PREBOARD EXAMINATION-(2025-26)

CLASS: XII

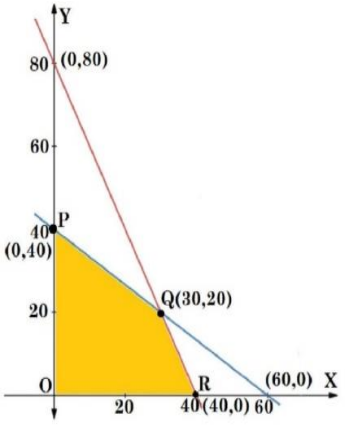
SUBJECT: MATHEMATICS (041)

Time Allowed: 3 Hours **Maximum Marks: 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 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.

Q.No.	**SECTION – A** (Multiple Choice Questions) Each question carries 1 mark	Marks
1.	If $\begin{bmatrix} 3p & -6 \\ 1 & 2 \end{bmatrix}$ is a singular matrix, then the value of 'p' is : (a)2 (b)3 (c)0 (d)-1	**1**
2.	If A is a square matrix of order 3 and $\lvert -2A \rvert = k\lvert A \rvert$, the value of k is (a) –8 (b) 8 (c) 4 (d) –4	**1**
3.	The value of λ for which the projection of $\vec{a} = \lambda\hat{\imath} + \hat{\jmath} + 4\hat{k}$ on $\vec{b} = 2\hat{\imath} + 6\hat{\jmath} + 3\hat{k}$ is 4 units : (a) 4 (b) 5 (c) 3 (d) 6	**1**
4.	The function $f(x) = \begin{cases} \frac{\sin x}{x} + \cos x & , x \neq 0 \\ k & , x = 0 \end{cases}$ is continuous at x= 0 , then the value of k is a. 3 b. 2 c. 1 d. 1.5	**1**
5.	The derivative of $\sec(\tan^{-1} x)$ w.r.t x is : (a) $\frac{x}{1+x^2}$ (b) $\frac{1}{\sqrt{1+x^2}}$ (c) $\frac{x}{\sqrt{1+x^2}}$ (d) $x\sqrt{1+x^2}$	**1**

6.	If 'm' and 'n' respectively are the degree and order of the differential equation $\frac{d}{dx}\left[\left(\frac{dy}{dx}\right)^3\right]=0$, then m+n is : (a) 1 (b) 2 (c) 3 (d) 4	**1**
7.	For an L.P.P the objective function is $Z=4x+3y$, and the feasible region determined by a set of constraints (linear inequalities) is shown in the graph Which one of the following is true : (a) Maximum value of Z is at R. (b) Maximum value of Z is at Q. (c) Value of Z at R is less than the value at P. (d) Value of Z at Q is less than the value at R. 	**1**
8.	The area of a parallelogram whose adjacent sides are $\hat{i}-2\hat{j}+3\hat{k}$ and $2\hat{i}+\hat{j}-4\hat{k}$ is : (a) $5\sqrt{3}$ sq. units (b) $10\sqrt{3}$ sq. units (c) $5\sqrt{6}$ sq. units (d) $10\sqrt{6}$ sq. units	**1**
9.	The value of $\int_1^{\sqrt{3}}\frac{1}{1+x^2}dx$ is : (a) $\frac{\pi}{3}$ (b) $\frac{2\pi}{3}$ (c) $\frac{\pi}{6}$ (d) $\frac{\pi}{12}$	**1**
10.	Let A be a square matrix the $A.A^T$ is : (a) Singular matrix (b) symmetric matrix (c) skew-symmetric matrix (d) non-singular matrix	**1**
11.	The value of $\int\frac{(x+1)(x+\log x)^2}{x}dx$ is : (a) $\frac{(x+\log x)^3}{3}+C$ (b) $\frac{(x+\log x)^2}{2}+C$ (c) $\frac{1}{x+\log x}+C$ (d) $\frac{1}{(x+\log x)^2}+C$	**1**
12.	If $\begin{vmatrix}x+1 & x-1\\ x-3 & x+2\end{vmatrix}=\begin{vmatrix}4 & -1\\ 1 & 3\end{vmatrix}$, then the value of x is : (a) 4 (b) 3 (c) 0 (d) 2	**1**
13.	If A is a square matrix of order 3×3 such that $\lvert adj\ A\rvert=25$, then $\lvert A\rvert$ is :	**1**

