

MODEL HALFYEARLY EXAMINATION -2024

Class: 10

MATHEMATICS

Time : 3 Hours

Total Marks : 100

- Instructions :**
- (1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.
 - (2) Use Blue or Black ink to write and underline.

Notes : (i) This question paper contains **four** parts

PART I

Note:(1) Answer all the 14 questions.

14 × 1 = 14

(2) Choose the correct answer from the given four alternatives and write the option code and the corresponding answer.

1. If $n(A) = m$ and $n(B) = n$, then the total number of non empty relations that can be defined from A to B is

(A) m^n (B) n^m (C) $2^{mn} - 1$ (D) 2^{mn}
2. $f(x) = (x+1)^3 - (x-1)^3$ represents a function which is

(A) linear (B) cubic (C) reciprocal (D) quadratic
3. The sum of the exponents of the prime factors in the prime factorization of 1729 is

(A) 1 (B) 2 (C) 3 (D) 4
4. The sum of the sequence $\frac{-3}{2}, \frac{-3}{2}, \frac{-3}{2}, \dots$ upto first 20 terms is

(A) 3 (B) $\frac{-3}{2}$ (C) 30 (D) 20
5. $\frac{3y-3}{y} \div \frac{7y-7}{3y^2}$ is

(A) $\frac{9y}{7}$ (B) $\frac{9y^3}{(21y-21)}$ (C) $\frac{21y^2-42y-21}{3y^3}$ (D) $\frac{7(y^2-2y+1)}{y^2}$
6. Statement (i) : $x^4 + 10x^3 + 31x^2 + 30x + 19$ is a perfect square
Statement (ii) : A Quadratic equation must have 2 roots

(A) Both statements (i) & (ii) are true.
(B) Statement (i) is true but statement (ii) is false.
(C) Statement (i) is false but statement (ii) is true
(D) Both statements (i) & (ii) are false.
7. If A is a 2×3 matrix and B is a 3×4 matrix, how many columns does AB have _____ .

(A) 3 (B) 4 (C) 2 (D) 5
8. If in ΔABC , $DE \parallel BC$. $AB = 3.6$ cm, $AC = 2.4$ cm and $AD = 2.1$ cm then the length of AE is

(A) 1.4 cm (B) 1.8 cm (C) 1.2 cm (D) 1.05 cm

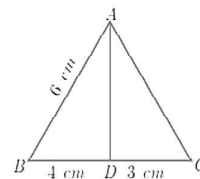
9. The slope of the line joining $(12, 3)$, $(4, a)$ is $\frac{1}{8}$. The value of 'a' is _____.
- (A) 1 (B) 4 (C) 5 (D) 2
10. A straight line has equation $8y = 4x + 21$ Which of the following is true?
- (A) The slope is 0.5 and the y intercept is 2.6
 (B) The slope is 5 and the y intercept is 1.6
 (C) The slope is 0.5 and the y intercept is 1.6
 (D) The slope is 5 and the y intercept is 2.6
11. If $a \cot \theta + b \operatorname{cosec} \theta = p$ and $b \cot \theta + a \operatorname{cosec} \theta = q$, then $p^2 - q^2$ is equal to _____.
- (A) $a^2 - b^2$ (B) $b^2 - a^2$ (C) $a^2 + b^2$ (D) $b^2 - a^2$
12. The total surface area of a cylinder whose radius is $\frac{1}{3}$ of its height is _____.
- (A) $\frac{9\pi h^2}{8}$ sq.units (B) $24\pi h^2$ sq.units (C) $\frac{8\pi h^2}{9}$ sq.units (D) $\frac{56\pi h^2}{9}$ sq.units
13. If the radius of the base of a cone is doubled and the height is tripled, then the volume is _____.
- (A) made 6 times (B) made 12 times (C) made 4 times (D) made 2 times
14. Which of the following is incorrect?
- (A) $P(A) > 1$ (B) $0 \leq P(A) \leq 1$ (C) $P(\phi) = 0$ (D) $P(A) + P(\bar{A}) = 1$

PART - II

Answer any 10 questions. Question no. 28 is compulsory.

$10 \times 2 = 20$

15. If $A \times B = \{(3,2), (3,4), (5,2), (5,4)\}$, then find A and B.
16. If $f(x) = x^2 - x$, then find $f(x - 1) - f(x + 1)$
17. Find the number of terms in the A.P. 3, 6, 9, 12, ..., 111.
18. If $1^3 + 2^3 + 3^3 + \dots + k^3 = 44100$, then find $1 + 2 + 3 + \dots + k$.
19. Find the excluded values of the expression $\frac{x+10}{8x}$.
20. Determine the nature of the roots for the quadratic equation $\sqrt{2}t^2 - 3t + 3\sqrt{2} = 0$.
21. In the Figure AD is the bisector of $\angle A$. If $BD = 4$ cm, $DC = 3$ cm and $AB = 6$ cm, then find AC.
22. If the three points $(3, -1)$, $(a, 3)$ and $(1, -3)$ are collinear, find the value of a.



