$ is
    (a) positive only   **(b)** negative only
    (c) non-positive only   **(d)** non-negative only

33. What is the minimum value of
$\dfrac{(a^8 + a^4 + 1)(b^8 + b^4 + 1)}{a^4 b^4}$ where $a > 0, b > 0$?
(a) 1   (b) 4   (c) 9   (d) 16

34. In a class containing 200 students, n students prefer both tea and coffee; $2n$ students prefer coffee; $3n$ students prefer tea; $4n$ students prefer neither tea nor coffee. What is the value of n?
(a) 20   (b) 25   (c) 30   (d) 35

35. Let ABC be a triangle with area 36 square cm. If AB = 9 cm, BC = 12 cm and $\angle$ABC= θ, what is cosθ equal to?
(a) $\dfrac{\sqrt{5}}{3}$ (b) $\dfrac{\sqrt{5}}{4}$ (c) $\dfrac{1}{3}$ (d) $\dfrac{2}{3}$

36. Let n be a natural number. The HCF of n, and $(n + 10)$ is 10. If the LCM is x (a 2-digit number), then how many values of x are possible?
(a) Only one   (b) Only two
(c) Only three   (d) More than three

37. What is HCF of
$a^4 + 2a^3 + 3a^2 + 2a + 1$ and $a^6 - 2a^3 + 1$?
(a) $a^3 + 3a^2 + 2a + 1$ (b) $a^3 + a^2 + a + 1$
(c) $(a^2 + a + 1)^2$ (d) $(a^2 - a + 1)^2$

38. If the roots of the equation
$x^2 - (k - 2)x + (k + 1) = 0$ are equal, then what are the values of k ?
(a) 0, 4   (b) 0, 8   (c) 4, 4   (d) 2, 6

39. What is $\left(\dfrac{\cos\theta - \sin\theta + 1}{\cos\theta + \sin\theta - 1}\right)$ $(\cot\theta - \text{cosec}\theta)$ equal to?
(a) –1   (b) 0   (c) 1   (d) 2

40. What is $\dfrac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta}$ equal to?
(a) $\sin^2\theta$ (b) $\cos^2\theta$ (c) $\cot\theta$ (d) $\tan\theta$

41. The mean weight of 150 students in a class is 60 kg. The mean weight of boys in the class is 70 kg and that of girls is 55 kg. What is the ratio of number of boys to number of girls?
(a) 1:2   (b) 1:1   (c) 2 : 1   (d) 2:3

42. Two towers A and B of height 23 m and 11 m, respectively, stand 9 m apart. A straight rod is joined to the two tops of the towers. A monkey sitting on the top of A, climbs the rod to reach the top of B. If the monkey takes 5 minutes to reach the other end, what is the average speed of the monkey?
(a) 10 m/min   (b) 5 m/min
(c) 10 cm/s   (d) 5 cm/s

43. A spherical wooden ball of radius r is to be divided into eight identical parts by cutting by planes passing through the same diameter. What is the surface area of each final piece?
(a) $\dfrac{\pi r^2}{3}$ (b) $\dfrac{3\pi r^2}{2}$ (c) $\dfrac{2\pi r^2}{3}$ (d) $\dfrac{4\pi r^2}{3}$

44. A trolley with two wheels one metre apart is moved clockwise on the circular track around a ground with radius 50 m (described by right wheel). If the size of each wheel is of 1 foot radius and the right wheel turns 1,000 times, how many times will the other wheel turn?
(a) 1,010   (b) 1,015   (c) 1,020   (d) 1,025

45. What is the remainder when
$70 \times 71 \times 72 \times 73 \times 74 \times 75 \times 76 \times 77 \times 78 \times 79$ is divided by 1000?
(a) 3   (b) 2   (c) 1   (d) 0

46. A vertical pole of length 80 m is situated on the horizontal plane. The base of the pole is at P. There are two points A and B such that P, A, B are on the same straight line. Let the angles of elevation of top of the pole from A and B be α and β ($\alpha > \beta$) respectively. If PA = 64 m and AB = 36 m, then what is $(\alpha + \beta)$ equal to?
(a) 60°   (b) 90°   (c) 120°   (d) 135°

47. Let k be a positive integer. What is the quotient when
$x^{8k+3} + x^{8k+6} + x^{8k+9} + x^{8k+12}$ is divided by $(1 + x^3)(1 + x^6)$?
(a) x^{8k} (b) x^{8k+1} (c) x^{8k+2} (d) x^{8k+3}

48. A square is drawn inside a square of side 14 cm in such a way that the corners of the inner square coincide with the mid points of the sides of the outer square. What is the area lying between the two squares?
(a) 98 square cm   (b) 56 square cm
(c) 49 square cm   (d) 24·5 square cm

49. The base of a right-angled triangle is $\dfrac{4}{3}$ times the height of triangle. If the area of the triangle is 54 square cm, then what is the perimeter of the triangle?
(a) 30 cm   (b) 32 cm   (c) 36 cm   (d) 40 cm

50. What is the area of a triangle having sides 4, 4 and 6 units?
(a) $3\sqrt{7}$ square unit   (b) 8 square unit
(c) 7 square unit   (d) $7\sqrt{3}$ square unit

Consider the following for the next three (03) items that follow:

Let ABC be a triangle right-angled at B. Let P be the point on BC such that BP= PC. If AB = 10 cm, $\angle$BAP = 45° and $\angle$CAP = θ.

51. What is tanθ equal to?
(a) $\dfrac{1}{2}$ (b) $\dfrac{1}{3}$ (c) $\dfrac{1}{4}$ (d) $\dfrac{1}{5}$

52. If $\angle ACP = \gamma$, then what is $\tan\gamma$ equal to?

(a) $\dfrac{1}{2}$ (b) $\dfrac{1}{3}$ (c) $\dfrac{2}{3}$ (d) 1

53. Consider the following statements:
   I. The line segment AP divides the area of the triangle ABC into two equal parts.
   II. The perimeter of the triangle APC is more than 46 cm.

III. The area of the triangle APC is 50 square cm.

Which of the statements given above are correct?
(a) I and II only   (b) II and III only
(c) I and III only   (d) I, II and III

Consider the following for the next two items that follow:

A frequency distribution is as follows :

Marks	18–26	27–35	36–44	45–53	54–62	63–71	72–80
Number of Students	5	7	10	15	8	3	2

54. What is the median of the distribution?
   (a) 44.9   (b) 45.5   (c) 45.9   (d) 46.3

55. What is the mode of the distribution?
   (a) 47.25   (b) 47.75   (c) 48.25   (d) 48.75

Consider the following for the next two items that follow:

ABC is a triangle right-angled at B. Given that $AC - AB = 2$ cm and $BC = 16$ cm

56. If $\angle BAC = \theta$ then what is $\sin\theta + \cos\theta$ equal to?

(a) 1   (b) $\dfrac{71}{65}$ (c) $\dfrac{73}{65}$ (d) $\dfrac{79}{65}$

57. If BD is the perpendicular on the side AC, then what is the length of BD?

(a) $\dfrac{1008}{65}$ cm   (b) $\dfrac{756}{65}$ cm

(c) $\dfrac{168}{7}$ cm   (d) $\dfrac{165}{7}$ cm

Consider the following for the next three (03) items that follow:

Let MN be a chord of length 16 cm of a circle with centre at O and radius 10 cm. The tangents at M and N intersect at a point P. Further, OP intersects MN perpendicularly at Q.

58. What is OQ equal to?
   (a) 5 cm   (b) 6 cm   (c) 7 cm   (d) 8 cm

59. What is PM equal to?
   (a) 10 cm   (b) 12 cm

(c) $\dfrac{40}{3}$ cm   (d) $\dfrac{50}{3}$ cm

60. What is the area of triangle OMN?
   (a) 36 square cm   (b) 40 square cm
   (c) 45 square cm   (d) 48 square cm

61. A question is given followed by two statements I and II. Consider the question and the statements and mark the correct option.

   Question: What is the integral value of k for which the expression $4x^2 - kx + 1$ is positive?

Statement-I: $k < -2$

Statement-II: $k > -4$

Which one of the following is correct in respect of the above question and the statements?
(a) The question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.
(b) The question can be answered by using either statement alone.
(c) The question can be answered by using both the statements together, but cannot be answered using either statement alone.
(d) The question cannot be answered even by using both the statements together.

62. A question is given followed by two statements I and II. Consider the question and the statements and mark the correct option.

   Question: In how many days can A, B and C together finish the work?

   Statement-I: A and B together can finish the work in 24 days.

   Statement-II: B and C together can finish the work in 36 days.

Which one of the following is correct in respect of the above question and the statements?
(a) The question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.
(b) The question can be answered by using either statement alone.
(c) The question can be answered by using both the statements together, but cannot be answered using either statement alone.
(d) The question cannot be answered even by using both the statements together.

63. A question is given followed by two statements I and II. Consider the question and the statements and mark the correct option.

   Question: Can we have a common solution which is prime?

