## I-PRE BOARD EXAMINATION (2024-25)
## SUBJECT- MATHS
## CLASS- XII

**M.M: 80**

**DURATION: 3Hrs.**

**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, 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 of 4 marks** each with sub-parts.

### <u>SECTION-A</u> (1 Mark Each)

8

1. If $\begin{bmatrix} a & c & 0 \\ b & d & 0 \\ 0 & 0 & 5 \end{bmatrix}$ is a scalar matrix, then the value of a + 2b + 3c + 4d is :

5

(A) 0 (B) 5 (C) 10 (D) 25

2. Given that $A^{-1} = \frac{1}{7}\begin{bmatrix} 2 & 1 \\ -3 & 2 \end{bmatrix}$, matrix A is :

(A) $7\begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$ (B) $\begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$ (C) $\frac{1}{7}\begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$ (D) $\frac{1}{49}\begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$

3. If $A = \begin{bmatrix} 2 & 1 \\ -4 & -2 \end{bmatrix}$, then the value of $I - A + A^2 - A^3 + \ldots$ is :

(A) $\begin{bmatrix} -1 & -1 \\ 4 & 3 \end{bmatrix}$ (B) $\begin{bmatrix} 3 & 1 \\ -4 & -1 \end{bmatrix}$ (C) $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ (D) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

4. If $A = \begin{bmatrix} -2 & 0 & 0 \\ 1 & 2 & 3 \\ 5 & 1 & -1 \end{bmatrix}$, then the value of $|A\,(\text{adj. } A)|$ is :

(A) 100 I (B) 10 I (C) 10 (D) 1000

5. Given that $[1 \quad x]\begin{bmatrix} 4 & 0 \\ -2 & 0 \end{bmatrix} = 0$, the value of $x$ is :

(A) –4 (B) –2 (C) 2 (D) 4

6. Derivative of $e^{2x}$ with respect to $e^x$, is :

(A) $e^x$ (B) $2e^x$

(C) $2e^{2x}$ (D) $2e^{3x}$

7. For what value of k, the function given below is continuous at $x = 0$ ?

$$f(x) = \begin{cases} \dfrac{\sqrt{4+x}-2}{x}, & x \neq 0 \\ k \quad , & x = 0 \end{cases}$$

(A) 0 (B) $\frac{1}{4}$ (C) 1 (D) 4

8. The value of $\int_0^3 \frac{dx}{\sqrt{9-x^2}}$ is :

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{4}$ (C) $\frac{\pi}{2}$ (D) $\frac{\pi}{18}$

9. The general solution of the differential equation $x\,dy + y\,dx = 0$ is :

(A) $xy = c$ (B) $x + y = c$

(C) $x^2 + y^2 = c^2$ (D) $\log y = \log x + c$

10. The integrating factor of the differential equation $(x + 2y^2)\frac{dy}{dx} = y\ (y > 0)$ is :

(A) $\frac{1}{x}$ (B) $x$

(C) $y$ (D) $\frac{1}{y}$

11. If $\vec{a}$ and $\vec{b}$ are two vectors such that $|\vec{a}| = 1$, $|\vec{b}| = 2$ and $\vec{a} \cdot \vec{b} = \sqrt{3}$, then the angle between $2\vec{a}$ and $-\vec{b}$ is :

(A) $\frac{\pi}{6}$ (B) $\frac{\pi}{3}$

(C) $\frac{5\pi}{6}$ (D) $\frac{11\pi}{6}$

12. The vectors $\vec{a} = 2\hat{i} - \hat{j} + \hat{k}$, $\vec{b} = \hat{i} - 3\hat{j} - 5\hat{k}$ and $\vec{c} = -3\hat{i} + 4\hat{j} + 4\hat{k}$ represents the sides of

(A) an equilateral triangle (B) an obtuse-angled triangle

(C) an isosceles triangle (D) a right-angled triangle

13. Let $\vec{a}$ be any vector such that $|\vec{a}| = a$. The value of

$$|\vec{a} \times \hat{i}|^2 + |\vec{a} \times \hat{j}|^2 + |\vec{a} \times \hat{k}|^2 \text{ is :}$$

(A) $a^2$ (B) $2a^2$ (C) $3a^2$ (D) 0

$x = 0$ ?

