PRINCE ACADEMY
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BOARD SAMPLE PAPER- II (2025-26)

Time : 03 : 00 Hours | **CLASS :– XII-MATHS (041)** | M.M. : 80

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 MCQs 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 (4marks each) with sub parts

SECTION - A

1. If the matrix $A=\left[a_{ij}\right]_{2\times 2}$ is such that $a_{ij}=\begin{cases}1, & if\ i\neq j\\ 0 & if\ i=j\end{cases}$, then $A+A^2$ is equal to :

(a) $\begin{bmatrix}1 & 0\\ 0 & 1\end{bmatrix}$ (b) $\begin{bmatrix}0 & 1\\ 1 & 0\end{bmatrix}$ (c) $\begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix}$ (d) $\begin{bmatrix}0 & 0\\ 0 & 0\end{bmatrix}$

2. The domain of $f(x)=\cos^{-1}(2x)$ is :

(a) $[-1,1]$ (b) $\left[0,\frac{1}{2}\right]$ (c) $[-2,2]$ (d) $\left[-\frac{1}{2},\frac{1}{2}\right]$

3. The value of determinant $\begin{vmatrix}\cos 75^o & \sin 75^o\\ \sin 15^o & \cos 15^o\end{vmatrix}$ is :

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

4. For a non-singular matrix X, if $X^2=I$, then X^{-1} is equal to :

(a) X (b) X^2 (c) I (d) O

5. The cofactor of the element a_{32} in the determinant $\Delta=\begin{vmatrix}1 & 2 & 3\\ 2 & 3 & 1\\ 3 & 1 & 2\end{vmatrix}$ is :

(a) ± 5 (b) -5 (c) 5 (d) 0

6. If A is an identity matrix of order n, then A (Adj A) is a/an :

(a) Identity matrix (b) Row matrix
(c) Zero matrix (d) Skew symmetric matrix

7. If $x=t^3$ and $y=t^2$, then $\frac{d^2y}{dx^2}$ at t = 1 is :

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

8. The area bounded by the parabola $x^2 = y$ and the line y = 1 is :

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

9. If the rate of change of volume of a sphere is twice the rate of change of its radius, then the surface area of the sphere is :

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

10. $\int \frac{3\cos\sqrt{x}}{\sqrt{x}} dx$ is equal to :

(a) $-6sin\sqrt{x}+C$ (b) $-6cos\sqrt{x}+C$ (c) $6cos\sqrt{x}+C$ (d) $6\sin\sqrt{x}+C$

11. If $\frac{d}{dx}f(x) = 3x^2 - \frac{3}{x^4}$ such that $f(1)=0$, then $f(x)$ is :

(a) $6x+\frac{12}{x^5}$ (b) $x^4-\frac{1}{x^3}+2$ (c) $x^3+\frac{1}{x^3}-2$ (d) $x^3+\frac{1}{x^3}+2$

12. In an LPP, corner points of the feasible region determined by the system of linear constraints are $(1,1)$, $(3,0)$ and $(0,3)$. If $Z = ax+by$, where a, b > 0 is to be minimized, the condition on a and b, so that minimum of Z occurs at $(3,0)$ and $(1,1)$, will be

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

13. The maximum value of $Z = 3x+4y$ subject to the constraints $x+y \le 1,\ x, y \ge 0$ is :

(a) 3 (b) 4 (c) 7 (d) 0

14. The general solution of the differential equation $\frac{dy}{dx} = 2x.e^{x^2+y}$ is

(a) $e^{x^2+y} = C$ (b) $e^{x^2} + e^{-y} = C$ (c) $e^{x^2} = e^y + C$ (d) $e^{x^2-y} = C$

15. If 'm' and 'n' are the degree and order respectively of the differential equaion $1+\left(\frac{dy}{dx}\right)^3 = \frac{d^2y}{dx^2}$, then the value of $(m+n)$ is :

