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PRE-BOARD-2 QUESTION PAPER CLASS XII SESSION 2025-26
MATHEMATICS(041)

TIME ALLOWED: 3 HOURS**MAX.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 of 4 marks each with sub-parts.

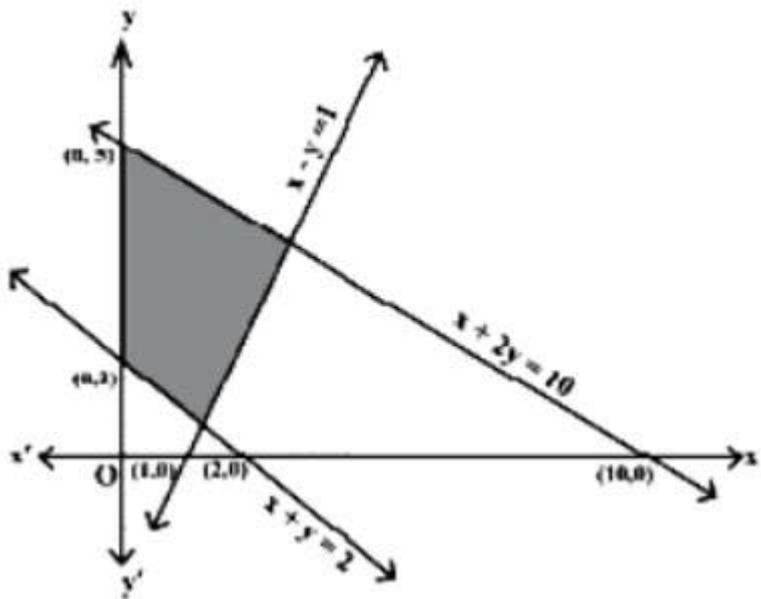
SECTION A

(Multiple Choice Questions)

Each question carries 1 mark

Q1.	If $A = \begin{bmatrix} 0 & 1 & c \\ -1 & a & -b \\ 2 & 3 & 0 \end{bmatrix}$ is a skew-symmetric matrix, then $a+b+c$ is equal to (a) 1 (b)-5 (c) 5 (d) 3
Q2.	For what value of 'k' is the function $f(x) = \begin{cases} \frac{\sin 5x}{3x} + \cos x, & \text{if } x \neq 0 \\ k, & \text{if } x = 0 \end{cases}$ (a) 1 (b) $\frac{3}{8}$ (c) $\frac{8}{3}$ (d) $\frac{5}{3}$
Q3.	Integrating factor of the differential equation $\cos x \frac{dy}{dx} + y \sin x = 1$ is (a) $\cos x$ (b) $\tan x$ (c) $\sec x$ (d) $\sin x$
Q4.	The solution of the differential equation $x dx + y dy = 0$ represents a family of (a) <i>straight lines</i> (b) <i>parabolas</i> (c) <i>circles</i> (d) <i>ellipses</i>
Q5.	$\int \frac{\cot \sqrt{x}}{\sqrt{x}} dx$ is equal to (a) $\log \sin \sqrt{x} + c$ (b) $\frac{\log \sin \sqrt{x}}{2\sqrt{x}} + c$ (c) $2 \log \sin \sqrt{x} + c$ (d) $\frac{\log \sin \sqrt{x}}{\sqrt{x}} + c$
Q6.	The inverse of $A = \begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ is equal to

(a)	$\begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$	(b)	$\begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -1 \end{bmatrix}$	(c)	$\begin{bmatrix} -1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	(d)	$\begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$
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Q7.	The unit vector perpendicular to the two vectors $\hat{i}-\hat{j}$ and $\hat{i}+\hat{j}$ forming a right handed system is (a) \hat{k} (b) $\hat{j} - \hat{k}$ (c) $\frac{\hat{i}-\hat{j}}{\sqrt{2}}$ (d) $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$
Q8.	If matrix A is order 3x3 with $ A = 4$, then the value of $ \text{adj}(\text{adj}A) $ is (a) 16 (b) 64 (c) 256 (d) 4
Q9.	If $\vec{a} + \vec{b} + \vec{c} = 0$, $ \vec{a} = \sqrt{37}$, $ \vec{b} = 3$ and $ \vec{c} = 4$, then the angle between \vec{b} and \vec{c} is (a) $\frac{\pi}{3}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$
Q10.	P is a point on the line segment joining the points (3,2-1) and (6,2,-2). If the x-co-ordinate of P is 5, then its y co-ordinate is (a) -2 (b) 1 (c) -1 (d) 2
Q11.	The feasible region corresponding to the linear constraints of a Linear Programming problem is given below  <p>Which of the following is not a constraint to the given Linear Programming Problem? (a) $x + y \geq 2$, (b) $x + 2y \leq 10$ (c) $x - y \geq 1$ (d) $x - y \leq 1$</p>

