Class XII | Session 2026-27

Subject - Mathematics

Sample Question Paper - Set 10

General Instructions:

1. This Question paper contains - five sections A, B, C, D and E. Each section is compulsory. However, there are internal choices in some questions.
2. Section A has 18 MCQ's and 02 Assertion-Reason based questions of 1 mark each.
3. Section B has 5 Very Short Answer (VSA)-type questions of 2 marks each.
4. Section C has 6 Short Answer (SA)-type questions of 3 marks each.
5. Section D has 4 Long Answer (LA)-type questions of 5 marks each.
6. Section E has 3 source based/case based/passage based/integrated units of assessment (4 marks each) with sub parts.

Section A

1. If A is a null matrix then **[1]**

a) A is a square matrix
b) A is a cube matrix
c) A is not a square matrix
d) both A is a square matrix and A is not a square matrix

2. If A is a 3-rowed square matrix and |3A| = k |A| then k = ? **[1]**

a) 9
b) 27
c) 3
d) 1

3. The solution of the differential equation $\frac{dy}{dx} = \frac{x^2+xy+y^2}{x^2}$, is **[1]**

a) $\tan^{-1}\left(\frac{y}{x}\right) = \log y + C$
b) $\tan^{-1}\left(\frac{x}{y}\right) = \log x + c$
c) $\tan^{-1}\left(\frac{x}{y}\right) = \log y + C$
d) $\tan^{-1}\left(\frac{y}{x}\right) = \log x + C$

4. The function $f(x) = \frac{4-x^2}{4x-x^3}$ is **[1]**

a) discontinuous at exactly three points
b) discontinuous at only one point
c) discontinuous at exactly four points
d) discontinuous at exactly two points

5. The projections of a line segment on X, Y and Z axes are 12, 4 and 3 respectively. The length and direction cosines of the line segment are **[1]**

a) 11; $\frac{12}{11}, \frac{14}{11}, \frac{3}{11}$
b) 19; $\frac{12}{19}, \frac{4}{19}, \frac{3}{19}$
c) 13; $\frac{12}{13}, \frac{4}{13}, \frac{3}{13}$
d) 15; $\frac{12}{15}, \frac{14}{15}, \frac{3}{15}$

[1]

6. Degree of the differential equation $\sin x + \cos\left(\frac{dy}{dx}\right) = y^2$ is

a) 2
b) 0
c) 1
d) not defined

7. The common region determined by all the constraints of a linear programming problem is called: **[1]**

a) a feasible region
b) a bounded region
c) an optimal region
d) an unbounded region

8. $\sin\left[\frac{\pi}{3} + \sin^{-1}\left(\frac{1}{2}\right)\right]$ is equal to **[1]**

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

9. $\int \frac{1}{\sqrt[3]{x}} dx = ?$ **[1]**

a) $\frac{3}{2x^{\frac{2}{3}}} + C$
b) $\frac{2}{3}x^{\frac{3}{2}} + C$
c) $\frac{3}{2}x^{\frac{2}{3}} + C$
d) $\frac{2}{3x^{\frac{2}{3}}} + C$

10. If for the matrix A = $\begin{bmatrix} \tan x & 1 \\ -1 & \tan x \end{bmatrix}$, $A + A' = 2\sqrt{3}I$, then the value of $x \in \left[0, \frac{\pi}{2}\right]$ is: **[1]**

a) 0
b) $\frac{\pi}{6}$
c) $\frac{\pi}{4}$
d) $\frac{\pi}{3}$

11. The objective function Z = 4 x + 3 y can be maximised subjected to the constraints $3x + 4y \leq 24$, $8x + 6y \leq 48$, $x \leq 5$, $y \leq 6$; $x, y \geq 0$ **[1]**

a) at a finite number of points
b) at only one point
c) at an infinite number of points
d) at two points only

12. Let f(x) = |x| and g(x) = $|x^3|$, then **[1]**

a) f(x) and g(x) both are continuous at x = 0
b) f(x) is differentiable but g(x) is not differentiable at x = 0
c) f(x) and g(x) both are not differentiable at x = 0
d) f(x) and g(x) both are differentiable at x = 0

13. A line passes through the point A (5, -2. 4) and it is parallel to the vector $(2\hat{i} - \hat{j} + 3\hat{k})$. The vector equation of the line is **[1]**

a) $\vec{r} \cdot (5\hat{i} + 2\hat{j} - 4\hat{k}) = \sqrt{12}$
b) $\vec{r} = (2\hat{i} - \hat{j} + 3\hat{k}) + \lambda(5\hat{i} - 2\hat{j} + 4\hat{k})$
c) $\vec{r} \cdot (5\hat{i} - 2\hat{j} + 4\hat{k}) = \sqrt{14}$
d) $\vec{r} = (5\hat{i} - 2\hat{j} + 4\hat{k}) + \lambda(2\hat{i} - \hat{j} + 3\hat{k})$

