# COMMON PRE-BOARD EXAMINATION

## MATHEMATICS - Code No. 041

## CLASS: XII (2025-26) – SET-2

**Time Allowed: 3 hours** **Maximum Marks: 80**

**General Instructions**:

a) This Question paper contains 38 questions. All questions are compulsory.

b) This Question paper is divided into five Sections - A, B, C, D and E.

c) In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) with only one correct option and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.

d) In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.

e) In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.

f) In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.

g) In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.

h) There is no overall choice. However, an internal choice has been provided in 2 questions in Section B, 3 questions in Section C, 2 questions in Section D and one subpart each in 2 questions of Section E.

i) Use of calculator is not allowed.

| NO | SECTION A | MARKS |
|---|---|---|
| 1 | If the area of a triangle with vertices $(-3, 0), (3, 0)$ and (0, k) is 9 sq. units. Then the value of k will be:<br>(a) 9 (b) 3 (c) $-9$ (d) 6 | 1 |
| 2 | The number of points, where $f(x) = [x], 0 < x < 3$ ([.] denotes greatest integer function) is not differentiable is:<br>1 (b) 2 (c) 3 (d) 4 | 1 |
| 3 | Domain of the function $\sin^{-1}(3x - 1)$ is:<br>(a) [0,1] (b) $[-1,1]$ (c)$(-1,1)$ (d) $\left[0, \frac{2}{3}\right]$ | 1 |

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| 4 | If A and B are symmetric matrices of same order, then AB – BA is a:<br>(a) Skew symmetric matrix (b) Symmetric matrix<br>(c) Zero matrix (d) Identity matrix | 1 |
| 5 | If matrix $\begin{bmatrix} 2 & 3 & -1 \\ x+4 & -1 & 2 \\ 3x & 2 & -1 \end{bmatrix}$ is a singular matrix, then the value of x is :<br>(a) $\frac{-3}{16}$ (b) $\frac{3}{16}$ (c) $\frac{1}{8}$ (d) $\frac{8}{10}$ | 1 |
| 6 | The diagonal of a square, of side $3\sqrt{2}$ cm, is increasing at a rate of 2 cm/sec. Which of the following is the rate at which its area is increasing?<br>$\sqrt{2}$ cm$^2$/sec (b) $6\sqrt{2}$ cm$^2$/sec (c) 12 cm$^2$/sec (d) 24 cm$^2$/sec | 1 |
| 7 | $\int e^{\log \sin x}\, dx$ is equal to :<br>(a) $\sin x + C$ (b) $\cos x + C$ (c) $-\cos x + C$ (d) $-\sin x + C$ | 1 |
| 8 | If $y = \sin^{-1} x$, then $\frac{d^2y}{dx^2}$ is:<br>(a) $\sec y$ (b) $\sec y \tan y$<br>(c) $\sec^2 y \tan y$ (d) $\tan^2 y \sec y$ | 1 |
| 9 | The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{4-z}{k}$ and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{-2}$ are mutually perpendicular if the value of k is:<br>(a) $\frac{-2}{3}$ (b) $\frac{2}{3}$ (c) $-2$ (d) 2 | 1 |
| 10 | Integrating factor of the differential equation, cos x$\frac{dy}{dx}$+ y sin x = 1, is<br>(a) sin x b) sec x (c) tan x (d) cos x | 1 |
| 11 | If $\vec{a} = 2\hat{i} + \hat{j} + 3\hat{k}$ and $\vec{b} = 3\hat{i} + 5\hat{j} - 2\hat{k}$ ,then $\lvert\vec{a}\times\vec{b}\rvert$ is:<br>(a) $\sqrt{507}$ (b) 25 (c) 24 (d) $\sqrt{524}$ | 1 |
| 12 | $\int_0^{\pi/2} \left\lvert \cos\left(\frac{x}{2}\right) \right\rvert dx$ is equal to<br>1 (b) $-2$ (c) $\sqrt{2}$ (d) 0 | 1 |
| 13 | Solution set of the inequality 2x+ y > 5 is:<br>(a) The half plane containing origin.<br>(b) The open half plane not containing origin.<br>(c) XY- plane excepts the points on the line 2x + y = 5<br>(d) None of these | 1 |

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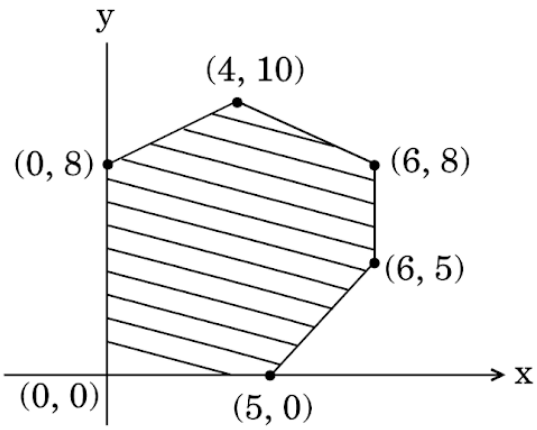
| 14 | The feasible solution for a LPP is shown in Figure Let z = 3x – 4y be the objective function. Minimum of Z occurs at:<br>  <br><br>(a) (0, 0) (b) (0, 8) (c) (5, 0) (d) (4, 10) | 1 |
| 15 | For what value of 'a' , the vectors $2\hat{i} - 3\hat{j} + 4\hat{k}$ and $a\hat{i} + 6\hat{j} - 8\hat{k}$ are collinear:<br>(a) 3 (b) 4 (c) $-4$ (d) $-3$ | 1 |
| 16 | If P(A) = 1/2, P(B) = 0, then P(A\|B) is:<br>(a) 0 (b) $\frac{1}{2}$ (c) not defined (d) 1 | 1 |
| 17 | Let $A = \begin{bmatrix} 1 & \sin\alpha & 1 \\ -\sin\alpha & 1 & \sin\alpha \\ -1 & -\sin\alpha & 1 \end{bmatrix}$, where $0 \leq \alpha \leq 2\pi$, then:<br>$\|A\| = 0$ (b) $\|A\| \in (2, \infty)$ (c) $\|A\| \in (2, 4)$ (d) $\|A\| \in [2, 4]$ | 1 |
| 18 | If A is a square matrix of order 3 and \|A\| = 5, then the value of $\|2A'\|$ is<br>(a) $-10$ (b) 10 (c) $-40$ (d) 40 | 1 |
| | **Question number 19 and 20 are Assertion and Reason based question. Two statements are given, one labelled Assertion (A) and the other labelled Reason (R). Select the correct answers from the codes A, B C and D as given below.**<br>(a) Both A and R are true and R is the correct explanation of A.<br>(b) Both A and R are true but R is not the correct explanation of A.<br>(c) A is true and R is false.<br>(d) A is false and R is true. | |
| 19 | **Assertion (A):** Lines $\frac{3-x}{2} = \frac{2y+4}{\lambda} = \frac{z-1}{5}$ and $\frac{x-2}{-1} = \frac{y+2}{4} = \frac{z-2}{2}$ are perpendicular if $\lambda = -4$. | 1 |