14. The vector equation of a line passing through the point (1, –1, 0) and parallel to Y-axis is :

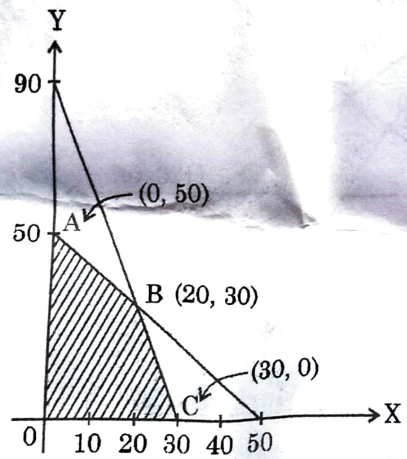
(A) $\vec{r} = \hat{i} - \hat{j} + \lambda(\hat{i} - \hat{j})$ (B) $\vec{r} = \hat{i} - \hat{j} + \lambda\hat{j}$

(C) $\vec{r} = \hat{i} - \hat{j} + \lambda\hat{k}$ (D) $\vec{r} = \lambda\hat{j}$

15. The lines $\frac{1-x}{2} = \frac{y-1}{3} = \frac{z}{1}$ and $\frac{2x-3}{2p} = \frac{y}{-1} = \frac{z-4}{7}$ are perpendicular to each other for p equal to :

(A) $-\frac{1}{2}$ (B) $\frac{1}{2}$ (C) 2 (D) 3

16. The maximum value of $Z = 4x + y$ for a L.P.P. whose feasible region is given below is :




(A) 50 (B) 110 (C) 120 (D) 170

17. The probability distribution of a random variable X is :

| X | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| P(X) | 0.1 | k | 2k | k | 0.1 |

where k is some unknown constant.

The probability that the random variable X takes the value 2 is :

(A) $\frac{1}{5}$ (B) $\frac{2}{5}$ (C) $\frac{4}{5}$ (D) 1

18. The function $f(x) = kx - \sin x$ is strictly increasing for

(A) $k > 1$ (B) $k < 1$ (C) $k > -1$ (D) $k < -1$



3

**ASSERTION-REASON BASED QUESTION:**

In the following questions, a statement of assertion (A) is followed by a statement of R. Choose the correct answer out of the following choices.

(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.

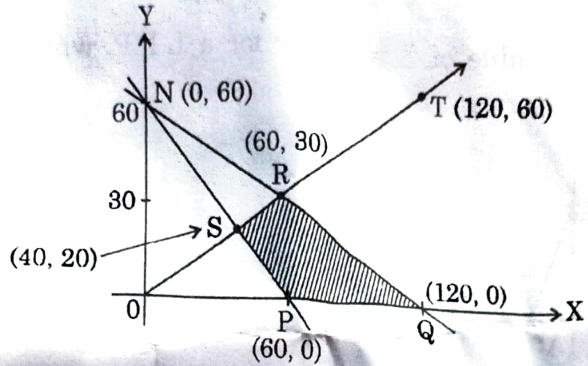
(c) A is true but R is false.

(d) A is false but R is true.

19. **Assertion (A) :** The relation $R = \{(x, y) : (x + y)$ is a prime number and $x, y \in N\}$ is not a reflexive relation.

**Reason (R) :** The number '2n' is composite for all natural numbers n.

20. **Assertion (A) :** The corner points of the bounded feasible region of a L.P.P. are shown below. The maximum value of $Z = x + 2y$ occurs at infinite points.