14. For any two events A and B, if $P(\bar{A}) = \frac{1}{2}$, $P(\bar{B}) = \frac{2}{3}$ and $P(A \cap B) = \frac{1}{4}$, then $P\left(\frac{\bar{A}}{\bar{B}}\right)$ equals: **[1]**

a) $\frac{8}{9}$
b) $\frac{1}{4}$
c) $\frac{5}{8}$
d) $\frac{3}{8}$

15. Which of the following is a second order differential equation? **[1]**

a) $(y')^2 + x = y^2$
b) $y'y' + y = \sin x$

c) $y'' + (y')^2 + y = 0$

d) $y' = y^2$

16. The function $f(x) = x^3 + 3x$ is increasing in interval **[1]**

a) $(-\infty, 0)$

b) $(0, 1)$

c) $(0, \infty)$

d) $\mathbb{R}$

17. If $x = at, y = \frac{a}{t}$, then $\frac{dy}{dx}$ is: **[1]**

a) $\frac{1}{t^2}$

b) t^2

c) $-\frac{1}{t^2}$

d) $-t^2$

18. If the direction ratios of a line are 2, 3 and -6, then direction cosines of the line making obtuse angle with Y-axis are **[1]**

a) $\frac{2}{7}, \frac{3}{7}, \frac{6}{7}$

b) $\frac{-2}{7}, \frac{3}{7}, \frac{-6}{7}$

c) $\frac{-2}{7}, \frac{-3}{7}, \frac{-6}{7}$

d) $\frac{-2}{7}, \frac{-3}{7}, \frac{6}{7}$

19. **Assertion (A):** Direction cosines of a line are the sines of the angles made by the line with the negative directions of the coordinate axes. **[1]**

Reason (R): The acute angle between the lines x - 2 = 0 and $\sqrt{3x - y - 2}$ is 30^o.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

20. **Assertion (A):** $\int xe^{x^2}dx = \frac{1}{2}e^{x^2} + c$ **[1]**

Reason (R): To solve above integral put $x^2 = t$.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

21. Find equation of line joining (3, 1) and (9, 3) using determinants. **[2]**

OR

Evaluate the determinant $\begin{vmatrix} 2 & 3 & -2 \\ 1 & 2 & 3 \\ -2 & 1 & -3 \end{vmatrix}$ by expanding it along first column.

22. Evaluate $\int_1^3 \frac{\cos(\log x)}{x}dx$ **[2]**

23. The volume of a cube is increasing at a rate of 8 cm^3/ sec . How fast is the surface area increasing when the length of an edge is 12 cm? **[2]**

OR

Find the intervals in which $f(x) = (x+2)e^{-x}$ is increasing or decreasing.

24. A die marked 1, 2, 3 in red and 4, 5, 6 in green is tossed. Let A be the event **number is even** and B be the event **number is marked red**. Find whether the events A and B are independent or not. **[2]**

25. Find the sum of the order and the degree of the differential equation: $\left(x + \frac{dy}{dx}\right)^2 = \left(\frac{dy}{dx}\right)^2 + 1$ **[2]**

Section C

26. Find: $\int \frac{x^3+1}{x^3-x}dx$ **[3]**

27. For what value of λ, the function defined by f(x) = $\begin{cases} \lambda\left(x^2+2\right), & \text{if } x \leq 0 \\ 4x+6, & \text{if } x > 0 \end{cases}$ is continuous at x = 0? Hence, check the differentiability of f(x) at x = 0. **[3]**

28. $\int_0^{\pi/2} \frac{\cos^2 x}{\cos^2 x+4\sin^2 x} dx$ **[3]**

OR

Evaluate $\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x} dx$

29. Solve the initial value problem: x dy + y dx = xy dx, y(1) = 1 **[3]**

OR

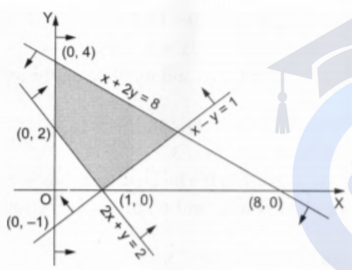
Find the particular solution of the differential equation $xe^{y/x} - y + x\frac{dy}{dx} = 0$, given that y(e) = 0.

30. Find the distance of the point with position vector $-\hat{i} - 5\hat{j} - 10\hat{k}$ from the point of intersection of the line $\vec{r} = (2\hat{i} - \hat{j} + 2\hat{k}) + \lambda(3\hat{i} + 4\hat{j} + 12\hat{k})$ with the plane $\vec{r} \cdot (\hat{i} - \hat{j} + \hat{k}) = 5$ **[3]**

OR

If $\vec{a} = (\hat{i} - \hat{j}), \vec{b} = (3\hat{j} - \hat{k})$ and $\vec{c} = (7\hat{i} - \hat{k})$, find a vector $\vec{d}$ which is perpendicular to both $\vec{a}$ and $\vec{b}$ and for which $\vec{c} \cdot \vec{d} = 1$.

