COMMON PRE-BOARD EXAMINATION 2025-26

MATHEMATICS -CODE NO. 041

CLASS-XII-(2025-26)

SET: 2

Time allowed: 3 Hrs. Maximum Marks: 80

General Instructions:

Read the following instructions very carefully and strictly follow them:

1. This question paper contains 38 questions. All the questions are compulsory.
2. This question paper is divided into five Sections- A, B, C, D and E.
3. In Section A, Question no.1 to 18 are multiple choice questions (MCQs) and question number 19 and 20 are Assertion-Reason based questions of 1 mark each.
4. In Section B, Question no.21 to 25 are very short answer (VSA) type questions, carrying 2 marks each.
5. In Section C, Question no. 26 to 31 are short answer (SA) type questions, carrying 3 marks each.
6. In Section D, Question no. 32 to 35 are long answer (LA) type questions, carrying 5 marks each.
7. In Section E, Question no. 36 to 38 are case study-based questions, carrying 4 marks each.
8. There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 2 questions in Section C, 2 questions in Section D and one sub-part in 1 question of Section E.
9. Use of calculators is not allowed.

SECTION-A **[1 × 20 = 20]**

(This section comprises of multiple-choice questions (MCQs) of 1 mark each.)

Select the correct option (Question 1 - Question 18)

1.	If $A = [a_{ij}]$ is a square matrix of order 2 such that $a_{ij} = \begin{cases} 1 \text{ when } i \neq j \\ 0 \text{ when } i = j \end{cases}$ then A^2 is (a) $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 & 1 \\ 0 & 0 \end{bmatrix}$ (c) $\begin{bmatrix} 1 & 1 \\ 1 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}$	1
2.	If A is a square matrix of order 3, $\|A'\| = -5$, then $\|AA'\|$ is (a) 5 (b) -25 (c) 25 (d) -5	1

3.	If $A = \begin{bmatrix} a & 0 & 0 \\ 0 & a & 0 \\ 0 & 0 & a \end{bmatrix}$, then $\|A\|\|adjA\| =$ (a) a^{27} (b) a^{9} (c) a^{6} (d) a^{8}	1
4.	The sum of the order and degree of differential equation $\left(\frac{d^2y}{dx^2}\right)^2$ - $\left(\frac{dy}{dx}\right)^2 = y^3$is (a) 3 (b) 2 (c) 4 (d) not defined	1
5.	Vectors $\vec{a}$ and $\vec{b}$ are inclined at an angle $\theta = 120°$. If $\|\vec{a}\| = 1$ and $\|\vec{b}\| = 2$, then the value of $\left\|(\vec{a} + 3\vec{b}) \times (3\vec{a} - \vec{b})\right\|^2$ (a) 225 (b) 275 (c) 325 (d) 300	1
6.	If $\|\vec{a}\|$=8, $\|\vec{b}\| = 3\ and\ \|\vec{a} \times \vec{b}\| = 12, then\ \vec{a}.\vec{b}$ (a) $6\sqrt{3}$ (b) $8\sqrt{3}$ (c) $9\sqrt{3}$ (d) $12\sqrt{3}$	1
7.	$\int (x^x)^2(1 + logx)\ dx =$ (a) $x^{2x} + C$ (b) $\frac{x^{2x}}{2} + C$ (c) $2x^{2x} + C$ (d) $\frac{x^x}{2} + C$	1
8.	The value of $\cos^{-1}\left(\cos\left(\frac{13\pi}{6}\right)\right)$ is (a) $\frac{13\pi}{6}$ (b) $\frac{7\pi}{6}$ (c) $\frac{5\pi}{6}$ (d) $\frac{\pi}{6}$	1
9.	If area of the triangle is 35sq units with vertices $(2, -6), (5,4)$ and $(k, 4)$. Then k is (a) $-12, -2$ (b) $12, -2$ (c) $, -2$ (d) 12	1
10.	Two numbers are selected at random from integers 1 through 9. If the sum is even, the probability that both numbers being odd is (a) $\frac{5}{8}$ (b) $\frac{3}{8}$ (c) $\frac{3}{10}$ (d) $\frac{5}{4}$	1
11.	Let $F = 4x + 6y$ be the objective function. The Minimum value of F occurs at......... (a) Only $(0,2)$ (b) only $(3,0)$ (c) The mid-point of the line segment joining the points $(0,2)$and$(3,0)$ only. (d) any point on the line segment joining the points$(0,2)$ and $(3,0)$.	1
12.	If the rate of change of area of a circle is equal to the rate of change of its diameter, then its radius is (a) $\frac{2}{\pi}$ unit (b) $\frac{1}{\pi}$ unit (c) $\frac{\pi}{2}$ unit (d) π unit	1
13.	If A and B are invertible matrices of order 3,$\|A\| = 2$ and $\|(AB)^{-1}\| = \frac{-1}{6}$ then $\|B\|$is	1