23. Find the equation of a straight line which is parallel to the line $3x - 7y = 12$ and passing through the point (6,4)
24. Prove that $\cos^2 \theta + \frac{1}{1+\cot^2 \theta} = 1$
25. The curved surface area of a right circular cylinder of height 14 cm is 88 cm^2 . Find the diameter of the cylinder.
26. The volumes of two cones of same base radius are 3600 cm^3 and 5040 cm^3 . Find the ratio of heights.
27. If $P(A) = \frac{2}{3}, P(B) = \frac{2}{5}, P(A \cup B) = \frac{1}{3}$, then find $P(A \cap B)$
28. Mean and standard deviation of a data are 15 and 9 respectively. If 3 is added to each value of the data, then find the coefficient of variation of the new data

PART - III

Answer any 10 questions. Question no. 42 is compulsory.

10 × 5 = 50

29. Let $A = \{1, 2, 3, 4\}$ and $B = \{2, 5, 8, 11, 14\}$ be two sets. Let $f: A \rightarrow B$ be a function given by $f(x) = 3x - 1$. Represent this function (i) by arrow diagram (ii) in a table form (iii) as a set of ordered pairs (iv) in a graphical form.
30. If $f(x) = x - 1, g(x) = 3x + 1$ and $h(x) = x^2$. Show that $(f \circ g) \circ h = f \circ (g \circ h)$.
31. Find the HCF by using Euclid's Division Algorithm of 396, 504, and 636.
32. In a G.P. the product of three consecutive terms is 27 and the sum of the product of two terms taken at a time is $\frac{57}{2}$. Find the three terms.
33. If $9x^4 + 12x^3 + 28x^2 + ax + b$ is a perfect square, find the values of a and b
34. If $A = \begin{pmatrix} 5 & 2 & 9 \\ 1 & 2 & 8 \end{pmatrix}, B = \begin{pmatrix} 1 & 7 \\ 1 & 2 \\ 5 & -1 \end{pmatrix}$ verify that $(AB)^T = B^T A^T$.
35. State and prove Pythagoras theorem.
36. Find the value of k , if the area of a quadrilateral is 28 sq units, whose vertices are taken in the order $(-4, -2), (-3, k), (3, -2)$ and $(2, 3)$
37. If $D(11, 7), E(13.5, 4)$ and $F(9.5, 4)$ are the mid points of the sides AB, BC and AC of triangle ABC respectively, then find the equation of the median from the vertex C
38. Two ships are sailing in the sea on either sides of a lighthouse. The angle of elevation of the top of the lighthouse as observed from the ships are 30° and 45° respectively. If the lighthouse is 200 m high, find the distance between the two ships. ($\sqrt{3}=1.732$)

39. If the radii of the circular ends of a frustum which is 45 cm high are 28 cm and 7 cm, find the volume of the frustum
40. A silver cup in the shape of a hemisphere surmounted by a cylinder. The height of the silver cup is 11.25 cm and its common diameter is 10.5 cm. Find its capacity
41. Two dice are rolled together. Find the probability of getting a doublet or sum of faces as 4.
42. A rectangular park is to be designed whose breadth is 4m less than its length. Its area is to be 6 sq. metres more than the area of a park that has already been made in the shape of an isosceles triangle with its base as the breadth of the rectangular park and of altitude 10 m. Find the length and breadth of the rectangular park.

PART IV

Answer the following:

$2 \times 8 = 16$

43. a) Draw a circle of diameter 6 cm from a point P which is 8 cm away from its centre. Draw the two tangents PA and PB to the circle and measure their lengths.

(OR)

- b) Draw ΔPQR such that $PQ = 6.8$ cm, vertical angle is 50° and the bisector of the vertical angle meets the base at D where $PD = 5.2$ cm

44. a) Nishanth is the winner in a marathon race of 12 km distance. He ran at the uniform speed of 12 km/hr and reached the destination in 1 hour. He was followed by Aradhana, Jeyanth, Sathya and Swetha with their respective speeds of 6 km/hr, 4 km/hr, 3 km/hr and 2 km/hr. And, they covered the distance in 2 hrs, 3 hrs, 4 hrs and 6 hours respectively. Draw the speed-time graph and use it to find the time taken by Kaushik with his speed of 2.4 km/hr.

(OR)

- b) Draw the graph and discuss the nature of solutions of the quadratic equation $x^2 - 9x + 20 = 0$.

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