CENTRE FOR PEDAGOGICAL STUDIES IN MATHEMATICS (CPSM)
ACHIEVEMENT-CUM-DIAGNOSTIC TEST IN MATHEMATICS-2023

INSTRUCTION: Write your Name, Class Roll No. etc. in the answersheet. Select the correct answer out of (a), (b), (c) and (d) of particular item and fill the specific rectangle ■ with blue/black ball pen denoting the correct answer. For example, if (c) is the correct answer to Q. No. X: blacken like this: Q. No. X: □ □ ■ □. Rough work is to be done on separate paper. Marks will be deducted for wrong answer. Don't waste time for answering a question which appears difficult to you, better try the next question.

1. What will be the nature of the figure obtained by joining the mid-points of the sides of a square?

   (a) rhombus (b) rectangle (c) trapezium (d) square

2. If S and R be the areas of a square and a rhumbus on the same base then the correct relation between S and R is

   (a) $S = R$ (b) $S < R$ (c) $S > R$ (d) $R = \frac{3}{4} S$

3. ΔABC is a right angled triangle with $\angle ABC = 90°$ and $BD \perp AC$, *then* $AB^2 - BC^2 + CD^2 =$

   (a) AD^2 (b) BD^2 (c) $\frac{1}{2} AC^2$ (d) $2\ AD^2$

4. A point within an equilateral triangle whose perimeter is 30 cm is 2 cm from one side and 3 cm from another side. Find the distance of that point from the third side.

   (a) $\sqrt{5} - 3$ cm (b) $5(\sqrt{3} - 1)$ cm

   (c) $5\sqrt{3} + 5$ cm (d) $5\sqrt{3} - 3$ cm

5. A triangle, a parallelogram and a rhombus lie on the same base and between the same parallels whose areas are T, P and R respectively then which of the following relations is correct?

(a) $P = R = T$ (b) $2T = P = R$

(c) $T = 2P = \frac{1}{2}R$ (d) $2T = P + R$

6. Side AB of the rhombus $ABCD$ is 6 cm in length and $\angle BCD = 60°$. What is the length of BD.

(a) $6\sqrt{2}$ cm (b) 9 cm (c) 8 cm (d) 6 cm

7. If a, b, c be the lengths of the sides BC, CA and AB respectively of the triangle ABC and $a^2 + b^2 + c^2 = bc + ca + ab$ then the triangle is

(a) isoscles (b) equilateral

(c) right angled (d) obtuse angled

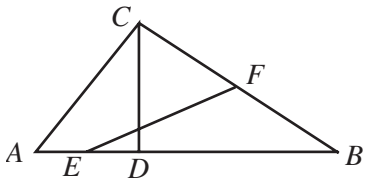
8. The number of diagonals of a decagon is—

(a) 20 (b) 30 (c) 35 (d) 36

9. A point is selected at random inside an equilateral triangle of height h. From this point perpendiculars are dropped on each side, the sum of these perpendiculars is

(a) h (b) $3h$ (c) $\frac{h}{2}$ (d) $\frac{h}{3}$

10. ABC is an acute angled triangle CD is the altitude through C. If $AB = 8$ cm, $CD = 6$ cm. Find the distance between the mid-points of AD and BC.



(a) 5.5 cm (b) 6 cm (c) 4.5 cm (d) 5 cm

11. The distance between the points $(a + b, c - d)$ and $(a - b, c + d)$ is

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

12. The points (2, –2), (8, 4), (5, 7) and (–1, 1) will form a

(a) square (b) rhombus (c) rectangle (d) kite

13. In which quadrant do the point $\left(\sqrt{3}-2,1-\sqrt{3}\right)$ lie?

(a) 4th (b) 3rd (c) 2nd (d) 1st

14. A diameter of a circle has the extreme points (7, 9) and (–1, –3). What would be the coordinates of the centre.

(a) (3, 3) (b) (–3, –3) (c) (–3, 3) (d) (3, –3)

15. A point divides internally the line segment joining the points (8, 9) and (–7, 4) in the ratio 2 : 3, the coordinates of the point is—

(a) (–2, –7) (b) (–2, 7) (c) (2, –7) (d) (2, 7)