	(a) 2 (b) –2 (c) 3 (d) –3	
14.	If a line makes angles α, β, γ with the positive direction of the coordinate axes, then the value of $cos2\alpha + cos2\beta + \cos 2\gamma$ is (a) 0 (b) –1 (c) 1 (d) 2	1
15.	The value of k for which $f(x) = \begin{cases} \frac{sin5x}{x^2+2x}, & if\ x \neq 0 \\ k+1, & if\ x = 0 \end{cases}$ is continuous at $x = 0$ is (a) 1 (b) –2 (c) $\frac{3}{2}$ (d) $\frac{1}{2}$	1
16.	The derivative of $f(x) = \|x-1\| + \|x-4\|$ at $x = 3$ is (a) 3 (b) -3 (c) 0 (d) 1	1
17.	$\int \frac{\sqrt{x}}{\sqrt{a^3 - x^3}}\, dx =$ (a) $\frac{3}{2}\sin^{-1}\left(\frac{x}{a^{3/2}}^{3/2}\right) + C$ (b) $\frac{2}{3}\sin^{-1}\left(\frac{x}{a^{3/2}}^{3/2}\right) + C$ (c) $\sin^{-1}\left(\frac{x}{a^{3/2}}^{3/2}\right) + C$ (d) $\frac{2}{3}\sin^{-1}\left(\frac{a}{x^{3/2}}^{3/2}\right) + C$	1
18.	The corner points of the feasible region determined by the system of linear constraints are (0, 10), (5, 5) (15, 15) and (0, 20). Let $Z = px + qy$ where p, q> 0. Condition on p and q so that the maximum of Z occurs at both the points (15, 15) and (0, 20) is (a) $3p = q$ (b) $p = 2q$ (c) $p = 3q$ (d) $2p = q$	1
	ASSERTION-REASON BASED QUESTIONS (**Questions number 19 and 20 are Assertion and Reason based questions carrying 1 mark each. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer from the codes (A), (B), (C) and (D) as given below.)** **[1× 2 = 2]** (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 $sec^{-1}(2x)\ is\ (-\infty, \frac{1}{2}] \cup [\frac{1}{2}, \infty)$ **Reason (R):** $sec^{-1}(-2) = \frac{-\pi}{4}$	1
20.	**Assertion (A):** The angle between the straight lines $\frac{x+1}{2} = \frac{y-2}{5} = \frac{z+3}{4}$ and $\frac{x-1}{1} = \frac{y+2}{2} = \frac{z-3}{-3}$ is 90°. **Reason (R):** Skew lines are lines in different planes which are parallel and intersecting.	1

	SECTION B **[2 × 5 = 10]** **(This section comprises of 5 very short answer (VSA) type questions of 2 marks each.)**	
21.	For the curve $\sqrt{x}+\sqrt{y}=1$, find the value of $\frac{dy}{dx}$ at the point $\left(\frac{1}{9},\frac{1}{9}\right)$.	2
22.	If $x=a\left(cos\theta+logtan\frac{\theta}{2}\right); y=asin\theta$, then prove that $\frac{dy}{dx}=tan\theta.$	2
23.	If $\vec{a}$ and $\vec{b}$ are unit vectors, then what is the angle between the vectors $\vec{a}$ and $\vec{b}$ so that $\sqrt{2}\vec{a}-\vec{b}$ is a unit vector?	2
24.	Write the value of $tan^{-1}\left[2sin\left(2cos^{-1}\frac{\sqrt{3}}{2}\right)\right]$ **OR** Find the value of $\tan^{-1}(1)+\cos^{-1}\left(\frac{-1}{2}\right)+\sin^{-1}\left(\frac{-1}{2}\right)$	2
25.	Evaluate: $\int_{-2}^{2}\frac{x^2}{1+5^x}\,dx.$ **OR** Evaluate: $\int_0^{\frac{\pi}{4}}\sqrt{1+sin2x}dx$	2
	SECTION C **[3 × 6 =18]** **(This section comprises of 6 short answer (SA) type questions of 3 marks each.)**	
26.	A bag contains 4 balls. Two balls are drawn at random and are found to be white. What is the probability that all balls in the bag are white?	3
27.	If $y=\sin(m\sin^{-1}x)$, prove that $(1-x^2)\frac{d^2y}{dx^2}-x\frac{dy}{dx}+m^2y=0$ **OR** If $y=(\log x)^x+x^{\log x}$ find $\frac{dy}{dx}$.	3
28.	Using integration find the area of the region bounded by the curve $y=1+\lvert x+1\rvert$ and the lines $x=-3, x=3, y=0$. OR Use integration to find the area of the region enclosed by the curve $y=-x^2$ and the straight line $x=-3, x=2$ and $y=0$.	3
29.	The equations of a line are $5x-3=15y+7=3-10z$. Write the direction cosines of the line and find the coordinates of a point through which it passes. **OR**	3