Q12.	The value of $x \in \left[0, \frac{\pi}{2}\right]$, is $A + A' = \sqrt{3}I$, where $A = \begin{bmatrix} \cos x & \sin x \\ -\sin x & \cos x \end{bmatrix}$ is equal to (a) $\frac{\pi}{3}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$
Q13.	If $y = \log\left[\frac{1-x^2}{1+x^2}\right]$, then $\frac{dy}{dx}$ is equal to (a) $\frac{4x^3}{1-x^4}$ (b) $\frac{-4x}{1-x^4}$ (c) $\frac{4x^3}{1+x^4}$ (d) $\frac{4x^3}{1+x^4}$
Q14.	The corner points of the feasible region for an LPP are (2,72), (15,20), and (40,15), Let $Z = 18x + 9y$ be the objective function, then (a) Z has maximum at (2,72) and minimum at (15,20) (b) Z has maximum at (15,20) and minimum at (40,15) (c) Z has maximum at (40,15) and minimum at (15,20) (d) Z has maximum at (40,15) and minimum at (2,72)
Q15.	If A and B are invertible matrices, then which of the following is not correct (a) $(A + B)^{-1} = A^{-1} + B^{-1}$ (b) $(AB)^{-1} = B^{-1}A^{-1}$ (c) $\text{adj}A = A A^{-1}$ (d) $ A ^{-1} = A^{-1} $
Q16.	Two vectors \vec{a} and \vec{b} are such that $ \vec{a} \times \vec{b} = \vec{a} \cdot \vec{b} $, then the angle between the vectors is (a) $\frac{\pi}{3}$ (b) $\frac{\pi}{6}$ (c) $\frac{\pi}{2}$ (d) $\frac{\pi}{4}$
Q17.	What is the distance of the point (6,3,4) from x- axis is (a) 5 (b) 4 (c) 3 (d) 6
Q18.	If A and B be two events such that $P(A) = 0.6$, $P(B) = 0.2$ & $P(A \cap B) = 0.5$, then $P(A'/B')$ is (a) $\frac{7}{8}$ (b) $\frac{2}{5}$ (c) $\frac{1}{2}$ (d) $\frac{2}{3}$
<u>ASSERTION-REASON BASED QUESTIONS</u>	
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.	
Q19.	Assertion(A): The Function $f(x) = \cos x$, $x \in \left[0, \frac{3\pi}{2}\right]$ is bijective. Reason (R): For one-one function, if the images of distinct elements in the domain has distinct images in the co-domain.
Q20.	Assertion(A): The function $f(x) = x + \frac{1}{x}$ is strictly increasing on $(-1,1) - \{0\}$

	Reason (R): $f'(x) > 0$ for the given interval.
	Section –B [This section comprises of very short answer type questions (VSA) of 2 marks each]

Q21.	Find the value of k if $\sin^{-1}\left[k \tan\left(2 \cos^{-1}\frac{\sqrt{3}}{2}\right)\right] = \frac{\pi}{3}$ OR Solve for x, $2 \tan^{-1} x + \sin^{-1}\left(\frac{2x}{1+x^2}\right) = \frac{4\pi}{3}$
Q22.	If $y = \log\left[\tan\left(\frac{\pi}{4} + \frac{x}{2}\right)\right]$, then prove that $\frac{dy}{dx} - \sec x = 0$
Q23.	Find $\int \frac{dx}{\sqrt{9x-4x^2}}$
Q24.	The sides of an equilateral triangle are increasing at the rate of 2cm/sec. Find the rate at which its area is increasing when the side of the equilateral triangle is 10cm
Q25.	Find the intervals on which the function $f(x) = \sin x + \cos x$, $0 \leq x \leq \frac{\pi}{2}$ is increasing or decreasing OR Show that the maximum value of the function $y = \frac{\log x}{x}$ is $\frac{1}{e}$
	Section – C [This section comprises of short answer type questions (SA) of 3 marks each]
Q26.	If $x\sqrt{1+y} + y\sqrt{1+x} = 0$, for $-1 < x < 1$, then prove that $\frac{dy}{dx} = -\frac{1}{(1+x)^2}$
Q27.	Evaluate $\int_0^1 \frac{\log(1+x)}{1+x^2} dx$ OR Evaluate $\int_0^1 \log\left(\frac{1}{x} - 1\right) dx$
Q28.	Solve the differential equation $(x^3+x^2+x+1)\frac{dy}{dx} = 2x^2 + x$ OR Find the particular solution of differential equation $x \frac{dy}{dx} + y = x \cos x + \sin x$, given that $y = 1$ when $x = \frac{\pi}{2}$
Q29.	Evaluate $\int [\sqrt{\tan x} + \sqrt{\cot x}] dx$ OR $\int [\log(\log x) + \frac{1}{(\log x)^2}] dx$

Q30.	<p>Solve the following LPP</p> <p>Maximize $Z = 2x + 5y$</p> <p>subject to the conditions $x + 4y \leq 24$</p> <p>$3x + y \leq 21$</p> <p>$x + y \leq 9$ and $x, y \geq 0$</p>
Q31.	<p>A and B throw a die alternatively till one of them gets a '6' and wins the game. Find their respective probabilities of winning, if A starts the game.</p>
<p>Section –D</p> <p>[This section comprises of long answer type questions (LA) of 5 marks each]</p>	