16. The points (3, 0); (6, 4) and (–1, 3) form a triangle, the nature of the triangle is—

(a) right angled scalene (b) right angled isosceles

(c) equilateral (d) obtuse angled triangle

17. Find the ratio in which the line segment joining (5, –4) and (2, 3) is divided by the *x*-axis.

(a) 4 : 3 (b) 3 : 4 (c) 7 : 3 (d) 7 : 4

18. Find the point on the *y*-axis which is equidistant from the points (2, 3) and (–1, 2).

(a) (0, –4) (b) (0, 2) (c) (0, –2) (d) (0, 4)

19. The points (a, b), (b, a) and $(a^2, -b^2)$ are in a straight line, then which one of the following condition is not true?

(a) $a + b + 1 = 0$ (b) $1 - a + b = 0$

(c) $(a - b) = 0$ (d) $(a + b) = 0$

20. Find the value/values of 'a' for which the area of the triangle with vertices $(-1, -4)$, $(a, 1)$ and $(a, -4)$ is $12\frac{1}{2}$ sq units.

(a) 4, –3 (b) 4, 6 (c) 4, – 6 (d) 2, –6

21. The mean proportional between a^2bc and $4bc$ is—

(a) abc (b) $2abc$ (c) $\pm 2abc$ (d) $\pm 2a$

22. If $2^x = 3^y = 6^{-z}$ then $\left(\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)=$

(a) 0 (b) 1 (c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

23. Factorize : $x^3 - 8x^2 + 17x - 10$.

(a) $(x - 1)(x + 2)(x + 5)$ (b) $(x - 1)(x - 2)(x - 5)$

(c) $(x + 1)(x + 2(x - 5)$ (d) $(x- 1)(x - 2)(x + 5)$

24. The length of the hypotenuse of a right angled triangle is 5 cm and its area is 6 cm^2. What are the lengths of other two sides.

(a) 6 cm, 2 cm (b) 4 cm, 3 cm

(c) 5 cm, 3 cm (d) None of these

25. $\frac{1}{1+a^{n-m}}+\frac{1}{1+a^{m-n}}=$

(a) 0 (b) 2 (c) 1 (d) $\frac{1}{2}$

26. $\left(a^{\frac{1}{x-y}}\right)^{\frac{1}{x-z}}\times\left(a^{\frac{1}{y-z}}\right)^{\frac{1}{y-x}}\times\left(a^{\frac{1}{z-x}}\right)^{\frac{1}{z-y}}=$

(a) 0 (b) 1 (c) a (d) $\frac{1}{3}$

27. Find the value of x and y from the equations $ax + by = 1$ and $bx + ay = \frac{2ab}{a^2 + b^2}$.

(a) $x = \frac{1}{a^2 + b^2}$, $y = \frac{1}{a^2 + b^2}$ (b) $x = \frac{b}{a^2 + b^2}$, $y = \frac{a}{a^2 + b^2}$

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

28. If $2x^2 + px + 6 = (2x - a)(x - 2)$ is an identity then $p =$

(a) 3 (b) 7 (c) 10 (d) –7

29. If the H.C.F. and L.C.M. of x and y be 3 and 105 respectively and $x + y = 36$ then $\frac{1}{x} + \frac{1}{y} =$

(a) $\frac{1}{35}$ (b) $\frac{4}{35}$ (c) $\frac{36}{35}$ (d) $\frac{1}{9}$

30. The positive square root of $5 - 2\sqrt{6}$ is

(a) $\sqrt{3} - \sqrt{2}$ (b) $\sqrt{2} - \sqrt{3}$ (c) $\sqrt{3} + \sqrt{2}$ (d) $\sqrt{6}$

31. If $a : b = 3 : 4$ and $2a - b = 14$ then the value of $a + b$ is

(a) 35 (b) 70 (c) 51 (d) 49

32. If $x + \frac{1}{x} = 2$ then $x^n + \frac{1}{x^n} =$ (given n is a positive integer)

(a) 0 (b) 1 (c) 2^n (d) 2

33. If $p + \frac{1}{p} = \sqrt{3}$ then the value of $p^{84} + p^{78} + p^{60} + p^{54} + p^{36} + p^{30} + p^{12} + p^6$ is

