

Model Paper for H S (Vocational)

Mathematics (MTH1)

Class – XI

Semester – 2 (2024-25)

Full Marks: 40

Time: 2 hours

Answer the following Questions

Group – A (5 × 2 = 10)

(This group comprises 5 questions with 2 marks each)

1. If the sum up to n terms of an AP is given by $S_n = -3n^2 + 5n$, find its 10th term.

OR

Find the sum of the series: $\frac{1}{3} + \frac{1}{3^2} + \frac{1}{3^3} \dots \infty$

2. Find the term independent of x in the expansion of $\left(2x - \frac{5}{x}\right)^{20}$.
3. Find the value of k for which the points $(-3, 1)$, $(2, k - 1)$, $(-1, -2)$ are collinear.

4. Evaluate: $\log_{x \rightarrow 0} \left\{ \frac{\log_e(1-4x)}{\sin\left(\frac{3x}{2}\right)} \right\}$

OR

Evaluate: $\lim_{x \rightarrow 7} \left\{ \frac{x^{\frac{9}{2}} - 7^{\frac{9}{2}}}{\log_e(x-6)} \right\}$

5. If $f(x) = \sqrt[4]{x^{-7}} - \log_3 x$, $x > 0$, find $f'(1)$

OR

If $f(x) = |3 - 4x|$, then find (i) $f'(-3)$ (ii) $f'(\pi)$

Group – B (5 × 3 = 15)

(This group comprises 5 questions with 3 marks each)

6. Show that the middle term in $\left(x + \frac{1}{2x}\right)^n$ is $\frac{1.3.5 \dots (2n-1)}{n!}$

OR

Find the 7th term from the end in $\left(2x - \frac{5}{x^2}\right)^{17}$

7. Find the equation to the circle described on the common chord of the given circles $x^2 + y^2 - 4x - 5 = 0$ and $x^2 + y^2 + 8x + 7 = 0$ as diameter.

OR

The equation of in-circle of an equilateral triangle is $x^2 + y^2 + 4x - 6y - 3 = 0$. Find the area of the triangle.

8. Find the equation of the parabola whose vertex is $(-1, 3)$ and focus is $(3, -1)$.

9. Evaluate: $\lim_{x \rightarrow 1} \left(\frac{\sqrt[3]{x} + \sqrt[4]{x} + \sqrt{x} - 3}{x^3 - 1} \right)$

10. If $y = \sqrt{\frac{x}{m}} + \sqrt{\frac{m}{x}}$, prove that $2xy \frac{dy}{dx} = \frac{x}{m} - \frac{m}{x}$, where m is a constant.

OR

If $y = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \frac{x^4}{4!} + \dots + \frac{x^n}{n!}$, prove that $\frac{dy}{dx} + \frac{x^n}{n!} - y = 0$

Group – C (3 × 5 = 15)

(This group comprises 3 questions with 5 marks each)

11. Find the middle term and the sum of all terms of the series:

$$\frac{1}{2} + \frac{1}{3} + \frac{1}{6} + \dots + \left(-\frac{5}{6}\right).$$

12. Find the equation of the straight line passing through the point of intersection of the straight lines $2x + 3y + 4 = 0$ and $3x + y - 1 = 0$ and inclined to the positive direction of the x-axis at an angle 135° .

OR

Find the equation to the perpendicular bisector of the line segment joining the two points $(2, 3)$ and $(4, -1)$. What is the length of the perpendicular drawn from the origin to that perpendicular bisector?

13. Find the (i) centre (ii) length of latus rectum (iii) foci of the ellipse $3x^2 + 4y^2 + 6x - 8y - 5 = 0$

OR

Find the equation of the hyperbola having transverse and conjugate axes parallel to X and Y - axes respectively with centre $(3, -2)$, eccentricity $\frac{\sqrt{5}}{2}$ and length of latus rectum 2. Also find its foci and extremities of any latus rectum.

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