(a) 4 (b) 3 (c) 2 (d) 5

16. If $|\vec{a}|=1$, $|\vec{b}|=2$ and $\vec{a}.\vec{b}.=2$ then the value $|\vec{a}+\vec{b}|$ is :

(a) 9 (b) 3 (c) -3 (d) 2

17. Two vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}\times\vec{b}| = \vec{a}.\vec{b}$. The angle between the two vectors is :

(a) 30° (b) 60° (c) 45° (d) 90°

18. A coin is tossed three times. The probability of getting at least two heads is :

(a) $\frac{1}{2}$ (b) $\frac{3}{8}$ (c) $\frac{1}{8}$ (d) $\frac{1}{4}$

For questions 19 - 20

(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 and (R) is false.

(d) (A) is false, but (R) is true.

19. Consider the function $f: R \to R,$ defined as $f(x) = x^3$.

Assertion (A) : f(x) is one-one function.

Reason (R) : f(x) is a one-one function, if co-domain = range.

20. Assertion (A) : $f(x) = [x], x \in R,$ the greatest integer function is not differentiable at x = 2.

Reason (R) : The greatest integer function is not continuous at any integral value.

SECTION - B

21. (a) Find the principal value of $\cos^{-1}\left(-\frac{1}{2}\right)+2\sin^{-1}\left(\frac{1}{2}\right)$.

OR

(b) Prove that : $\tan^{-1}\sqrt{x}=\frac{1}{2}\cos^{-1}\left(\frac{1-x}{1+x}\right), x\in[0,1]$

22. If $e^{y}(x+1)=1$ prove that $\frac{dy}{dx}=e^{y}$.

23. A ladder 13 m long is leaning against the wall. The bottom of the ladder is pulled along the ground away from the wall at the rate of 2 m/s. How fast is the height on the wall decreasing when the foot of the ladder is 12 m away from the wall ?

24. (a) Find the value of λ if the points $(-1,-1,2)$ and $(3,11,6),(2,8,\lambda)$ are collinear.

OR

(b) $\vec{a}$ and $\vec{b}$ are two co-intial vectors forming the adjacent sides of a parallelogram such that $|\vec{a}|=10, |\vec{b}|=2$ and $\vec{a}.\vec{b}=2$. Find the area of the parallelogram.

25. Find the angle between the lines
$\vec{r}=(3+2\lambda)\hat{i}-(2-2\lambda)\hat{j}+(6+2\lambda)\hat{k}$ and $\vec{r}=(2\hat{j}-5\hat{k})+\mu(6\hat{i}+3\hat{j}+2\hat{k})$.

SECTION - C

26. Find the maximum slope of the curve $y=-x^{3}+3x^{2}+9x-30$.

27. (a) Find : $\int\sqrt{4x^{2}-4x+10}\,dx$

OR

(b) Evaluate : $\int_{0}^{\pi}\frac{x\sin x}{1+\cos^{2}x}dx$

28. Solve the following LPP graphically :
Maximize to the constraints $x+4y\le 8$

$2x+3y\le 12$

$3x+y\le 9$

$x\ge 0, y\ge 0$.

29. (a) Find the general solution of the differential equation $(2x^{2}+y)dx=xdy$.

OR

(b) For the differential equation $\frac{dy}{dx}-\frac{y}{x}+\operatorname{cosec}\left(\frac{y}{x}\right)=0$, find the particular solution, given that $y=0$ when $x=1$.

30. If $\hat{a},\hat{b}$ and $\hat{c}$ are unit vectors such that $\hat{a}.\hat{b}=\hat{a}.\hat{c}=0$ and the angle between $\hat{b}$ and $\hat{c}$ is $\frac{\pi}{6}$, then prove that $\hat{a}=\pm 2(\hat{b}\times\hat{c})$.