Statement-I: $x^2 - 26x + 133 = 0$

Statement-II: $x^2 - 44x + 475 = 0$

Which one of the following is correct in respect of the above question and the statements?

(a) The question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.

(b) The question can be answered by using either statement alone.

(c) The question can be answered by using both the statements together, but cannot be answered using either statement alone.

(d) The question cannot be answered even by using both the statements together.

64. A question is given followed by two statements I and II. Consider the question and the statements and mark the correct option.

Question: Is $327^n + 173^n$ divisible by 500?

Statement-I: n is odd natural number.

Statement-II: n is a positive integer.

Which one of the following is correct in respect of the above question and the statements?

(a) The question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.

(b) The question can be answered by using either statement alone.

(c) The question can be answered by using both the statements together, but cannot be answered using either statement alone.

(d) The question can be answered even without using any of the statements.

65. A question is given followed by two statements I and II. Consider the question and the statements and mark the correct option.

Question: If the price of petrol goes up by 20%, by what percentage should the consumption be reduced so that the expenditure remains the same?

Statement-I: Price of petrol per litre was ₹90.

Statement-II: Consumption was 24 litres before price hike.

Which one of the following is conect in respect of the above question and the statements?

(a) The question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.

(b) The question can be answered by using either statement alone.

(c) The question can be answered by using both the statements together, but cannot be answered using either statement alone.

(d) The question can be answered even without using any of the statements.

66. A question is given followed by two statements I and II. Consider the question and the statements and mark the correct option.

Question: The ratio of P's salary to Q's salary is 6 : 5. How much is P's expenditure?

Statement-I: The ratio of P's saving to Q's saving is 3 : 2.

Statement-II: The ratio of P's expenditure to Q's expenditure is 1 : 1.

Which one of the following is correct in respect of the above question and the statements?

(a) The question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.

(b) The question can be answered by using either statement alone.

(c) The question can be answered by using both the statements together, but cannot be answered using either statement alone.

(d) The question cannot be answered even by using both the statements together.

67. A question is given followed by two statements I and II. Consider the question and the statements and mark the correct option.

Question: The largest of the five different integers is 8 and least is 2. What is the average of these integers?

Statement-I: The sum of all the 5 integers is a multiple of 5.

Statement-II: The number of odd integers is odd.

Which one of the following is correct in respect of the above question and the statements?

(a) The question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.

(b) The question can be answered by using either statement alone.

(c) The question can be answered by using both the statements together, but cannot be answered using either statement alone.

(d) The question cannot be answered even by using both the statements together.

68. A question is given followed by two statements I and II. Consider the question and the statements and mark the correct option.

Question: There are three different weights. All the weights are integers and their sum is a prime number. What are the weights?

Statement I: One of the weights is twice the another weight.

Statement-II: One of the weights is thrice the another weight.

Which one of the following is correct in respect of the above question and the statements?
(a) The question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.
(b) The question can be answered by using either statement alone.
(c) The question can be answered by using both the statements together, but cannot be answered using either statement alone.
(d) The question cannot be answered even by using both the statements together.

69. A question is given followed by two statements I and II. Consider the question and the statements and mark the correct option.
Question: What is the amount at the end of 10 years?
Statement-I: The principal amount is ₹1,00,000.
Statement-II: Rate of interest is 10% per annum.
Which one of the following is correct in respect of the above question and the statements?
(a) The question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.
(b) The question can be answered by using either statement alone.
(c) The question can be answered by using both the statements together, but cannot be answered using either statement alone.
(d) The question cannot be answered even by using both the statements together.

70. A question is given followed by two statements I and II. Consider the question and the statements and mark the correct option.
Question: Is $p^2 + pq + q^2$ odd where p, q are integers?
Statement-I: $p + q$ is even.
Statement-II: pq is odd.
Which one of the following is correct in respect of the above question and the statements?
(a) The question can be answered by using one of the statements alone, but cannot be answered using the other statement alone.
(b) The question can be answered by using either statement alone.
(c) The question can be answered by using both the statements together, but cannot be answered using either statement alone.
(d) The question cannot be answered even by using both the statements together.

71. The total population of an area is 10,000 out of which males and females are equal in number. Out of the total population 30% are newspaper readers. Out of the total newspaper readers, one-third read English newspaper. Out of the total English newspaper readers, 20% are females. What is the number of males who do not read English newspaper?
(a) 800   (b) 2,100   (c) 4,200
(d) Cannot be detennined due to insufficient data.

72. What is the maximum area of a rectangle, in square cm, whose perimeter is 400 cm?
(a) 100   (b) 200   (c) 1,000   (d) 10,000

73. What is the remainder if we divide 3^{10} by 7?
(a) 0   (b) 1   (c) 2   (d) 4

74. What is the square root of 64%?
(a) 0.08%   (b) 0.8%   (c) 8%   (d) 80%

75. The difference of $10^{31} - 5$ and $10^{30} + p$ is divisible by 3 where p is a digit. How many values of p are possible?
(a) 4   (b) 3   (c) 2   (d) 1

76. Consider the following statements:
I. 61 divides $107^{100} - 76^{100}$
II. 100 divides $67^5 + 33^5$
Which of the statements given above is/are correct?
(a) I only   (b) II only
(c) Both I and II   (d) Neither I nor II

77. The average of the temperatures recorded at noontime from Monday to Sunday is 31°C. If the lowest temperature recorded is 30°C, then what is the maximum of temperature that is possible to record at noontime on any one of the days.
(a) 34°C   (b) 35°C   (c) 36°C   (d) 37°C

78. If $\left(x+\dfrac{1}{yz}\right)-\left(y+\dfrac{1}{zx}\right)=\left(y+\dfrac{1}{zx}\right)-\left(z+\dfrac{1}{xy}\right)$ and $x + z \neq 2y$, then what is xyz equal to?
(a) −3   (b) −1   (c) 1   (d) 3

79. Consider the following statements in respect of $p = n(n + 1)(n + 2)(n + 3) + 1$,
where n is a natural number :
I. p is always odd.
II. p is a perfect square.
Which of the statements given above is/are correct?
(a) I only   (b) II only
(c) Both I and II   (d) Neither I nor II

80. What is the difference between the average of first 50 even natural numbers and the average of first 50 odd natural numbers?
(a) 0   (b) 0.5   (c) 1   (d) 2

81. Three amounts x, y, z are such that y is the compound interest on x; and z is the compound interest on y. The rate of interest per annum

and the time period in years are same. Which one of the following is correct?
(a) $x^2 = yz$ (b) $y^2 = zx$
(c) $z^2 = xy$ (d) $x = yz$

82. There are n concentric squares. The area of the innermost square is 1 unit and the distance between corresponding corners of any two consecutive squares is 1 unit. Consider the following statements :
I. The diagonal of the nth square is $2n + \sqrt{2} - 2$.
II. The area included between nth square and $(n-1)$th square is independent of n.
Which of the statements given above is/ are correct?
(a) I only   (b) II only
(c) Both I and II   (d) Neither I nor II

83. In a rectangle ABCD, AC is one of the diagonals. If AC + AB = 3AD and AC – AD= 4 units, then what is the area of the triangle?
(a) 24 square unit   (b) 36 square unit
(c) 48 square unit   (d) 72 square unit

84. The area of the circle circumscribing three identical circles touching each other is $\dfrac{\pi(2+\sqrt{3})^2}{3}$ square cm. What is the radius of one of the smaller circles?
(a) 0.5 cm   (b) 1 cm   (c) 1.5 cm   (d) $\sqrt{3}$ cm

85. In a triangle ABC, AB = 21 cm, BC= 20 cm and CA = 13 cm. A perpendicular CD is drawn upon the longest side. What is the area of the triangle BCD?
(a) 96 square cm   (b) 84 square cm
(c) 80 square cm   (d) 72 square cm

86. There are two containers A and B. In container A, the ratio of milk and water is 1:3 and in container B, the ratio of milk and water is $m:n$. If the mixture in the containers A and B are mixed in the ratio 2:3 to get 20 litres of a mixture having milk and water in the ratio 3:7, then what is the value of $\dfrac{m}{n}$?
(a) $\dfrac{1}{2}$ (b) $\dfrac{2}{3}$ (c) $\dfrac{3}{4}$ (d) $\dfrac{4}{5}$

87. A cone, a hemisphere and a cylinder stand on equal base of radius r and have the same height. If the sum of volumes of cone, the hemisphere and the cylinder is equal to volume of a sphere of radius R, then what is $\dfrac{R^3}{r^3}$ equal to?
(a) 1.25   (b) 1.5   (c) 2   (d) 2.5

88. If $x^3 + px^2 + qx + r$ is an integer for all integral values of x, then consider the following statements :
I. p must be an integer.
II. q must be an integer.
III. r must be an integer.
Which of the statements given above is/are correct?
(a) I and II only
(b) III only
(c) I, II and III
(d) None of the statements is correct

89. XYZ is a 3-digit number, where X, Y, Z are distinct non-zero digits. The difference between the two 3-digit numbers XYZ and YXZ is 90. How many possible values exist for the sum (X+ Y)?
(a) 9   (b) 8   (c) 7   (d) 6