**Reason (R) :** The optimal solution of a LPP having bounded feasible region must occur at corner points.

## SECTION-B (2 Marks Each)

21. (a) Express $\tan^{-1}\left(\dfrac{\cos x}{1-\sin x}\right)$, where $\dfrac{-\pi}{2} < x < \dfrac{\pi}{2}$ in the simplest form.

**OR**

(b) Find the principal value of $\tan^{-1}(1) + \cos^{-1}\left(-\dfrac{1}{2}\right) + \sin^{-1}\left(-\dfrac{1}{\sqrt{2}}\right)$.

22. (a) If $y = \cos^3(\sec^2 2t)$, find $\dfrac{dy}{dt}$.

**OR**

(b) If $x^y = e^{x-y}$, prove that $\dfrac{dy}{dx} = \dfrac{\log x}{(1+\log x)^2}$.

23. Find the interval in which the function $f(x) = x^4 - 4x^3 + 10$ is strictly decreasing.

24. The volume of a cube is increasing at the rate of 6 $cm^3/s$. How fast is the surface area of cube increasing, when the length of an edge is 8 cm ?

Find : $\int \frac{1}{x(x^2-1)}\, dx.$

## SECTION-C (3 Marks Each)

26. Given that $y = (\sin x)^x \cdot x^{\sin x} + a^x$, find $\frac{dy}{dx}$.

27. (a) Evaluate : $\int_0^{\frac{\pi}{4}} \frac{x\, dx}{1+\cos 2x+\sin 2x}$

**OR**

(b) Find : $\int e^x \left[\frac{1}{(1+x^2)^{\frac{3}{2}}}+\frac{x}{\sqrt{1+x^2}}\right] dx$

28. Find : $\int \frac{3x+5}{\sqrt{x^2+2x+4}}\, dx$

29. (a) Find the particular solution of the differential equation $\frac{dy}{dx} = y \cot 2x$, given that $y\left(\frac{\pi}{4}\right) = 2$.

**OR**

(b) Find the particular solution of the differential equation

$$(xe^{\frac{y}{x}} + y)\, dx = x\, dy, \text{ given that } y = 1 \text{ when } x = 1.$$

30. Solve the following linear programming problem graphically :

Maximise $Z = 2x + 3y$

subject to the constraints :

$x + y \le 6, \quad x \ge 2, \quad y \le 3, \quad x, y \ge 0$

31. (a) A card from a well shuffled deck of 52 playing cards is lost. From the remaining cards of the pack, a card is drawn at random and is found to be a King. Find the probability of the lost card being a King.

**OR**

(b) A biased die is twice as likely to show an even number as an odd number. If such a die is thrown twice, find the probability distribution of the number of sixes. Also, find the mean of the distribution.

## SECTION-D (5 Marks Each)

36. A store has be... indicates tha... of units ($x$) ... by the

32. (a) Sketch the graph of $y = x|x|$ and hence find the area bounded by this curve, X-axis and the ordinates $x = -2$ and $x = 2$, using integration.

**OR**

(b) Using integration, find the area bounded by the ellipse $9x^2 + 25y^2 = 225$, the lines $x = -2$, $x = 2$, and the X-axis.

33. (a) Let $A = R - \{5\}$ and $B = R - \{1\}$. Consider the function $f : A \to B$, defined by $f(x) = \dfrac{x-3}{x-5}$. Show that f is one-one and onto.

**OR**

(b) Check whether the relation S in the set of real numbers R defined by $S = \{(a, b) : \text{where } a - b + \sqrt{2} \text{ is an irrational number}\}$ is reflexive, symmetric or transitive.

34. If $A = \begin{bmatrix} 2 & 1 & -3 \\ 3 & 2 & 1 \\ 1 & 2 & -1 \end{bmatrix}$, find $A^{-1}$ and hence solve the following system of equations :

$$2x + y - 3z = 13$$
$$3x + 2y + z = 4$$
$$x + 2y - z = 8$$

29
15 1
4
4

35. (a) Find the distance between the line $\dfrac{x}{2} = \dfrac{2y-6}{4} = \dfrac{1-z}{-1}$ and another line parallel to it passing through the point $(4, 0, -5)$.