(a) 4 (b) 3 (c) 0 (d) none of these

34. If $x = \frac{a}{2}\left(t + \frac{1}{t}\right)$ and $y = \frac{b}{2}\left(t - \frac{1}{t}\right)$ then $\frac{x^2}{a^2} - \frac{y^2}{b^2} =$

(a) 0 (b) 1 (c) 2 (d) 4

35. Eliminate t from the equations $v = u + ft$ and $s = ut + \frac{1}{2} ft^{2s}$

(a) $v^2 = u^2 + 2fs$ (b) $v^2 = u^2 - 2fs$

(c) $v^2 = u^2 + 2f$ (d) $v^2 + u^2 = 2fs$

36. If $a^x = bc$, $b^y = ca$ and $c^z = ab$ then

find the value of $\frac{1}{x+1} + \frac{1}{y+1} + \frac{1}{z+1}$

(a) 0 (b) 1 (c) 3 (d) $\frac{1}{3}$

37. If x and y be two unequal real numbers and $A = \frac{x+y}{2}$ and $G = \sqrt{xy}$ then which of the following relations is correct?

(a) $A < G$ (b) $A = G$ (c) $A > G$ (d) $A^2 = 2G$

38. If $(3^{2x+2} + 54) \div 15 = 9$ then $x =$

(a) 3 (b) 2 (c) 1 (d) 4

39. If $x = a(b - c)$, $y = b(c - a)$ and $z = c(a - b)$ then

$\left(\frac{x}{a}\right)^3 + \left(\frac{y}{b}\right)^3 + \left(\frac{z}{c}\right)^3 =$

(a) 3 (b) $\frac{xyz}{abc}$ (c) 0 (d) $\frac{3xyz}{abc}$

40. A certain number exceeds its reciprocal by 1. Find the number/numbers.

(a) $\frac{1}{2}(1 + \sqrt{5})$ and $\frac{1}{2}(1 - \sqrt{5})$

(b) $(1 + \sqrt{5})$ and $(1 - \sqrt{5})$

(c) 3 and –2

(d) $\frac{1}{2}(\sqrt{5} + 1)$ and $\frac{1}{2}(\sqrt{5} - 1)$

41. Three number are in the ratio 1 : 2 : 3 . The sum of their cubes is 7776. The greatest of thrse numbers is—

(a) 21 (b) 12 (c) 18 (d) 24

42. The ratio of $4^{3.5} : 2^5$ is equal to

(a) 1 : 4 (b) 2 : 1 (c) 4 : 1 (d) 8 : 1

43. Which of the following is a rational numbers

(a) $\sqrt{5}$ (b) $\frac{\sqrt{20}}{\sqrt{5}}$ (c) 0.3030030003… (d) π

44. If Anjali walks to her office at a speed of 4 km/hr she reaches her office 8 minutes before the office time, if she walks at 3 km/hr, she reaches the office 7 minutes late. Find the distance between the office and her house.

(a) 2 km (b) 4 km (c) $2\frac{1}{2}$ km (d) 1 km

45. A student secured 32% marks in an examination and failed by 12 marks. Another student secured 42% marks and got 28 marks more than the minimum marks required to pass. Find the pass percentage of marks.

(a) 30% (b) 35% (c) 36% (d) 40%

46. In a perfect square decimal number there are 16 digits after the decimal point. The square root of the number is calculated. Find the number of digits after the decimal point in the square root of the number.

(a) 8 (b) 15 (c) 4 (d) 12

47. Two watches were sold at the same price. One was sold at 10% profit and the other was sold at 10% loss. Find the overall profit/loss percentage made in the transaction.

(a) 1% profit (b) 1% loss (c) 2% profit (d) 2% loss

48. Two taps P and Q can fill an empty tank in 15 hrs and 30 hrs respectively. Both taps were opened at 4 a.m. and after some time, tap Q was closed. It was found that the tank was full at 4 p.m. For what time the tap Q was opened?