90. How many times does the minute hand of a clock coincide with the second hand between 2.01 p.m. and 4.01 p.m. on the same day?
(a) 121   (b) 120
(c) 119   (d) None of these

91. What is the HCF of $2^{36} - 1$ and $2^{45} - 1$?
(a) 1023   (b) 512   (c) 511   (d) 255

92. The section of a solid right circular cone by a plane containing vertex and perpendicular to base is an equilateral triangle of side 14 cm. What is the volume of the cone? $\left(\pi = \dfrac{22}{7}\right)$
(a) $1078\sqrt{3}$ cubic cm   (b) $\dfrac{1078}{\sqrt{3}}$ cubic cm
(c) $539\sqrt{3}$ cubic cm   (d) $\dfrac{539}{\sqrt{3}}$ cubic cm

93. Three identical cones each with base radius 3 cm are placed on their bases so that each is touching the other two. There will be one and only circle that would pass through each of the vertices of the cones. What is the area of the circle?
(a) 3π square cm   (b) 6π square cm
(c) 9π square cm   (d) 12π square cm

94. A circle is inscribed in a triangle ABC right-angled at B. If AB = 5 cm and BC = 12 cm, then what is the radius of the circle?
(a) 1 cm   (b) 1.5 cm   (c) 2 cm   (d) 2.5 cm

95. The ratio of sum of interior angles to sum of exterior angles of a regular polygon of n sides is $\dfrac{7}{2}$. What is the measure of an interior angle of polygon?
(a) 110°   (b) 120°   (c) 130°   (d) 140°

96. The number 199 can be written as $m^2 - n^2$, where m, n are natural numbers $(m > n)$. What is the value of mn?
  (a) 9900   **(b)** 9800   **(c)** 9701
  (d) Cannot be uniquely determined.

97. How many numbers of the form $2^n - 1$ and less than 2000 are prime?
  (a) 3   **(b)** 4   **(c)** 5   **(d)** 6

98. In a class of 160 students, each of them opt at least one language from among English, Hindi and Sanskrit. It is found that 130 students opt English, 120 students Hindi and 110 students Sanskrit. If the students opt either only one language or all three languages, then what is the number of students who study all three languages?
  (a) 40   **(b)** 60   **(c)** 80   **(d)** 100

99. Let $S = 5^a + 7^b + 11^c + 13^d$, where a, b, c and d are natural numbers. What is the number of distinct remainders of S when it is divided by 10?
  (a) 1   **(b)** 4
  (c) 5   **(d)** More than 5

100. In a right triangle ABC, $\angle A = 90°$ and AD is perpendicular to BC. If $\angle CAD = 60°$ and BC = 6 cm, then what is AB equal to?
  (a) 3 cm   **(b)** 4 cm   **(c)** 5 cm   **(d)** 6 cm

ANSWER KEY			
Q.No.	**Answer**	**Topic's Name**	**Chapter's Name**
1	b	Number System	Maxima/ Minima
2	a	Number System	Natural Numbers
3	b	Algebra	Remainder Theorem
4	d	Number System	Remainder Theorem
5	b	Number System	Numbers
6	c	Algebra	Variations
7	d	Number Theory	Division Algorithm
8	c	Number System	Square Roots
9	a	Number System	Time and Distance
10	c	Quadratic Equations	Quadratic Equations
11	b	Trigonometry	Maximum Value
12	b	Trigonometry	Trigonometric Identities
13	a	Trigonometry	Trigonometric Values
14	c	Trigonometry	Trigonometric Identities
15	b	Trigonometry	Trigonometric Identities
16	b	Trigonometry	Trigonometric Equations
17	a	Trigonometry	Trigonometric Identities
18	b	Trigonometry	Height and Distances
19	b	Trigonometry	Trigonometric Relations
20	b	Trigonometry	Maximum Value

Q.No.	Answer	Topic's Name	Chapter's Name
21	b	Statistics	Arithmetic Mean
22	a	Statistics	Geometric Mean
23	c	Statistics	Average
24	d	Number Theory	Prime Number
25	d	Algebra	Remainder Theorem
26	b	Algebra	Remainder Theorem
27	a	Geometry	Triangle
28	a	Number Theory	Division Algorithm
29	b	Algebra	Polynomial
30	c	Number Theory	Prime Number
31	c	Number Theory	Factors
32	b	Geometry	Triangle
33	c	Number System	Minimum Value
34	b	Algebra	Sets
35	a	Geometry	Triangle
36	b	Number System	HCF
37	c	Number Theory	HCF
38	b	Algebra	Quadratic Equations
39	a	Trigonometry	Trigonometric Identities
40	d	Trigonometry	Trigonometric Identities
41	a	Statistics	Average
42	d	Trigonometry	Height and Distances
43	b	Mensuration	Surface Area
44	c	Mensuration	Circles
45	d	Number Theory	Remainder Theorem
46	b	Trigonometry	Height and Distances
47	d	Number Theory	Division Algorithm
48	a	Geometry	Area
49	c	Geometry	Perimeter
50	a	Mensuration	Area
51	b	Trigonometry	Trigonometric Identities
52	a	Trigonometry	Trigonometric Identities

Q.No.	Answer	Topic's Name	Chapter's Name
53	**d**	Mensuration	Area
54	**d**	Statistics	Median
55	**c**	Statistics	Mode
56	**d**	Trigonometry	Trigonometric Identities
57	**a**	Trigonometry	Trigonometric Relations
58	**b**	Geometry	Circles
59	**c**	Geometry	Circles
60	**d**	Geometry	Area
61	**a**	Number System	Polynomial
62	**d**	Number System	Time and Work
63	**c**	Algebra	Quadratic Equations
64	**a**	Number Theory	Division Algorithm
65	**d**	Number System	Unitary Method
66	**d**	Number System	Ratio
67	**a**	Statistics	Average
68	**c**	Number System	Prime Number
69	**d**	Number System	Simple Interest
70	**a**	Number System	Integers
71	**c**	Number System	Percentage
72	**d**	Mensuration	Perimeter
73	**d**	Number Theory	Remainder Theorem
74	**d**	Number System	Square Roots
75	**b**	Number Theory	Division Algorithm
76	**b**	Number Theory	Division Algorithm
77	**d**	Statistics	Average
78	**b**	Algebra	Algebraic Expression
79	**c**	Algebra	Polynomial
80	**c**	Statistics	Average
81	**b**	Number Theory	Compound Interest
82	**a**	Mensuration	Area
83	**c**	Mensuration	Area
84	**b**	Mensuration	Area
85	**a**	Geometry	Area

Q.No.	Answer	Topic's Name	Chapter's Name
86	a	Number System	Ratio
87	b	Mensuration	Volume
88	c	Algebra	Integers
89	b	Number System	Numbers
90	d	Number System	Angles
91	c	Number System	HCF
92	b	Mensuration	Volume
93	d	Mensuration	Area
94	c	Geometry	Circle
95	d	Geometry	Angles
96	a	Number System	Algebraic Identities
97	b	Number Theory	Prime Number
98	d	Number System	Sets
99	c	Algebra	Remainder Theorem
100	a	Geometry	Triangle

ANSWERS WITH EXPLANATION

1. **Option (b) is correct.**
   Explanation: According to question
   $y = \text{Sum} = x + 4x^2$
   $\dfrac{dy}{dx} = 8x + 1 \Rightarrow 8x + 1 = 0 \Rightarrow x = -\dfrac{1}{8}$
   $\Rightarrow \dfrac{d^2y}{dx^2} = 8 > 0$
   So, $x = -\dfrac{1}{8} = -0.125$

2. **Option (a) is correct.**
   Explanation: Given: $m > n$
   $m^2 - n^2 = 72$
   $\Rightarrow (m - n)(m + n) = 72$
   So, possible pairs are:
   (19, 17), (11, 7) and (9, 3)

3. **Option (b) is correct.**
   Explanation: LCM (6, 12, 15, 24) = 120
   Greatest 5-digit number = 99999
   So, on dividing by 120, we get remainder as 39
   So, required value = 99999 – 39 – 4 = 99956

4. **Option (d) is correct.**
   Explanation: To check the divisibility by 5, we just work on units digits.
   Hence, the remainder we get
   = 1 + 2 + 1 = 4

5. **Option (b) is correct.**
   Explanation: On multiplying last three digits, we get $345 \times 789 = 272205$

6. **Option (c) is correct.**
   Explanation: $\because \; p \propto (x^2 + y^2 + z^2)$
   So, $\dfrac{p}{x^2 + y^2 + z^2} = \dfrac{70}{1^2 + 2^2 + 3^2}$
   $p = \dfrac{70}{14} \times ((-1)^2 + (1)^2 + 5^2)$
   $= 5 \times (1 + 1 + 25) = 135$

7. **Option (d) is correct.**
   Explanation: LCM (6, 12, 15, 18) = 180
   Required value N = 180K + 5

   for K = 7, N = 180(7) + 5
   = 1265 which is divisible by 11
   So, 1200 < N < 1300