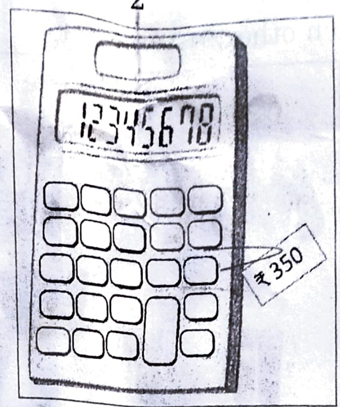
**OR**

(b) If the lines $\dfrac{x-1}{-3} = \dfrac{y-2}{2k} = \dfrac{z-3}{2}$ and $\dfrac{x-1}{3k} = \dfrac{y-1}{1} = \dfrac{z-6}{-7}$ are perpendicular to each other, find the value of k and hence write the vector equation of a line perpendicular to these two lines and passing through the point $(3, -4, 7)$.

6

## SECTION-E: CASE STUDY (4 Marks Each)

36. A store has been selling calculators at ₹ 350 each. A market survey indicates that a reduction in price (p) of calculator increases the number of units ($x$) sold. The relation between the price and quantity sold is given by the demand function $p = 450 - \frac{1}{2}x$.

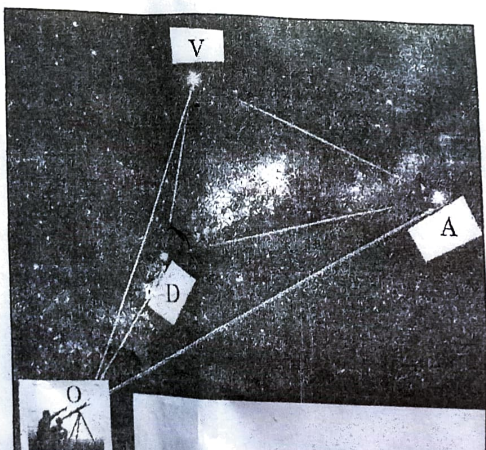



Based on the above information, answer the following questions :

(i) Determine the number of units ($x$) that should be sold to maximise the revenue $R(x) = xp(x)$. Also, verify the result.

(ii) What rebate in price of calculator should the store give to maximise the revenue ?

37. An instructor at the astronomical centre shows three among the brightest stars in a particular constellation. Assume that the telescope is located at O(0, 0, 0) and the three stars have their locations at the points D, A and V having position vectors $2\hat{i} + 3\hat{j} + 4\hat{k}$, $7\hat{i} + 5\hat{j} + 8\hat{k}$ and $-3\hat{i} + 7\hat{j} + 11\hat{k}$ respectively.




Based on the above information, answer the following questions :

(i) How far is the star V from star A ? **1**

(ii) Find a unit vector in the direction of $\overrightarrow{DA}$. **1**

(iii) Find the measure of $\angle VDA$. **2**

**OR**

(iii) What is the projection of vector $\overrightarrow{DV}$ on vector $\overrightarrow{DA}$ ? **2**

38. Rohit, Jaspreet and Alia appeared for an interview for three vacancies in the same post. The probability of Rohit's selection is $\frac{1}{5}$, Jaspreet's selection is $\frac{1}{3}$ and Alia's selection is $\frac{1}{4}$. The event of selection is independent of each other.

Based on the above information, answer the following questions :

(i) What is the probability that at least one of them is selected ? P(A∪B) 1

(ii) Find $P(G \mid \overline{H})$ where G is the event of Jaspreet's selection and $\overline{H}$ denotes the event that Rohit is not selected. 1

(iii) Find the probability that exactly one of them is selected. 2

**OR**

(iii) Find the probability that exactly two of them are selected. 2