31. Find the linear constraints for which the shaded area in the figure given is the solution set. **[3]**



Section D

32. If the area bounded by the parabola $y^2 = 16ax$ and the line $y = 4mx$ is $\frac{a^2}{12}$ sq. units, then using integration, find the value of m. **[5]**

33. If $\vec{a} \times \vec{b} = \vec{c} \times \vec{d}$ and $\vec{a} \times \vec{c} = \vec{b} \times \vec{d}$, then show that $\vec{a} - \vec{d}$ is parallel to $\vec{b} - \vec{c}$, where $\vec{a} \neq \vec{d}$ and $\vec{b} \neq \vec{c}$. **[5]**

OR

If with reference to the right handed system of mutually $\perp$ unit vectors $\hat{i}, \hat{j}, \hat{k}$ and $\vec{\alpha} = 3\hat{i} - \hat{j}, \vec{\beta} = 2\hat{i} + \hat{j} - 3\hat{k}$ then express $\vec{\beta}$ in the form $\vec{\beta} = \vec{\beta}_1 + \vec{\beta}_2$, where $\vec{\beta}$ is $\parallel$ to $\vec{\alpha}$ and $\vec{\beta}_2$ is $\perp$ to $\vec{\alpha}$

34. If $A = \begin{bmatrix} 1 & 0 & 2 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$, prove that $A^3 - 6A^2 + 7A + 2I = 0$. **[5]**

35. A square piece of tin of side 18 cm is to be made into a box without the top, by cutting a square piece from each corner and folding up the flaps. What should be the side of the square to be cut off so that the volume of the box is maximum? Also, find the maximum volume of the box. **[5]**

OR

Show that a cylinder of a given volume which is open at the top has minimum total surface area, when its height is equal to the radius of its base.

Section E

36. **Read the following text carefully and answer the questions that follow:** **[4]**

In pre-board examination of class XII, commerce stream with Economics and Mathematics of a particular school, 50% of the students failed in Economics, 35% failed in Mathematics and 25% failed in both Economics and Mathematics. A student is selected at random from the class.

i. Find the probability that the selected student has failed in Economics, if it is known that he has failed in Mathematics? (1)

ii. Find the probability that the selected student has failed in Mathematics, if it is known that he has failed in Economics? (1)

iii. Find the probability that the selected student has passed in Mathematics, if it is known that he has failed in Economics? (2)

OR

Find the probability that the selected student has passed in Economics, if it is known that he has failed in Mathematics? (2)

37. **Read the following text carefully and answer the questions that follow:** **[4]**

Sherlin and Danju are playing Ludo at home during Covid-19. While rolling the dice, Sherlin's sister Raji observed and noted the possible outcomes of the throw every time belongs to set $\{1, 2, 3, 4, 5, 6\}$. Let A be the set of players while B be the set of all possible outcomes.

$A = \{S, D\}$, $B = \{1, 2, 3, 4, 5, 6\}$

i. Let $R : B \to B$ be defined by $R = \{(x, y): y \text{ is divisible by } x\}$. Determine whether R is Reflexive, symmetric or transitive. (1)

ii. Raji wants to know the number of functions from A to B. How many number of functions are possible? (1)

iii. Let R be a relation on B defined by $R = \{(1, 2), (2, 2), (1, 3), (3, 4), (3, 1), (4, 3), (5, 5)\}$. Then describe R . (2)

OR

Raji wants to know the number of relations possible from A to B. How many numbers of relations are possible? (2)

38. **Read the following text carefully and answer the questions that follow:** **[4]**

Let f(x) be a real valued function. Then its

- Left Hand Derivative (L.H.D.): $Lf'(a) = \lim\limits_{h \to 0} \frac{f(a-h)-f(a)}{-h}$
- Right Hand Derivative (R.H.D.): $Rf'(a) = \lim\limits_{h \to 0} \frac{f(a+h)-f(a)}{h}$

Also, a function f(x) is said to be differentiable at x = a if its L.H.D. and R.H.D. at x = a exist and both are equal.

For the function $f(x) = \begin{cases} |x-3|, x \geq 1 \\ \frac{x^2}{4} - \frac{3x}{2} + \frac{13}{4}, x < 1 \end{cases}$

i. What is R.H.D. of f(x) at x = 1? (1)

ii. What is L.H.D. of f(x) at x = 1? (1)

iii. Check if the function f(x) is differentiable at x = 1. (2)

OR

Find f'(2) and f'(-1). (2)