8. **Option (c) is correct.**
   Explanation:
   $\dfrac{1}{\sqrt{10}+\sqrt{9}} + \dfrac{1}{\sqrt{11}+\sqrt{10}} + \dfrac{1}{\sqrt{12}+\sqrt{11}} + ... + \dfrac{1}{\sqrt{196}+\sqrt{195}}$
   $= \dfrac{\sqrt{10}-\sqrt{9}}{10-9} + \dfrac{\sqrt{11}-\sqrt{10}}{11-10} + \dfrac{\sqrt{12}-\sqrt{11}}{12-11} + ... + \dfrac{\sqrt{196}-\sqrt{195}}{196-195}$
   = 14 – 3 = 11

9. **Option (a) is correct.**
   Explanation: Let the speed of X and Y be x and y km/h
   According to question,
   $\dfrac{24x + 18y}{x + y} = 20$
   $24x + 18y = 20x + 20y$
   $4x = 2y$
   $\Rightarrow \dfrac{x}{y} = \dfrac{2}{4} = \dfrac{1}{2}$, i.e., 1 : 2

10. **Option (c) is correct.**
    Explanation: $\because \; p, q$ are roots of $x^2 + xm - n = 0$
    $\therefore \; p + q = -m$ and $pq = -n$
    Also, m, n are roots of $x^2 + px - q = 0$
    $\therefore \; m + n = -p$ and $mn = -q$
    On solving, we get
    $-p - q + n - p \Rightarrow n = +q$
    $\therefore \; pq = -q \Rightarrow p = -1$
    and $m(+q) = -q \Rightarrow m = -1$
    and $p + q = -m = +1$
    and $m(m + n) = (-1)(-p) = (-1)(1) = -1$
    So, both I and II are correct.

11. **Option (b) is correct.**
    Explanation: $\therefore \; \sin\theta \in [0, 1]$
    So, max. value of $\sin^2\theta = 1$
    $\therefore \; 8\sin\theta - 4\sin^2\theta = 8 - 4 = 4$

12. **Option (b) is correct.**
Explanation:
$(1 + \tan \alpha \tan \beta)^2 + (\tan \alpha - \tan \beta)^2$
$= 1 + \tan^2\alpha \tan^2\beta + 2 \tan\alpha \tan\beta + \tan^2\alpha$
$\qquad\qquad\qquad + \tan^2\beta - 2 \tan\alpha \tan\beta$
$= (1 + \tan^2\alpha)(1 + \tan^2\beta) = \sec^2\alpha \sec^2\beta$

13. **Option (a) is correct.**
Explanation:
I. $\tan 50^o - \cot 50^o$
$\dfrac{\sin 50^o}{\cos 50^o} - \dfrac{\cos 50^o}{\sin 50^o}$
$= \dfrac{\sin^2 50^o - \cos^2 50^o}{\sin 50^o \cdot \cos 50^o} = \dfrac{-2 \cos 100^o}{\sin 100^o}$
$= -2 \cot 100^o > 0$
II. $\cot 25^o - \tan 25^o$
$= \dfrac{\cos 25^o}{\sin 25^o} - \dfrac{\sin 25^o}{\cos 25^o}$
$= \dfrac{\cos^2 25^o - \sin^2 25^o}{\sin 25^o \cos 25^o} = \dfrac{2 \cos 50^o}{\sin 50^o}$
$= 2 \cot 50^o > 0$

14. **Option (c) is correct.**

Explanation: $\tan (\alpha + \beta) = \sqrt{3} = \tan \dfrac{\pi}{3}$

$\Rightarrow \quad \alpha + \beta = \dfrac{\pi}{3}$

and $\tan(\alpha - \beta) = \dfrac{1}{\sqrt{3}} = \tan \dfrac{\pi}{6}$

$\Rightarrow \quad \alpha - \beta = \dfrac{\pi}{6}$

On solving, we get $\alpha = \dfrac{\pi}{4}, \beta = \dfrac{\pi}{12}$

$\tan\alpha.\cot 2\beta = \tan \dfrac{\pi}{4} \cdot \cot \dfrac{\pi}{6} = 1.\sqrt{3} = \sqrt{3}$

15. **Option (b) is correct.**
Explanation: $\sin^2\theta \cos^2\theta (\sec^2\theta + \csc^2\theta)$

$= \sin^2\theta \cos^2\theta \left[\dfrac{1}{\cos^2 \theta} + \dfrac{1}{\sin^2 \theta} \right]$

$= \sin^2\theta \cos^2\theta \left[\dfrac{\sin^2 \theta + \cos^2 \theta}{\sin^2 \theta \cos^2 \theta} \right]$

$= \sin^2\theta + \cos^2\theta = 1$

16. **Option (b) is correct.**

Explanation: Given: $64^{\sin^2 \theta} + 64^{\cos^2 \theta} = 16$
The above equation satisfy for $\theta = 45^o$
$\therefore \tan\theta + \cot\theta = \tan 45^o + \cot 45^o = 1 + 1 = 2$

17. **Option (a) is correct.**
Explanation:

$\csc\theta - \cot\theta = m \Rightarrow \csc\theta + \cot\theta = \dfrac{1}{m}$

$\sec\theta - \tan\theta = n \Rightarrow \sec\theta + \tan\theta = \dfrac{1}{n}$

$\Rightarrow \quad m + n + \dfrac{1}{m} + \dfrac{1}{n} = \csc\theta - \cot\theta + \sec\theta$
$\qquad - \tan\theta + \csc\theta + \cot\theta + \sec\theta + \tan\theta$
$= 2(\csc\theta + \sec\theta)$

18. **Option (b) is correct.**

Explanation: Here, $\tan \alpha = \dfrac{h}{a}$ and $\tan \beta = \dfrac{h}{b}$

$\tan (90^o - \alpha) = \dfrac{h}{b}$
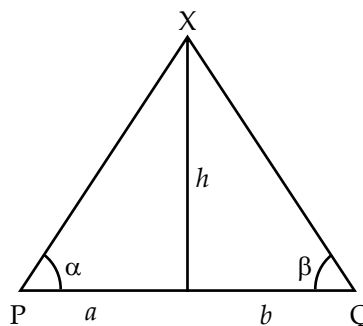
$\Rightarrow \cot \alpha = \dfrac{h}{b} \Rightarrow b = h \tan \alpha$
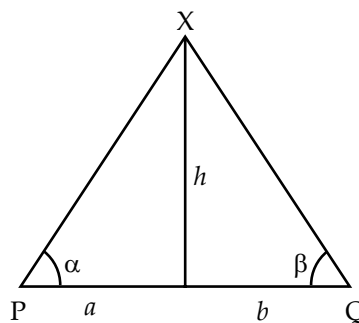
and $a = \dfrac{h}{\tan \alpha} = h \cot \alpha$

So, width of river $= a + b = h(\tan\alpha + \cot\alpha)$

19. **Option (b) is correct.**
Explanation: In $\triangle ABD$

$\sin 60^o = \dfrac{AD}{AB}$

$\Rightarrow \quad \dfrac{\sqrt{3}}{2} = \dfrac{AD}{6}$

$\Rightarrow \quad AD = 3\sqrt{3} \text{ cm}$

Now, area of triangle $= \dfrac{1}{2} \times BC \times AD$

$= \dfrac{1}{2} \times 8 \times 3\sqrt{3} = 12\sqrt{3} \text{ sq. cm}$

20. Option (b) is correct.

Explanation: Since, p and q are roots of the equation $x^2 - \sin^2\theta x - \cos^2\theta = 0$

$\therefore p + q = \sin^2\theta$ and $pq = -\cos^2\theta$

Now, $(p + q)^2 = p^2 + q^2 + 2pq$

$\Rightarrow p^2 + q^2 = \sin^4\theta + 2\cos^2\theta$

$= \sin^4\theta + 2(1 - \sin^2\theta)$

$\therefore$ Min. $(p^2 + q^2) = 1 + 2(1 - 1) = 1$

21. Option (b) is correct.

Explanation: AM = M

$\Rightarrow \dfrac{\text{Sum of } n \text{ numbers}}{n} = \text{M}$

$\Rightarrow \dfrac{\text{Sum of } (n-1) \text{ numbers} + n^{\text{th}} \text{ term}}{n} = \text{M}$

$\Rightarrow k + n^{\text{th}} \text{ number} = n\text{M}$

$\Rightarrow n^{\text{th}} \text{ number} = n\text{M} - k$

22. Option (a) is correct.

Explanation:

G.M. $= \sqrt[7]{3 \times 9 \times 27 \times 81 \times 243 \times 729 \times 2187}$

$= \sqrt[7]{3 \times 3^2 \times 3^3 \times 3^4 \times 3^5 \times 3^6 \times 3^7} = \sqrt[7]{3^{28}}$

$= 3^4 = 81$

23. Option (c) is correct.

Explanation: According to question

Total amount $= 1,000 + 500 + 250 + 200$

$\qquad\qquad = ₹1,950$

So, amount of tea powder purchased with ₹1,950 = 4 kg

$\therefore$ Quantity of tea powder purchased with

₹1,000 $= \dfrac{4}{1,950} \times 1,000 = 2.05$ kg

24. Option (d) is correct.

Explanation: Single digit prime numbers are 2, 3, 5, 7

Largest 4-digit number formed = 7532

and smallest 4-digit number forward = 2357

$\therefore$ Required sum $= 7532 + 2357 = 9889$

25. Option (d) is correct.

Explanation: $3^{255} = (3^3)^{85} = 27^{85} = (28 - 1)^{85}$

So, when $(3^3)^{85}$ divided by 28.