	(a) 125 (b) 9 (c) 5 (d) $\frac{1}{5}$	
14.	If A and B are two independent events such that $P(A) = 0.4$, $P(B) = p$ and $P(A \cup B) = 0.6$, then the value of 'p' is : (a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{2}{3}$ (d) $\frac{1}{5}$	**1**
15.	The corner points of the feasible region determined by the system of linear constraints are $(0,3), (1,1)$ and $(3,0)$. Let $Z = px + qy$, where $p, q > 0$. Conditions on p and q so that the minimum of z occurs at $(3,0)$ and $(1,1)$. (a) $p = 3q$ (b) $2p = q$ (c) $p = 3q$ (d) $p = q$	**1**
16.	If $y = 1 - x + \frac{x^2}{2!} - \frac{x^3}{3!} + \frac{x^4}{4!} - .....$ then $\frac{d^2y}{dx^2}$ is equal to (a) $-x$ (b) $-y$ (c) x (d) y	**1**
17.	If 'θ' is the angle between two vectors $\vec{a}$ and $\vec{b}$, then $\lvert\vec{a}.\vec{b}\rvert = \lvert\vec{a}\times\vec{b}\rvert$ when 'θ' is equal to (a) 0 (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{2}$ (d) π	**1**
18.	The direction ratios of the line $4x - 12 = 2y + 4 = 3z - 3$ are (a) 4,6,3 (b) 6,3,4 (c) 4,6,3 (d) 3,6,4	**1**

ASSERTION-REASON BASED QUESTIONS:

In the following questions, a statement of assertion (A) is followed by a statement of Reason (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 domain of the function $\sec^{-1}(2x+1)$ is $(-\infty, -1] \cup [0, \infty)$. **Reason (R):** $\sec^{-1}\left(-\frac{2}{\sqrt{3}}\right) = \frac{5\pi}{6}$	**1**

20.	**Assertion (A):** The lines $\frac{x-5}{7}=\frac{y+2}{-5}=\frac{z}{1}$ and $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ are perpendicular. **Reason (R):** Two lines $\frac{x-x_1}{a_1}=\frac{y-y_1}{b_1}=\frac{z-z_1}{c_1}$ and $\frac{x-x_2}{a_2}=\frac{y-y_2}{b_2}=\frac{z-z_2}{c_2}$ are perpendicular if $a_1a_2+b_1b_2+c_1c_2=0$.	**1**
	SECTION –B (This section comprises of very short answer type questions (VSA) of 2 marks each)	
21.	Find the value of $\sin\left(\frac{\pi}{2}-\sin^{-1}\left(\frac{-\sqrt{3}}{2}\right)\right)$ **OR** Show that the function f: R → R, defined as $f(x) = x^2$, is neither one-one nor onto.	**2**
22.	A particle moves along the curve $6y=x^3+2$. Find the points on the curve at which y-coordinate is changing 8 times as fast as the x-coordinate.	**2**
23.	Evaluate : $\int \sin^3 x\ dx$ **OR** Evaluate : $\int \frac{dx}{e^x+e^{-x}}$	**2**
24.	If $y=500e^{7x}+600e^{-7x}$, then show that $\frac{d^2y}{dx^2}=49y$.	**2**
25.	Find the maximum profit that a company can make, if the profit function is given by $P(x) = 72 + 42x - x^2$, where x is the number of units and P is profit in rupees.	**2**
	SECTION –C **(This section comprises of very short answer type questions (SA) of 3 marks each)**	
26.	Evaluate: $\int \frac{(x-3)}{(x-1)^3}e^x dx$	**3**
27.	A bag contains $(2n+1)$ coins. It is known that $(n-1)$ of these coins have a head on both sides, whereas the rest of the coins are fair. A coin is picked up at random from the bag and is tossed. If the probability that the toss results in a head is $\frac{31}{42}$, determine the value of n. **OR** An electric shop has two types of LED bulbs of equal quantity. The probability of an LED bulb lasting more than 6 months given that it is of type 1 is 0.7 and is given that it is	**3**