Q32.	<p>Let $A = \{1, 2, 3, \dots, 9\}$ and R be the relation in $A \times A$ defined by $(a, b)R(c, d)$ if $a + d = b + c$ for $(a, b), (c, d)$ in $A \times A$. Prove that R is an equivalence relation and also obtain the equivalence class $[(2, 5)]$</p> <p style="text-align: center;">OR</p> <p>If $A = R - \{3\}$ and $B = R - \{1\}$. Consider the function $f: A \rightarrow B$ defined by $f(x) = \frac{x-2}{x-3}$ for all $x \in A$. Then show that f is one -one and check whether 'f' is onto function or not</p>
Q33.	<p>Use the product $\begin{bmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{bmatrix} \begin{bmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{bmatrix}$ to solve the equations</p> $x - y + z = 4, x - 2y - 2z = 9 \text{ \& } 2x + y + 3z = 1$
Q34.	<p>Draw a rough sketch of the curve $y = x - 2$ and also find the area bounded by the curve and the lines $x = 0$ and $x = 4$ using the method of integrations</p>
Q35.	<p>Find the shortest distance between the lines</p> $\vec{r} = (1 - t)\hat{i} + (t - 2)\hat{j} + (3 - 2t)\hat{k} \quad \text{and} \quad \vec{r} = (s + 1)\hat{i} + (2s - 1)\hat{j} - (2s + 1)\hat{k}$ <p style="text-align: center;">OR</p> <p>Find the coordinates of the foot of the perpendicular drawn from the point $P(2, 3, -8)$ to the line $\frac{4-x}{2} = \frac{y}{6} = \frac{1-z}{3}$. Also, find the perpendicular distance of the given point from the line.</p>

Section –E

[This section comprises of 3 case- study/passage based questions of 4 marks each with sub parts. The first two case study questions have three sub parts (i), (ii), (iii) of marks 1,1,2 respectively. The third case study question has two sub parts of 2 marks each.]

Q36. Answer the questions based on the given informations.

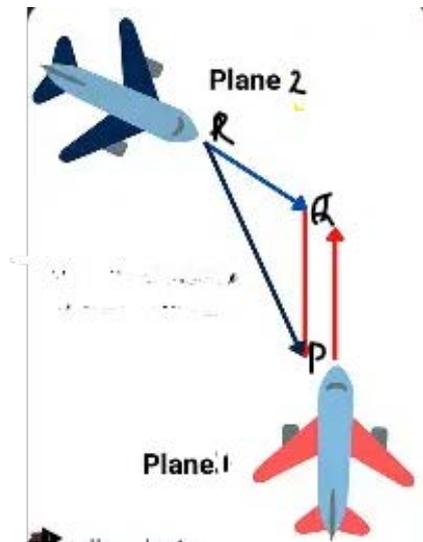
The flight path of two airplanes in a flight simulator game is shown below.

The coordinates of the airports P and Q are given.

Airplane I flies directly from P to Q

Airplane 2 has a layover at R and flies to Q. The path of Airplane 2 from P to R can be represented by the vector $5\hat{i} + \hat{j} - 2\hat{k}$

The points P & Q respectively are (-2,1,3) & (3,4, -1)



Based on this information answer the following questions

- (i) Find the vector that represents the flight path of Airplane 1
- (ii) Find the vector representing the path of Airplane 2 from R to Q.
- (iii) What is the angle between the flight paths of Airplane 1 and Airplane 2 just after takeoff?

OR

Consider that the Airplane 1 started the flight with a full fuel tank. Find the position vector of the point where a third of the fuel runs out if entire fuel is required for the flight

Q37.

Read the following text and answer the following questions, on the basis of the same:

The relation between the height of the plant (y in cm) with respect to exposure to sunlight is governed by the equation $y = 4x - \frac{1}{2}x^2$ where ' x ' is the number of days exposed to sunlight, for $x \leq 3$.



- (i) Find the rate of growth of the plant with respect to the number of days exposed to the sunlight.
- (ii) Does the rate of growth of the plant increase or decrease in the first three days?
- (iii) What is the number of days it will take for the plant to grow to the maximum height?

OR

What is the maximum height of the plant?

Q38.



A bank offers loans to its customers on different types of interest rates namely, fixed rate, floating rate, and variable rate. From the past data with the bank, it is known that a customer avails loan on fixed rate, floating rate, or variable rate with probabilities 10%, 20%, and 70% respectively. A customer after availing a loan can pay the loan or default on loan repayment. The bank data suggests that the probability that a person defaults on loan after availing it at fixed rate, floating rate, and variable rate is 5%, 3%, and 1% respectively.

Based on the above information, answer the following:

- (i) What is the probability that a customer after availing the loan will default on the loan repayment?
- (ii) A customer after availing the loan, defaults on loan repayment. What is the probability that he availed the loan at a variable rate of interest?