We get $-1 = -1 + 28 = 27$

26. Option (b) is correct.

Explanation: Since $100^{97} + 100^{54} + x + 1$, when divided by 9, given $3 + x$

So, x must give the value as 6.

27. Option (a) is correct.

Explanation: Given: AB . DC = AC . BD

$\Rightarrow \dfrac{\text{AB}}{\text{AC}} = \dfrac{\text{BD}}{\text{CD}}$

$\therefore$ AD bisect $\angle$BAC.
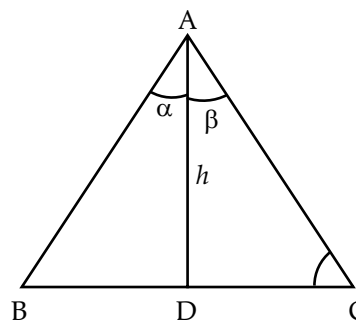
$\Rightarrow \angle$BAD = $\angle$CAD

or $\alpha = \beta$

28. Option (a) is correct.

Explanation:

Sum of digit $= 1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + A + B = 36 + A + B$

I. True, as the given number is divisible by 9, so, A + B must be divisible by 9.

II. False; for example, if A = 5 and B = 4

29. Option (b) is correct.

Explanation: $x^3 + \dfrac{1}{x^3} = \dfrac{65}{8} = 8 + \dfrac{1}{8}$

So, $x = 2$

and $y^3 + \dfrac{1}{y^3} = \dfrac{730}{27} = 27 + \dfrac{1}{27}$

So, $y = 3$

$\therefore xy = 2 \times 3 = 6$

30. Option (c) is correct.

Explanation: For $x = 1$ and $y = 4$

$11x + 5y = 11(1) + 5(4) = 11 + 20$

$\qquad\qquad = 31$, a prime number

31. Option (c) is correct.

Explanation: Let N $= a^2 \times b^4$

$\therefore$ N$^2 = a^4 \times b^8$

So, number of factor $= (4 + 1)(8 + 1) = 45$

32. Option (b) is correct.

Explanation: Let $p = 5$, $q = 12$ and $r = 13$

So, $(p - q - r)(q - r - p)(r - p - q)$

$= (5 - 12 - 13)(12 - 13 - 5)(13 - 5 - 12)$

$= (-20)(-6)(-4) < 0$

33. Option (c) is correct.

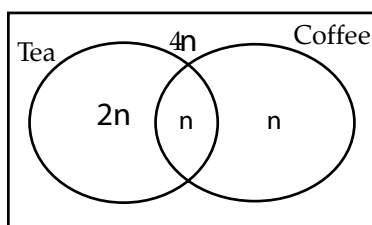*Explanation:* $\dfrac{(a^8 + a^4 + 1)(b^8 + b^4 + 1)}{a^4 b^4}$

$= \left(\dfrac{a^8 + a^4 + 1}{a^4}\right)\left(\dfrac{b^8 + b^4 + 1}{b^4}\right)$

$= \left(a^4 + \dfrac{1}{a^4} + 1\right)\left(b^4 + \dfrac{1}{b^4} + 1\right)$

$\geq (2 + 1)(2 + 1) = 9$

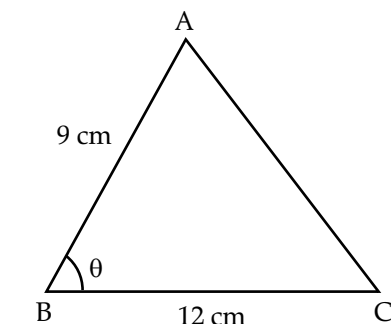**34. Option (b) is correct.**
Explanation:

According to the question
$$4n + 2n + 3n - n = 200$$
$$\Rightarrow 8n = 200$$
$$\Rightarrow n = 25$$

35. Option (a) is correct.

Explanation: Area $= \dfrac{1}{2} \times 9 \times 12 \sin\theta$

$$36 = 54 \sin\theta$$

$$\Rightarrow \sin\theta = \dfrac{36}{54} = \dfrac{2}{3}$$

$$\therefore \cos\theta = \sqrt{1 - \dfrac{4}{9}} = \sqrt{\dfrac{5}{9}} = \dfrac{\sqrt{5}}{3}$$

36. Option (b) is correct.
Explanation: Let the value of $n = 10$
then $n + 10 = 20$
Now, HCF of 10 and 20 = 10
and LCM of 10 and 20
$= 2 \times 2 \times 5 = 20$,
which is a 2-digit number
Let the value of $n = 20$
then $n + 10 = 30$
Now, HCF of 20 and 30 = 10
and LCM of 20 and 30
$= 2 \times 2 \times 3 \times 5 = 60$,
which is also a 2-digit number
Let the value of $n = 30$
then $n + 10 = 40$
Now, HCF of 30 and 40 = 10
and LCM of 30 and 40
$= 2 \times 2 \times 2 \times 3 \times 5 = 120$,
which is not a 3-digit number
Hence, only two valves of x
are possible, i.e., 10 and 20.

2	10, 20
2	5, 10
5	5, 5
	1, 1

2	20, 30
2	10, 15
3	5, 15
5	5, 5
	1, 1

2	30, 40
2	15, 20
2	15, 10
3	15, 5
5	5, 5
	1, 1

37. Option (c) is correct.
Explanation: Assuming value of $a = 2$
Then, $a^4 + 2a^3 + 3a^2 + 2a + 1$
$= 2^4 + 2 \times 2^3 + 3 \times 2^2 + 2 \times 2 + 1$
$= 16 + 16 + 12 + 5 = 49$
Now, putting the value of a in $a^6 - 2a^3 + 1$
$= 2^6 - 2 \times 2^3 + 1 = 64 - 16 + 1 = 49$
Now HCF of 49 and 49 is 49
Checking option (c)
$(a^2 + a + 1)^2 = (2^2 + 2 + 1)^2 = 7^2 = 49$

38. Option (b) is correct.
Explanation: For equal roots, $b^2 - 4ac = 0$
$b = -(K - 2) = 2 - K$
$a = 1$ and $c = K + 1$
So, $(2 - K)^2 - 4 \times 1 (K + 1) = 0$
$4 + K^2 - 4K - 4K - 4 = 0$
$K^2 - 8K = 0$
$K(K - 8) = 0$
$K = 0, K - 8 = 0 \Rightarrow K = 8$
Hence, $K = 0$ and $K = 8$

39. Option (a) is correct.
Explanation: Let $\theta = 45^\circ$

$$\left(\dfrac{\cos\theta - \sin\theta + 1}{\cos\theta + \sin\theta - 1}\right)(\cot\theta - \operatorname{cosec}\theta)$$

$$= \left(\dfrac{\cos 45^\circ - \sin 45^\circ + 1}{\cos 45^\circ + \sin 45^\circ - 1}\right)(\cot 45^\circ - \operatorname{cosec} 45^\circ)$$

$$= \left(\dfrac{\dfrac{\sqrt{2}}{2} - \dfrac{\sqrt{2}}{2} + 1}{\dfrac{\sqrt{2}}{2} + \dfrac{\sqrt{2}}{2} - 1}\right)(1 - \sqrt{2})$$

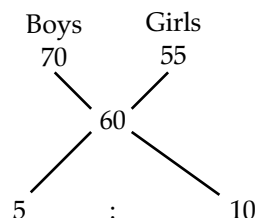$$= \left(\dfrac{1}{\sqrt{2} - 1}\right)(1 - \sqrt{2}) = \dfrac{(\sqrt{2} - 1)}{-(\sqrt{2} - 1)} = -1$$

40. Option (d) is correct.

Explanation: $\dfrac{\sin\theta - 2\sin^3\theta}{2\cos^3\theta - \cos\theta}$
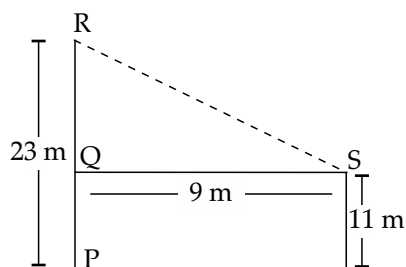
$$= \dfrac{\sin\theta(1 - 2\sin^2\theta)}{\cos\theta(2\cos^2\theta - 1)} = \dfrac{\sin\theta(\cos 2\theta)}{\cos\theta(\cos 2\theta)} = \tan\theta$$

41. Option (a) is correct.
Explanation: Using alligation method,

Hence, the required ratio is 5 : 10, i.e., 1 : 2.