	of type 2 is 0.4. Then find the probability that on LED bulb chosen uniformly at random lasts more than 6 months..	
28.	Evaluate $\int_0^{\frac{\pi}{2}} \frac{\cos^2 x}{1+3\sin^2 x} dx$ **OR** Evaluate: $\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x} dx$	**3**
29.	Find the particular solution of the differential equation $(1 + e^{2x})\, dy + (1 + y^2)e^x\, dx = 0$, given that y = 1 when x = 0. **OR** Solve the differential equation $ye^{x/y}\, dx = (x\, e^{x/y} + y^2)dy$ ($y \neq 0$).	**3**
30.	Solve the following Linear Programming Problem graphically: Maximize. Z=4x+y Subject to $x + y \leq 50$; $3x + y \leq 90$; $x, y \geq 0$.	**3**
31.	Evaluate: $\int \frac{x^2+x+1}{(x^2+1)(x+2)} dx$	**3**
	SECTION-D **(This section comprises of long answer type questions (LA) of 5 marks each)**	
32.	Using integration, find the area of the region enclosed between the circle $x^2 + y^2 = 16$ and the lines y = 1 and y = 2 in the first quadrant.	**5**
33.	Show that the relation R defined on the **set N×N** by (a,b) R (c,d) $\Rightarrow a^2 + d^2 = b^2 + c^2$ $\forall$ a, b, c, d $\in$ **N** is an equivalence relation **OR** Show that the relation R on the set $A = \{x \in Z : 0 \leq x \leq 12\}$, given by $R = \{(a,b) : \lvert a-b \rvert$ *is a multiple of* $4\}$ is an equivalence relation. Also write equivalence class $[1]$.	**5**
34.	Use the product $\begin{bmatrix} 1 & -1 & 2 \\ 0 & 2 & -3 \\ 3 & -2 & 4 \end{bmatrix} \begin{bmatrix} -2 & 0 & 1 \\ 9 & 2 & -3 \\ 6 & 1 & -2 \end{bmatrix}$ to solve the system of equation $x - y + 2z = 1; 2y - 3z = 1 ;\ 3x - 2y + 4z = 2$	**5**

35.	Find the coordinates of the image of the point (2, 3, 4) with respect to the line $\vec{r} = (2\hat{j} + 4\hat{k}) + \gamma(2\hat{i} + 4\hat{j} + \hat{k})$; where γ is a scalar. Also, find the distance of the image from the origin. **OR** If with reference to the right handed system of mutually perpendicular unit vectors $\hat{i}, \hat{j}$ and $\hat{k}$, $\vec{\alpha} = 3\hat{i} - \hat{j}$, $\vec{\beta} = 2\hat{i} + \hat{j} - 3\hat{k}$, then express $\vec{\beta}$ in the form $\vec{\beta} = \vec{\beta}_1 + \vec{\beta}_2$, where $\vec{\beta}_1$ is parallel to $\vec{\alpha}$ and $\vec{\beta}_2$ is perpendicular to $\vec{\alpha}$.	**5**

SECTION-E

This section contains three Case-study / Passage based questions. First two questions have three sub-parts (i), (ii) and (iii) of marks 1, 1 and 2 respectively. Third question has two sub-parts of 2 marks each.

36. **4**

A shopkeeper sells three types of flowers seeds A_1, A_2 and A_3. These are sold as mixture, where their proportions are 4:4:2 respectively. Also their germination rates are 45%, 60% and 35% respectively. Let A_1: seed A_1 is chosen, A_2: seed A_2 is chosen and A_3: seed A_3 is chosen.

Also let E: seed germinates.

(i) Find P(A_1), P(A_2) and P(A_3).

(ii) Write P(E | A_1) +P(E | A_2) + P(E | A_3).

(iii) Calculate the probability of a randomly chosen seed to germinate. Express the answer in %.

OR

(iii) Calculate the probability that seed is of the type A_2 given that a randomly chosen seed does not germinate.

37.	**CASE STUDY II:** Read the following passage and answer the questions given below. A sports stadium is elliptical in shape. The district sports administration wants to design a rectangular football field with the maximum possible area. The football field is given by the graph of $\frac{x^2}{25}+\frac{y^2}{9}=1$. **(i)** If the length and the breadth of the rectangular field be '2x' and '2y' respectively, then find the area function in terms of 'x'. **(ii)** Find the critical point of the function obtained in **(i).** **(iii)** Use first derivative test to find the length '2x' and width '2y' of the soccer field, that will maximize its area. **OR** **(iii)** Use second derivative test to find the length '2x' and width '2y' of the soccer field, that will maximize its area.	**4**
38.	**CASE STUDY III :** Read the following passage and answer the questions given below. An airplane is flying along the line $\vec{r} = \alpha(2\hat{i} + 3\hat{j} + 4\hat{k})$; where α is a scalar and another aeroplane is flying along the line $\vec{r} = (\hat{i} + \hat{j}) + \gamma(3\hat{j} + 2\hat{k})$; where γ is a scalar. (i) At what points on the line should they reach, so that distance between them is shortest (ii) Find the shortest possible distance between them.	**4**

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