(a) Q was opend for 8 hrs (b) Q was opened for 4 hrs

(c) Q was opened for 12 hrs (d) Q was opened for 6 hrs

49. A person saves 180 minutes in covering a certain distance when he increases his speed from 25 km/hr to 30 km/hr. Find the distance

(a) 250 km (b) 420 km (c) 450 km (d) 500 km

50. The price of an article reduced twice at the rate of 10% and finally became Rs. 9 What was its price in the beginning.

(a) Rs. 11 (b) Rs. 10 (c) Rs. 12 (d) Rs. $11\frac{1}{9}$

51. The area of an equilateral triangle is $16\sqrt{3}$ m^2, the perimeter of the triangle is

(a) 24 m (b) 12 m (c) 36 m (d) 48 m

52. The lengths of the diagonals of a rhombus are $(a + b)$ units and $(a - b)$ units, the area of the rhombus is

(a) $\frac{1}{2}(a^2 + b^2)$ sq . units (b) $\frac{1}{4}(a^2 - b^2)$ sq. units

(c) $\frac{1}{2}(a^2 - b^2)$ sq. units (d) $\frac{1}{4}ab$ sq. units

53. ABC is a right angled triangle with $\angle BAC = 90°$, $AH \perp BC$, if $AB = 60$ cm, $AC = 80$ cm, then $BH =$

(a) 36 cm (b) 48 cm (c) 32 cm (d) 24 cm

54. The area of the triangle having sides 20 cm, 15 cm and 9 cm is

(a) 1001 cm^2 (b) 63 cm^2 (c) $2\sqrt{1001}$ cm^2 (d) $\sqrt{1001}$ cn^2

55. The circumference and area of a circular field are numerically equal.. The length of the side of a square is equal to the radius of the circle. The area of the square is

(a) 16 sq. units (b) 4 sq. units

(c) 8 sq. units (d) 20 sq. units

56. The perimeter of a circle is decreased by 50%, what is the percentage decrease in area?

(a) 25% (b) 50% (c) 75% (d) 60%

57. *ABCD* is a square inscribed in a circle of radius 14 cm,; *E*, *F*, *G*, *H* are the midpoints of the sides *DA*, *AB*, *BC* and *CD* respectively. The area of figure *EFGH* is

(a) 196 cm^2 (b) 392 cm^2 (c) 98 cm^2 (d) 294 cm^2

58. What is the area of the region of the circle which is situated outside the inscribed square of side *a* cm.

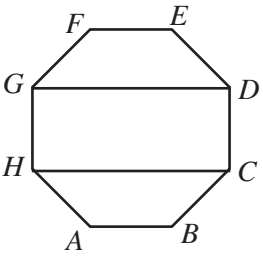
(a) $(\pi - 2)a^2$ cm^2 (b) $(\pi - 2)\frac{a^2}{2}$ cm^2

(c) $2(\pi - 2)\ a^2$ cm^2 (d) $(\pi - 2)\frac{a^2}{4}$ cm^2

59. The length of each side of a rhombus is 4 cm and the sum of its diagonals is 10 cm. The area of the rhombus is

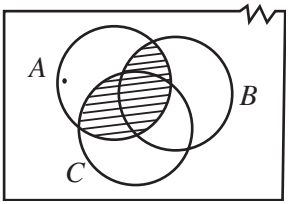
(a) 12 cm^2 (b) 10 cm^2 (c) 9 cm^2 (d) none of these

60. *ABCDEFGH* is a regular octagon whose each side measures 10 m, *DG* = 22 m and height of the part *DEFG*, which is an isosceles trapezium is 8 m. The area of the regular octagon is



(a) 476 m^2 (b) 256 m^2 (c) 400 m^2 (d) 348 m^2

61. What does the shaded region represent in the adjoining figure.



(a) $(A \cup B) - (A \cap C)$

(b) $A \cap (B \cup C)$

(c) $(A \cap B) \cup (A \cap C)$

(d) $(A \cap B) \cap (A \cap C)$

62. If $A = \{x \mid x$ is prime and $x < 20\}$ and $B = \{x \mid x = n^2, n \in \mathbb{N}$ and $x < 5\}$ then A and B are

(a) equal sets (b) overlapping sets

(c) disjoint sets (d) equivalent sets

63. If $A = \{x \mid x$ is a multiple of 3 and $x < 20\}$ and $B = \{x \mid x$ is a multiple of 5 and $x < 20\}$. Then $A \cap B =$