42. Option (d) is correct.

Explanation:

Tower A   Tower B

RQ = RP – PQ = 23 m – 11 m = 12 m

Using pythagoras theorem

$RS = \sqrt{(12)^2 + (9)^2} = \sqrt{144 + 81} = \sqrt{225} = 15$ m

Using speed = $\dfrac{\text{distance}}{\text{time}} = \dfrac{15 \text{ m}}{5 \text{ min}}$

= 3 m/min = 5 cm/s

$= 3 \times \dfrac{100}{60}$

43. Option (b) is correct.

Explanation: Surface area of each part

$= \dfrac{1}{8} \times$ surface area of sphere

$\qquad\qquad\qquad$ + area of 2 semi-circles

$= \dfrac{1}{8} \times 4\pi r^2 + 2 \times \dfrac{1}{2}\pi r^2$

$= \dfrac{\pi r^2}{2} + \pi r^2 = \dfrac{3\pi r^2}{2}$

44. Option (c) is correct.

Explanation: ∵ $\theta = \dfrac{\text{length of arc}}{\text{Radius}}$

∴ $\theta = \dfrac{2\pi \times 0.305 \times 1000}{50} = \dfrac{2\pi \times 0.305 \times n}{51}$

⇒ $n = 1020$

45. Option (d) is correct.

Explanation:

$70 \times 71 \times 72 \times 73 \times 74 \times 75 \times 76 \times 77 \times 78 \times 79$

$= 7 \times 10 \times 71 \times 18 \times 4 \times 73 \times 74 \times 3 \times 25$
$\qquad\qquad\qquad\qquad\qquad \times 76 \times 77 \times 78 \times 79$

$= 7 \times 71 \times 18 \times 73 \times 74 \times 3 \times 76 \times 77$
$\qquad\qquad\qquad\qquad\qquad \times 78 \times 79 \times 1000$

when we divided by 1000 get remainder 0.

46. Option (b) is correct.

Explanation:

$\tan \alpha = \dfrac{80}{64} = \dfrac{5}{4}$; $\tan \beta = \dfrac{80}{100} = \dfrac{4}{5}$; $\cot \beta = \dfrac{5}{4}$
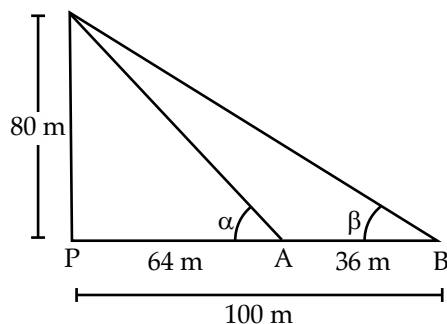
$\tan \alpha = \cot \beta$, then α and β are complementary angles.

Hence, α + β = 90°

47. Option (d) is correct.

Explanation:

$x^{8k+3} + x^{8k+6} + x^{8k+9} + x^{8k+12}$

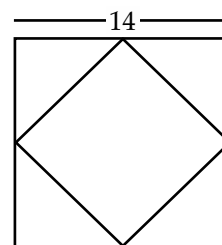⇒ $x^{8k+3}(1 + x^3 + x^6 + x^9)$

Now, dividing by $(1 + x^3)(1 + x^6)$

$\dfrac{x^{8k+3}((1+x^3)(1+x^6))}{(1+x^3)(1+x^6)} = x^{8k+3}$

48. Option (a) is correct.

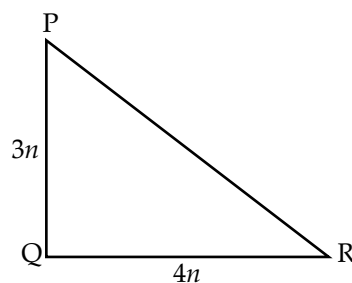*Explanation:* Area of outer square

= 14 cm × 14 cm = 196 cm^2

So, area of inner square = $\dfrac{196}{2}$ = 98 cm^2, as area

of inner square coincide with mid-point of outer square is always half of outer square.

So, the remaining area = 196 cm^2 – 98 cm^2
= 98 cm^2

49. Option (c) is correct.

Explanation: Assuming the height be 3n then

base will be $\dfrac{4}{3} \times 3n = 4n$

Using, area of right angled triangle

$= \dfrac{1}{2} \times$ Base $\times$ Height $= 54$ cm^2

$\dfrac{1}{2} \times 3n \times 4n = 54$ cm^2

$n^2 = 9$

$n = 3$, so height $= 3 \times 3 = 9$ cm

base $= 4 \times 3 = 12$ cm

PR $= \sqrt{9^2 + 12^2} = \sqrt{81 + 144} = 15$

Hence, the perimeter $= 9 + 12 + 15 = 36$ cm

50. **Option (a) is correct.**

Explanation: Sides of triangle $= 4, 4$ and 6

Semi-perimeter (S) $= \dfrac{4 + 4 + 6}{2} = 7$

Using Heron's formula

Area $= \sqrt{7(7-4)(7-4)(7-6)}$

$= \sqrt{7 \times 3 \times 3 \times 1} = 3\sqrt{7}$ square unit

51. **Option (b) is correct.**

Explanation: Put the value

$\tan(45 + \theta) = \dfrac{\tan 45^\circ + \tan \theta}{1 - \tan 45^\circ \tan \theta}$

$= \dfrac{20}{10} = \dfrac{1 + \tan \theta}{1 - \tan \theta} = \dfrac{2}{1}$

$= \dfrac{1}{\tan \theta} = \dfrac{3}{1}$

$= \tan \theta = \dfrac{1}{3}$

So, $\tan \theta = \dfrac{1}{3}$
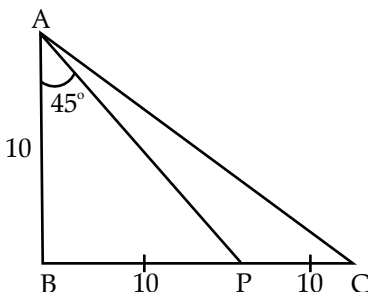
52. **Option (a) is correct.**

Explanation: $\tan \gamma = \dfrac{AB}{BC}$

$\tan \gamma = \dfrac{10}{20}$

$\tan \gamma = \dfrac{1}{2}$

So, $\tan \gamma$ is equal to $\dfrac{1}{2}$

53. **Option (d) is correct.**

Explanation: See statement

Area of $\triangle ABP = \dfrac{1}{2} \times 10 \times 10 = 50$ cm^2

Area of $\triangle APC = \dfrac{1}{2} \times 10 \times 10 = 50$ cm^2

$\therefore$ Perimeter of $\triangle APC = 14.14 + 10 + 22.3$

$= 46.44$

Therefore, all statements are correct.

54. **Option (d) is correct.**

Explanation:

Class	F	CF
17.5 – 26.5	5	5
26.5 – 35.5	7	12
35.5 – 44.5	10	22
44.5 – 53.5	15	37
53.5 – 62.5	8	45
62.5 – 71.5	3	48
71.5 – 80.5	2	50

$= \dfrac{N}{2} = \dfrac{50}{2} = 25$

$N = 25$

Put the formula

Median $= M = l + \dfrac{\dfrac{N}{2} - C}{F} \times h = 44.5 + \dfrac{25 - 22}{15} \times 9$

$= 44.5 + 1.8 = 46.3$

So, median of the distribution is 46.3.

55. **Option (c) is correct.**

Explanation: Mode of the distribution

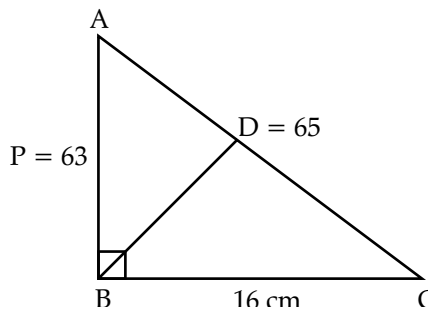Mode $= L + h \dfrac{(F_m - F_1)}{(F_m - F_1) + F_m - F_2}$

Put the formula

$= 44.5 + \dfrac{5}{5 + 7} \times 9 = 44.5 + \dfrac{5 \times 3}{4}$

$= 44.50 + 3.75 = 48.25$

56. **Option (d) is correct.**

Explanation: $\dfrac{BC}{AB} + \dfrac{AB}{AC} = \dfrac{16}{65} + \dfrac{63}{65} = \dfrac{79}{65}$

So, the value of $\sin \theta + \cos \theta = \dfrac{79}{65}$

57. **Option (a) is correct.**

Explanation: Since, $\triangle ABC \sim \triangle ADB$
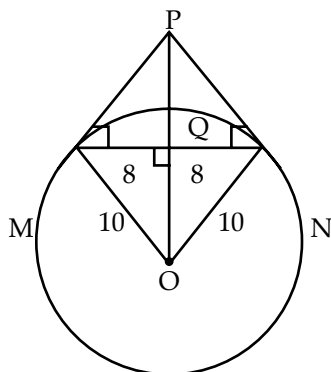
$$\frac{AC}{AB} = \frac{BC}{BD}$$

$$63 \times 16 = 65P$$

So, BD $= \dfrac{1008}{65}$ cm

Length of BD $= \dfrac{1008}{65}$ cm

58. Option (b) is correct.
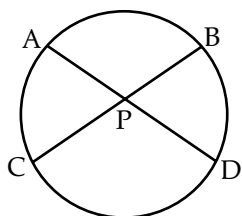*Explanation:* OQ equal to show the diagram

$$OQ = \sqrt{10^2 - 8^2} = 6 \text{ cm}$$

59. Option (c) is correct.
Explanation: PM is equal to
When, AP . BP = CP . DP
$$8 \times 8 = 6 \times PQ$$

$$PQ = \frac{64}{6} = \frac{32}{3}$$

$$PM = \frac{\sqrt{1024}}{9} + 64 = 8\sqrt{\frac{16}{9} + 1} = 8 \times \frac{5}{3}$$

$$\boxed{PM = \frac{40}{3}}$$

i.e., PM equal to $\dfrac{40}{3}$.