31. (a) Four students of class XII are given a problem to solve independently. Their chances of solving the problem respectively are $\frac{1}{2},\frac{1}{3},\frac{2}{3}$ and $\frac{1}{5}$. Find the probability that at most one of them will solve the problem.

OR

(b) The probability distribution of a random variable X is given below :

X	1	2	4	2k	3k	5k
P(X)	$\frac{1}{2}$	$\frac{1}{5}$	$\frac{3}{25}$	$\frac{1}{10}$	$\frac{1}{25}$	$\frac{1}{25}$

Find k, if $E(X)=2.94$ and also find $P(X\le 4)$.

SECTION - D

32. If $A=\begin{bmatrix}3 & 2 & 1\\ 4 & -1 & 2\\ 7 & 3 & -3\end{bmatrix}$, find A^{-1}. Using A^{-1}, solve the given system of equations $3x+4y+7z=14;\ 2x-y+3z=4;$ $x+2y-3z=0$.

33. (a) If $y=\cos x^2+\cos^2 x+\cos^2\left(x^2\right)+\cos\left(x^x\right)$, find $\dfrac{dy}{dx}$.

(b) Find the intervals in which the function given by $f(x)=\frac{3}{10}x^4-\frac{4}{5}x^3-3x^2+\frac{36}{5}x+11$ is :

(i) Strictly increasing. (ii) Strictly decreasing.

34. Using integration, find the area of the region $y=x^2, y=x, x=3$ and x-axis :

35. (a) Find the shortest distance between the lines l_1 and l_2 given by :

$l_1:\vec{r}=\hat{i}+2\hat{j}-4\hat{k}+\lambda\left(4\hat{i}+6\hat{j}+12\hat{k}\right)$ and $l_2:\vec{r}=3\hat{i}+3\hat{j}-5\hat{k}+\lambda\left(6\hat{i}+9\hat{j}+18\hat{k}\right)$.

OR

(b) Show that the line $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4}$ and $\frac{x-4}{5}=\frac{y-1}{2}=\frac{z}{1}$ intersect. Also, find their point of intersection.

SECTION - E

Case Study- 1

36. A window is in the form of a rectangle surmounted by an equilateral triangle on its length. Let the rectangular part have length and breadth x and y metres recpectively.
Based on the given information, answer the following questions :
(i) If the perimeter of the window is 12 m, find the relation between x and y.
(ii) Using the expression obtained in (i), write an expression for the area of the window as a function of x only.
(iii) (a) Find the dimensions of the rectangle that will allow maximum light through the window. (use expression obtained in (ii))

OR

(b) If it is given that the area of the window is 50 m^2, find an expression for its perimeter in terms of x.

Case Study- 2

37. During the festival season, there was a mela organized by the Resident Welfare Association at a park, near the society. The main attraction of the mela was a huge swing installed at one corner of the park. The swing is traced to follow the path of a parabola given by $x^2=y$.
Based on the given information, answer the following questions :
(i) Let f : $N\rightarrow R$ is defined by $f(x)=x^2$. What will be the range ?
(ii) Let f : $N\rightarrow N$ is defined by $f(x)=x^2$. Check if the function is injective or not.
(iii) (a) Let f : $\{1,2,3,4.....\}\rightarrow\{1,4,9,16......\}$ be defined by $f(x)=x^2$. Prove that the function is bijective.

OR

(iii) (b) Let f : $R\rightarrow R$ is defined by $f(x)=x^2$. Show that f is neither injective nor surjective.

Case Study- 3

38. Two persons are competing for a position on the Managing Committee of an organisation. The probabilities that the first and the second person will be appointed are 0.5 and 0.6 respectively. Also, if the first person gets appointed, then the probability of introducing waste treatment plant is 0.7 and the corresponding probability is 0.4, if the second person gets appointed.
(i) What is the probability that the waste treatment plant is introduced ?
(ii) After the selection, if the waste treatment plant is introduced, what is the probability that the first person had introduced it ?

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