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COMMON HALF YEARLY EXAMINATION - 2024

Standard - X
MATHEMATICS

Reg.No.

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Marks: 100

Time: 3.00 hrs.

PART - I

I. Choose the most appropriate answer:

14 × 1 = 14

- If there are 1024 relations from a set $A = \{1, 2, 3, 4, 5\}$ to a set B , then the number of elements in B is
 a) 3 b) 2 c) 4 d) 8
- If $f: A \rightarrow B$ is a constant function, then the range of f will have _____ elements.
 a) 0 b) 1 c) 2 d) 10
- $7^{4k} \equiv \underline{\hspace{2cm}} \pmod{100}$
 a) 1 b) 2 c) 3 d) 4
- For the given matrix $\begin{bmatrix} 1 & 3 & 5 & 7 \\ 2 & 4 & 6 & 8 \\ 9 & 11 & 13 & 15 \end{bmatrix}$ the order of the matrix A^T is
 a) 2×3 b) 3×2 c) 3×4 d) 4×3
- $\frac{3y-3}{y} + \frac{7y-y}{3y^2}$ is
 a) $\frac{9y}{7}$ b) $\frac{9y^3}{21y-21}$ c) $\frac{21y^2-42y+21}{3y^3}$ d) $\frac{7(y^2-2y+1)}{y^2}$
- Two poles of heights 6m and 11m stand vertically on a plane ground. If the distance between their feet is 12m, what is the distance between their tops?
 a) 13m b) 14m c) 15m d) 12.8m
- If a line with slope m , $m \neq 0$ makes x intercept d , then the equation of the straight line is
 a) $y = mx$ b) $y = m(x - d)$ c) $y = mx + d$ d) $x = m(y - d)$
- The straight line given by the equation $x = 11$ is
 a) parallel to x axis b) parallel to y axis
 c) passing through the origin d) passing through the point $(0, 11)$
- If the ratio of the height of a tower and the length of its shadow is $\sqrt{3} : 1$, then the angle of elevation of the sun has measure
 a) 45° b) 30° c) 90° d) 60°
- If $5x = \sec\theta$ and $\frac{5}{y} = \tan\theta$ then $x^2 - \frac{1}{y^2}$ is equal to
 a) 25 b) $1/25$ c) 5 d) 1
- The C.S.A. of a right circular cylinder of equal radius and height is _____ the area of its base.
 a) 2 times b) 3 times c) half d) equal

12. The ratio of the volumes of a cylinder, a cone and a sphere, if each has the same diameter and same height is
 a) 1 : 2 : 3 b) 2 : 1 : 3 c) 1 : 3 : 2 d) 3 : 1 : 2
13. The sum of all deviations of the data from its mean is
 a) Always positive b) always negative
 c) zero d) non-zero integer
14. Which of the following is not a measure of dispersion?
 a) Range b) Standard deviation c) Arithmetic mean d) Variance

PART - II

II. Answer any 10 questions. (Question No.28 is compulsory) 10×2=20

15. A relation R is given by the set $\{(x, y)/y = x + 3, x \in \{0, 1, 2, 3, 4, 5\}\}$
 Determine its domain and range.

16. Find k if $f \circ f(k) = 5$ where $f(k) = 2k - 1$

17. Find the sum $3 + 1 + \frac{1}{3} + \dots \dots \dots \infty$

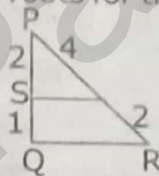
18. $a_n = \frac{5n}{n+2}$. Find a_6 and a_{13}

19. Simplify : $\frac{x^2 - 1}{x^2 + x}$

20. Define Scalar matrix and give example?

21. Determine the nature of the roots for the quadratic equation $\sqrt{2}t^2 - 3t + 3\sqrt{2} = 0$.

22. Show that $\Delta PST \sim \Delta PQR$



23. Show that the straight lines $x - 2y + 3 = 0$ and $6x + 3y + 8 = 0$ are perpendicular.

24. Find the area of the triangle whose vertices are A (-1, 2), B (5, -2) and C (7, 4).

25. Find the angle of elevation of the top of a tower from a point on the ground, which is 30m away from the foot of a tower of height $10\sqrt{3}$ m.

26. Prove that : $\sqrt{\frac{1 + \sin \theta}{1 - \sin \theta}} = \sec \theta + \tan \theta$

27. The slant height of a frustum of a cone is 5cm and the radii of its ends are 4cm and 1cm. Find its curved surface area.

28. The range of a set of data is 13.67 and the largest value is 70.08. Find the smallest value.

PART - III

III. Answer any 10 questions. (Question No.42 is compulsory) 10×5=50

29. Let A = The set of all natural numbers less than 8,
 B = The set of all prime numbers less than 8,
 C = The set of even prime number. Verify that $(A \cap B) \times C = (A \times C) \cap (B \times C)$
30. Find x if $\text{gff}(x) = \text{fgg}(x)$, given $f(x) = 3x + 1$ and $g(x) = x + 3$
31. Find the sum to n terms of the series $7 + 77 + 777 + \dots$
32. In a Geometric progression the 4th term is $\frac{8}{9}$ and the 7th term is $\frac{64}{243}$. Find the Geometric progression.
33. Solve : $x + y + z = 5$; $2x - y + z = 9$; $x - 2y + 3z = 16$.
34. $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & -1 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & -1 \\ -1 & 4 \\ 0 & 2 \end{bmatrix}$ show that $(AB)^T = B^T A^T$
35. State and Prove Pythagoras theorem.
36. A quadrilateral has vertices at A(-4, -2), B(5, -1), C(6, 5) and D(-7, 6). Show that the mid-points of its sides form a parallelogram.
37. Find the equation of a straight line passing through (1, -4) and has intercepts which are in the ratio 2 : 5.
38. From the top of a light house, the angle of depression of two ships on the opposite sides of its are observed to be 60° and 45° . The distance between the two ships is $200 \left(\frac{\sqrt{3} + 1}{\sqrt{3}} \right)$ m. Find the height of the lighthouse.
39. A solid iron cylinder has total surface area of 1848 sq.cm. Its curved surface area is five - sixth of its total surface area. Find the radius and height of the iron cylinder.
40. A right circular cylindrical container of base radius 6cm and height 15cm is full of icecream. The icecream is to be filled in cones of height 9cm and base radius 3cm, having a hemispherical cap. Find the number of cones needed to empty the container.
41. Blue and Ash colour dice are rolled together. Find the outcomes. Also find the probability of getting doublet or sum of faces as 4.
42. P and Q are the midpoints of the sides CA and CB respectively of ΔABC , right angled at C. Prove that $4(AQ^2 + BP^2) = 5AB^2$

PART - IV

IV. Answer all the questions:

2×8=16

43. a) Construct a ΔPQR which the base $PQ = 4.5\text{cm}$ $\angle R = 35^\circ$ and the median RG from R to PQ is 6cm .

(OR)

- b) Draw the two tangents from a point which is 10cm away from the centre of a circle of radius 5cm . Also measure the lengths of the tangents.
44. a) The following table shows the data about the number of pipes and the time taken to fill the same tank.

No of pipes (x)	2	3	6	9
Time Taken (in min) (y)	45	30	15	10

Draw the graph for the above data and hence i) find the time taken to fill the tank when five pipes are used.

ii) Find the number of pipes when the time is 9 minutes.

(OR)

- b) Draw the graph of $y = x^2 - 5x - 6$ and hence solve $x^2 - 5x - 14 = 0$.