60. Option (d) is correct.
Explanation: Area of triangle OMN
Show the diagram.
Put the value of formula:

$$= \frac{1}{2} \times MN \times OQ = \frac{1}{2} \times 16 \times 6 = 48$$

Area of triangle OMN = 48 cm

61. Option (a) is correct.
Explanation: Integration value of K
$$4x^2 - kx + 1$$
Statement-1: $y = 4x^2 - kx + 1 > 0$
Imaginary: $b^2 - 4ac < 0$
$$k^2 - 4(4) < 0$$
$$(k - 4)(k + 4) < 0$$
Statement-2:
$$-4 < K < 4$$
$$K < -2$$
$$K = -3$$
So, this question can be answered by using one of the statement alone, but cannot be answered using the other statement alone.

62. Option (d) is correct.
Explanation: A, B, C together finish the work
Statement-1: A and B together can finish the work in 24 days.
Statement-2: B and C together can finish the work in 36 days.
The question can be answered even by using both the statement together.

63. Option (c) is correct.
Explanation:
Statement-1: $x^2 - 26x + 133 = 0$
Statement-2: $x^2 - 44x + 475 = 0$
When solving these equation, we find the some number.
$$x^2 - 26x + 133 = 0 \qquad 19, 7$$
$$x^2 - 44x + 475 = 0 \qquad 19, 25$$
Common is 19.

64. Option (a) is correct.
Explanation: $327^n + 173^n$ by 500
Statement-1: n is odd natural number
Statement-2: n is positive integrates
$$a^n + b^n \div a + b$$
$$327^n + 173^n \div 500$$
When n is odd.

65. Option (d) is correct.
Explanation: Price of petrol is rise upon 20%
Statement-1: Price of petrol ₹90
Statement-1: Consumption 24 litre

$$P = 5 \to 6 \text{ then } \frac{1}{6} \times 100$$

$$Q = 6 \to 5 \text{ so, } 16\frac{2}{3}\%$$

66. Option (d) is correct.
Explanation: Salary of P and Q 6 : 5 to expend
Statement-1: Saving of P and Q is 3 : 2
Statement-2: Expenditure 1 : 1

So salary   P   Q
                $6x$ $5x$
Saving $3y$ $2y$
Expend z z

$$\left.\begin{array}{c} 6x - 3y = z \\ 5x - 2y = z \end{array}\right\} \ x, y, z = ?$$

So, that is not sufficient for given to correct answer.

67. Option (a) is correct.
Explanation: The largest five different integration is 8 and least 2.
Statement-1: Sum of all integers multiple of 5
Statement-2: The number of odd integers is odd
Let, 2, a, b, c, 8
When; $3 + 4 + 5 = 22$
When; $5 + 6 + 7 = 28$
So, $3 + 5 + 7 = 15$
                 $4 + 5 + 6 = 15$
2nd statement:
                2, 3, 4, 6, 8
                2, 4, 5, 6, 8
                2, 4, 6, 7, 8
                2, 3, 5, 7, 8
Its not correct for these statement.

68. Option (c) is correct.
Explanation: There are three different weights. All the weights are integers and their sum is a prime number.
Statement-1: One of the weights is twice the another weights.
Statement-2: One of the weights is thrice the another weights.
Let, $a + b + c =$ prime number
$$\frac{a}{b} = \frac{2}{1}, \frac{b}{c} = \frac{3}{1}$$
$a : b : c = \boxed{1, 2, 6} \ \boxed{1, 2, 3} \ \boxed{1, 3, 6}$

69. Option (d) is correct.
Explanation: Amount at the end 10 year
Statement-1: The principal amount 1,00,000
Statement-2: Rate of interest 10%
The question cannot be answered even by using both statement together.

70. Option (a) is correct.
Explanation: $p^2 + pq + q^2$ odd. p, q are integers.
Statement-1: $p + q$ is even
Statement-2: pq is odd
    E + E = Even
    O + O = Odd
When P = Odd, q = Odd
The question cannot be answered even by us both the statement together but can be used for other statement.

71. Option (c) is correct.
Explanation: Total population = 10,000
    Male = 5,000
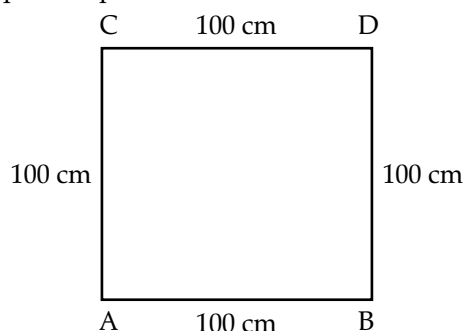   Female = 5,000
Read English newspaper = 1,000
    Female → 200
    Male → 800
So, male not read the English newspaper is 4,200.

72. Option (d) is correct.
Explanation: Maximum area of rectangle is square of perimeter is 400 cm.

    C   100 cm   D
    ┌─────────────────┐
100 cm │   │ 100 cm
    └─────────────────┘
    A   100 cm   B

So, Area $= (100)^2 = 10,000$

73. Option (d) is correct.
Explanation: ∴. Dividing 3^{10} by 7
Since, 3^{10} by 7
$$= \frac{3^{10}}{7} \cdot \frac{(3^2)^5}{7} = \frac{9^5}{7} = \frac{(7+2)^5}{7} = \frac{2^5}{7} = \frac{32}{7} = 4\frac{4}{7}$$

74. Option (d) is correct.
Explanation: Square root of 64%
Then $\sqrt{64}\%$
$$\sqrt{\frac{64}{100}} = \frac{8}{10} = \frac{8}{10} \times 100 = 80\%$$

75. Option (b) is correct.
Explanation: Difference of $10^{31} - 5$ and $10^{30} + $ P Value of P
$= (10^{31} - 5) - (10^{30} + P)$
$= 10 \times 10^{30} - 5 - 10^{30} - P$
$= 9 \times 10^3 - \dfrac{P+5}{3}$
So, $\boxed{\begin{array}{c} P = 1 \\ P = 4 \\ P = 7 \end{array}}$
i.e., $\boxed{P = 3}$

76. Option (b) is correct.
Explanation:
Statement-1: 61 divides $107^{100} - 76^{100}$
Statement-2: 100 divides $67^5 + 33^5$

$$\frac{\left(107^{50}-76^{50}\right)\left(107^{50}+76^{50}\right)}{31}$$

$a^n - b^n \div a - b$ always
$a^n + b^n \div a + b$
n is odd
So, only (b) is correct.

77. Option (d) is correct.
Explanation: Monday to Sunday = 31°C
Lowest temperature = 30°C
Minimum temperate = 31 × 7 = 217°C
So, maximum temperature is 37°C.

78. Option (b) is correct.
Explanation:

$$\left(x+\frac{1}{yz}\right)-\left(y+\frac{1}{zx}\right)=\left(y+\frac{1}{zx}\right)-\left(z+\frac{1}{xy}\right)$$

$x + z \ne 2y$

So, $\left(\frac{xyz+1}{yz}\right)-\left(\frac{xyz+1}{zx}\right)=\left(\frac{xyz+1}{zx}\right)-\left(\frac{xyz+1}{xy}\right)$

$xyz + 1 = 0$ $\frac{1}{yz}-\frac{1}{zx}=\frac{1}{zx}-\frac{1}{xy}$

$xyz = -1$ $\frac{2}{zx}=\frac{1}{yz}+\frac{1}{xy}$

So, $\boxed{xyz = -1}$ $\boxed{2y = x + z}$

Hence proved   But its not match the
                      answer.

79. Option (c) is correct.
Explanation: $p = n(n+1)(n+2)(n+3) + 1$
n is natural number.
Statement-1: p is always odd
Statement-2: p is perfect square
So, $p = (n^2 + n)(n^2 + 5n + 6) + 1$
   $p = n^2 + 6n^3 + 11n^2 + 6n + 1$
   $p = (n^2 + 3n + 1)^2$
So, n is always here, that is why both statement.