(a) $\{3, 5\}$ (b) $\{15\}$ (c) ϕ (d) $\{3, 15\}$

64. if $A = \{x \mid x$ is an even number$\}$; $B = \{x \mid x$ is a prime number$\}$ then $A \cap B$ equals

(a) $\{x \mid x$ is a odd number$\}$

(b) $\{x \mid x$ is an even number$\}$

(c) $\{2\}$

(d) ϕ

65. A and B are two sets such that $n(A \cup B) = 18$, $n(A) = 8$, $n(B) = 15$, then $n(A \cap B) =$

(a) 4 (b) 5 (c) 7 (d) 8

66. The class mark of a particular class is 17.5 and the class size is 5, the class interval is

(a) 14 – 19 (b) 15 – 20 (c) 14.5 – 19.5 (d) 17.5 – 22.5

67. If $\bar{x}$ be the mean of n observations $x_1, x_2, x_3, \ldots \ldots x_n$. If $(a-b)$ is added to each observation, then the mean of the new set of observations is

(a) 0 (b) $\bar{x}$ (c) $\bar{x} - (a - b)$ (d) $\bar{x} + (a - b)$

68. In a class of 19 students seven boys failed in a test. Those who passed scored 12, 15, 17, 15, 16, 15, 19, 19, 17, 18, 18 and 19 marks. The median score of those 19 students in the class is

(a) 15 (b) 16 (c) 17 (d) 18

69. The mean of 1, 7, 5, 3, 4 and 4 is m. The observations 3, 2, 4, 2, 3, 3 and p have mean $(m - 1)$. Find the median of 3, 2, 4, 2, 3, 3 and p is

(a) 4 (b) 2.5 (c) 3 (d) 5

70. The observations 29, 32, 48, 50, x, $x + 2$, 72, 78, 84 and 95 are arranged in ascending order. What is the value of x if the median of the data is 63.

(a) 61 (b) 62 (c) 62.5 (d) 63

71. Two fair coins are tossed. Find the probability that head turns up exactly once.

(a) $\frac{1}{4}$ (b) $\frac{1}{2}$ (c) $\frac{3}{4}$ (d) 1

72. Two fair dice are tossed, find the probability that the product of the scores is 12

(a) $\frac{1}{4}$ (b) $\frac{2}{3}$ (c) $\frac{3}{4}$ (d) $\frac{1}{9}$

73. One card is drawn from a pack of well-shuffled pack of cards. Find the probability that the card drawn is a queen.

(a) $\frac{1}{52}$ (b) $\frac{1}{13}$ (c) $\frac{1}{26}$ (d) $\frac{12}{13}$

74. A perfect cube die is thrown, find the probability that a prime number comes up.

(a) $\frac{2}{3}$ (b) $\frac{1}{3}$ (c) $\frac{1}{6}$ (d) $\frac{1}{2}$

75. Which of the following can not be the probability of an event.

(a) 0.28 (b) $\frac{7}{13}$ (c) 2.4 (d) 1

76. If $\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b} = 1$ then

$\frac{a^2}{b+c} + \frac{b^2}{c+a} + \frac{c^2}{a+b} =$

(a) 1 (b) 0 (c) $a + b + c$ (d) $\frac{1}{2}$

77. The point whose abscissa and ordinate have different signs will lie on

(a) 1st and 2nd quadrant (b) 1st and 4th quadrant

(c) 3rd quadrant only (d) 2nd and 4th quadrant

78. The perimeter of an equilateral triangle having an area $9\sqrt{3}$ cm^2 is

(a) 21 cm (b) 27 cm (c) 36 cm (d) 18 cm

79. If the point (3,–2) lies on the straight line $4x+ky = 9$, then $k =$

(a) $\frac{1}{2}$ (b) $1\frac{1}{2}$ (c) $-1\frac{1}{2}$ (d) –3

80. Find the probability of getting 53 sundays in a leap year.

(a) $\frac{4}{7}$ (b) $\frac{3}{7}$ (c) $\frac{2}{7}$ (d) $\frac{1}{7}$