	Find the Vector and Cartesian equation of a line passing through the point $(1,2,-4)$ and parallel to the line joining the points A$(3,3,-5)$ and B$(1,0,-11)$. Hence find the distance between the lines.	
30.	Find the maximum value of $Z = 3x + 4y$ Subject to constraints $x + y \leq 40, x + 2y \leq 60, x \geq 0$ and $y \geq 0$.	3
31.	Prove that $y = \frac{4\sin\theta}{(2+\cos\theta)} - \theta$ is an increasing function in $\left[0, \frac{\pi}{2}\right]$.	3

SECTION D **[5 × 4 = 20]**

(This section comprises of 4 long answer (LA) type questions of 5 marks each)

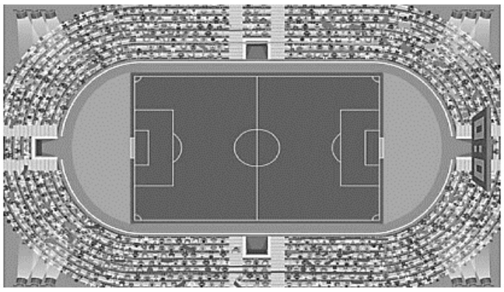
32.	If $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 3 \\ 1 & -2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 7 & -3 & 2 \\ 3 & 0 & -3 \\ -1 & 3 & 1 \end{bmatrix}$, then find AB. Hence solve the system of equations $x + y + z = 6,\ y + 3z = 11, x - 2y + z = 0$	5
33.	Show that following differential equation is homogeneous, and hence solve it $2ye^{x/y}dx + \left(y - 2xe^{x/y}\right)dy = 0$, given that $y = 1$, when $x = 0$. **OR** Solve $(3xy - y^2)dx + (x^2 + xy)dy = 0$	5
34.	Evaluate $\int_0^{\frac{\pi}{4}} \frac{sinx+cosx}{9+16sin2x}\, dx$ OR Evaluate: $\int x^2 \tan^{-1} x.\, dx$	5
35.	Find the point on the line $\frac{x+2}{3} = \frac{y+1}{2} = \frac{z-3}{2}$ at a distance of $3\sqrt{2}$ units from a point $A(1,2,3)$.	5

SECTION- E **[4 × 3= 12]**

(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 (a), (b), (c) of marks 1, 1, 2 respectively. The third case study question has two sub parts of 2 marks each)

36. **CASE STUDY – I:** Read the following passage and the answer the questions given below.

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.

a)	Write $P(E/A_1) + P(E/A_2) + P(E/A_3)$	2
b)	Calculate the probability of a randomly chosen seed to germinate. Express the answer in %. **OR** Calculate the probability that it is of the type A_2 given that a randomly chosen seed does not germinate.	2
37.	**CASE STUDY – II:** Read the following passage and answer the questions given below.  In an elliptical sport field the authority wants to design a rectangular soccer field with the maximum possible area. The sport field is given by the graph of $\frac{x^2}{25} + \frac{y^2}{9} = 1$	
a)	If the length and the breadth of the rectangular field be '2x' and '2y' respectively, then find the area function in terms of 'x'.	1
b)	Find the critical point of the function obtained in a).	1
c)	Use first derivative test to find the length '2x' and width '2y' of the soccer field that will maximize its area. **OR** Use second derivative test to find the length '2x' and width '2y' of the soccer field that will maximize its area.	2
38.	**CASE STUDY – III:** A math teacher is keen to assess the learning of her students the concept of "relations" taught to them. She writes the following five relations each defined on the set A $= \{1,2,3\}$. $R_1 = \{(2,3),(3,2)\}$ $R_2 = \{(1,2),(1,3),(3,2)\}$ $R_3 = \{(1,2),(2,1),(1,1)\}$ $R_4 = \{(1,1),(1,2),(3,3),(2,2)\}$ $R_5 = \{(1,1),(1,2),(3,3),(2,2),(2,1),(2,3),(3,2)\}$	
a)	Identify the relations which are symmetric but neither reflexive nor transitive.	1
b)	Identify the relation which is reflexive, transitive but not symmetric.	1
c)	What pairs should be added to the relation R_2 to make it an equivalence relation?	2