80. Option (c) is correct.
Explanation: Different between average first 50
natural number.

So, Sum of even = $\frac{2+100}{2}=51$

Sum of odd = $\frac{1+99}{2}=50$

1 is correct.

81. Option (b) is correct.
Explanation: The rate of interest per annum and
time period, three compound x, y, z.

So, $y = x\left(1+\frac{R}{100}\right)^T - x$

$z = y\left(1+\frac{R}{100}\right)^T - y$

So, $\frac{y}{z}=\frac{x}{y}$

So, $\boxed{y^2 = zx}$

82. Option (a) is correct.
Explanation: Length of diagonal

1st = $\sqrt{2}$

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

3rd = $\sqrt{2} + 4$

So, $a + (n-1)d$

$\sqrt{2} + 2(n-1) = 2n + \sqrt{2} - 2$

Amount = $\frac{d^2}{2}$

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

$=\frac{1}{2}[4n^2 + (\sqrt{2}-2)^2 + 2(2n)(\sqrt{2}-2)$
$\qquad\qquad -4(n-1)^2 - (\sqrt{2}-2)^2$
$\qquad\qquad -2-2(n+1)(\sqrt{2}-2)]$

$=\frac{8n-4\sqrt{2}+4}{2}$

Only one is correct.

83. Option (c) is correct.
Explanation: Area of triangle two statement

$\sqrt{x^2 + y^2} + x = 3y$ ...(i)

$\sqrt{x^2 + y^2} - y = 4$ ...(ii)

$= x + y = 3y - 4$
$\boxed{x = 2y - 4}$

Then, $\sqrt{x^2 + y^2} = 4 + y$
           $x^2 + y^2 = 16 + y^2 + 8y$
           $x^2 = 16 + 4(2y)$
           $x^2 = 4x + 32 = 0$
           $x = 8$
           $y = 6$
Put the value $x = 2y - 4$ and 48 square cm.

84. Option (b) is correct.
Explanation: Area of circle circumscribing

So, $R = \dfrac{2r}{\sqrt{3}} + r = R = \left(\dfrac{2}{\sqrt{3}} + 1\right)r$

$\pi r^2 = \dfrac{\pi\left(2+\sqrt{3}\right)^2 r^2}{3} = \pi\left(\dfrac{2+\sqrt{3}}{3}\right)^2 r^2$

$r^2 = 1$

$r = 1$

85. Option (a) is correct.

Explanation:

AB = 21 cm

BC = 20 cm

CA = 13 cm

$S = \dfrac{21+20+13}{2} = 27$

Area of DABC = $\dfrac{1}{2} \times 21 \times CD$

$\sqrt{27 \times 6 \times 14 \times 7} = \dfrac{1}{2} \times 21 \times CD$

$CD = 12$

$BD = \sqrt{20^2 - 12^2} = 16$

$\therefore$ Area of $\triangle BCD = \dfrac{1}{2} \times 16 \times 12 = 96$

86. Option (a) is correct.

Explanation: A container of milk = 1 : 3

2nd container of milk = M : N

Find the value of $\dfrac{M}{N}$ = ?

$\dfrac{\dfrac{1}{4} \times 8 + \dfrac{12m}{m+n}}{\dfrac{3}{4} \times 8 + \dfrac{12n}{m+n}} = \dfrac{3}{7} = \dfrac{14m+2n}{6m+18n} = \dfrac{3}{7}$

$= 98 + 14n = 18m + 54n$

$80m = 40n$

$\dfrac{M}{N} = \dfrac{1}{2}$

87. Option (b) is correct.

Explanation: Put the formula:

Sum of volumes =

$\dfrac{1}{3}\pi r^2 r + \dfrac{2}{3}\pi r^2 r + \pi r^2 \times r = \dfrac{4}{3}\pi R^3$

So, $\left(\dfrac{1}{3} + \dfrac{2}{3} + 1\right)\pi r^3 = \dfrac{4}{3}\pi R^3$

$2r^3 = \dfrac{4}{3}R^3$

$\dfrac{R^3}{r^3} = \dfrac{6}{4} = 1.5$

So, $\boxed{\dfrac{R^3}{r^3} = 1.5}$

88. Option (c) is correct.

Explanation: If $x^3 + px^2 + qx + r$

Solve when p is integer

$x^3 + px^2 + qx + r = z$

Put $x = 0$

$r = z$ integer

$3x^2 + 2px + q = z'$

$6x + 2p = z''$

Put $x = 1$

p and q are integer

89. Option (b) is correct.

Explanation: Many possibility to exist sum value of $(x + y)$

$(100x + 10y + z) - (100y + 10x + z) = 90$

$90x - 90y = 90$

$x - y = 1$ $x \neq y \neq 0$

$x = y + 1$

So, 8 possibility for $(x + y)$ value.

90. Option (d) is correct.

Explanation:

$2 : 01 \rightarrow 3 : 00 - 59$ times

$3 : 01 \rightarrow 4 : 00 - 59$ times

Total round of clock is 118 times.

91. Option (c) is correct.

Explanation: HCF = $2^{36} - 1$ and $2^{45} - 1$

$2^{36} - 1$ and $2^{45} - 1$

$= (2^9)^4 - 1$ and $(2^9)^5 - (1) \div 2^{9-1}$

$512 - 1 = 511$

92. Option (b) is correct.

Explanation: $\pi = \dfrac{22}{7}$

Given, $r = 7$
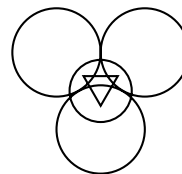
Then, $h = \sqrt{196 - 49} = 7\sqrt{3}$

Volume of the cone = $\dfrac{1}{3} \times \dfrac{22}{7} \times 7 \times 7 \times \sqrt{3}$

$\dfrac{154 \times 7 \times \sqrt{3}}{3} = \dfrac{1078}{\sqrt{3}}$

93. Option (d) is correct.
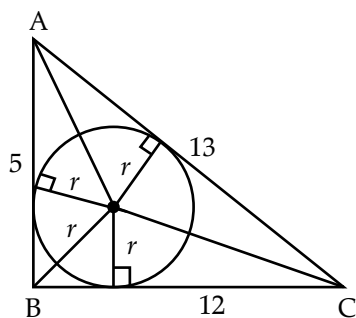
Explanation:

Area of circle is,

Put the formula,

$$R = \frac{s}{\sqrt{3}}$$

$$R = \frac{6}{\sqrt{3}} = 2\sqrt{3} \text{ cm}$$

$$\pi R^2 = \frac{\pi \times 36}{3} = 12\pi$$

94. Option (c) is correct.
Explanation:

Radius of circle
Put the formula

$$S = \frac{a+b+c}{2} = \frac{5+12+13}{2} = 15$$

$$\therefore \sqrt{15 \times 10 \times 3 \times 2} = \frac{1}{2} \times r(5+12+13)$$

$$30 = 15r$$
$$r = 2$$

95. Option (d) is correct.

Explanation: Ratio $= \dfrac{(n-2)\,180^\circ}{360^\circ} = \dfrac{7}{2}$

$$n - 2 = 7$$
$$n = 9$$

Exterior $= \dfrac{360^\circ}{9} = 40^\circ$

Integration $= 140^\circ$

96. Option (a) is correct.
Explanation: Number $= 199$
$(m^2 - n^2)$ natural number
$(m + n)(m - n) = 199 \times 1$
$m + n = 199$
$m - n = 1$

$m = 100$, $n = 99$
So, $mn = 9900$

97. Option (b) is correct.
Explanation: Form $2^n - 1$ is less than 2000
When 1, 3, 7, 15, 31, 63, 127, 255, 511, 1023
These are number to prime
4 number is prime.

98. Option (d) is correct.
Explanation: No. of student $= 160$
English $= 130$
Hindi $= 120$
Sanskrit $= 110$
All three language $= n$
$(130 - n) + (120 - n) + (110 - n) + n = 160$
$360 - 2n = 160$
$n = 100$

99. Option (c) is correct.
Explanation: $S = 5^a + 7^b + 11^c + 13^d$
5 is divide by 10

$$\frac{5^a + 7^b + 11^c + 13^d}{10}$$

last digit $5^a = 5$
last digit $7^b = 7, 9, 3$ or 1
last digit $11^c = 1$
last digit $13^d = 3, 9, 7$ or 1
case 1 = 5+7+1+3= 16, remainder = 6
case 2 =5+7+1 +9=22, remainder = 2
case 3 =5+9+1 +3=18, remainder = 8
case 4 =5+3+1 +1=10, remainder = 0
case 5 =5+9+1 +9=24, remainder = 4
[0,2,4,6,8,]
Then 5 number.

100. Option (a) is correct.
Explanation: AB is equal to

$\cos 60^\circ = \dfrac{x}{6}$

$\dfrac{1}{2} = \dfrac{x}{6}$

So, $x = 3$