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| | **Reason (R):** Two lines with direction ratios $a_1$, $b_1$, $c_1$ and $a_2$, $b_2$, $c_2$ are perpendicular if $a_1a_2 + b_1b_2 + c_1c_2 = 0$. | |
| 20 | **Assertion (A)**: The value of $\sin\left[\tan^{-1}(-\sqrt{3}) + \cos^{-1}\left(\frac{-\sqrt{3}}{2}\right)\right]$ is 1.<br>**Reason (R):** $\tan^{-1}(\tan x) = x$ for $x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ and $\cos^{-1}(\cos x) = x$ for $x \in [0, \pi]$ | 1 |
| | **SECTION B** | |
| 21 | Determine the value of 'k' so that the function $f(x) = \begin{cases} \frac{kx}{\lvert x\rvert}, \text{if } x < 0 \\ 3, if\ x \geq 0 \end{cases}$ is continuous at $x = 0$. | 2 |
| 22 | A) Evaluate: $3\sin^{-1}\left(\frac{1}{\sqrt{2}}\right) + 2\cos^{-1}\left(\frac{\sqrt{3}}{2}\right) + \cos^{-1}(0)$.<br>**OR**<br>B) Express $\tan^{-1}\left(\frac{\cos x}{1-\sin x}\right), -\frac{3\pi}{2} < x < \frac{\pi}{2}$ in simplest form. | 2 |
| 23 | If $y = 5e^{7x} + 6e^{-7x}$, then show that $\frac{d^2y}{dx^2} = 49y$ | 2 |
| 24 | Find the projection of $(\vec{b} + \vec{c})$ on $\vec{a}$, where $\vec{a} = 2\hat{\imath} - 2\hat{\jmath} + \hat{k}$, $\vec{b} = \hat{\imath} + 2\hat{\jmath} - 2\hat{k}$ and $\vec{c} = 2\hat{\imath} - \hat{\jmath} + 4\hat{k}$. | 2 |
| 25 | A) Find $\int \frac{2^{x+1} - 5^{x-1}}{10^x}$ dx .<br>**OR**<br>B) Find the area bounded by the curve $y = \sin x$ between x = 0 and x = $2\pi$. | 2 |
| | **SECTION C** | |
| 26 | Find the absolute maximum and absolute minimum values of the function $f$ given by $f(x) = \sin^2 x - \cos x$ , $x \in [0, \pi]$. | 3 |
| 27 | A) Find $\int \frac{\text{dx}}{\sqrt{\sin^3 x \cos(x-a)}}$<br>**OR**<br>B) Find the area of the region bounded by the curves $x^2 + y^2 = 4$, $x = 3\sqrt{y}$ and x-axis in the first quadrant. | 3 |
| 28 | A) If $x = \cos t(3 - 2\cos^2 t)$ and $y = \sin t(3 - 2\sin^2 t)$, find the value of $\frac{dy}{dx}$ at $t = \frac{\pi}{4}$ .<br>**OR** | 3 |

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| | B) Differentiate the following function with respect to x: $y = (\sin x)^x + \sin^{-1}\sqrt{x}$ . | |
| 29 | A) Find the vector and the cartesian equations of a line that passes through the point $A(1,2,-1)$ and parallel to the line $5x - 25 = 14 - 7y = 35z$.<br>**OR**<br>B) Find the shortest distance between the line whose vector equations are:<br>$\overrightarrow{r_1} = (\hat{\imath} + \hat{\jmath}) + \lambda(2\hat{\imath} - \hat{\jmath} + \hat{k})$ and $\overrightarrow{r_2} = (2\hat{\imath} + \hat{\jmath} - \hat{k}) + \mu(3\hat{\imath} - 5\hat{\jmath} + 2\hat{k})$ | 3 |
| 30 | Assume that each born child is equally likely to be a boy or girl. If a family has two children, what is the conditional probability that both are girls given that<br>a) The youngest is a girl? b) at least one is a girl? | 3 |
| 31 | Solve the following linear programming problem graphically:<br>Minimize: $z = 5x + 10y$<br>Subject to constraints:<br>$x + 2y \leq 120$ ; $x + y \geq 60$ ; $x - 2y \geq 0, x, y \geq 0$ | 3 |
| | **SECTION D** | |
| 32 | A) Evaluate: $\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x}$ dx<br>**OR**<br>B) Evaluate: $\int_{\pi/6}^{\pi/3} \frac{\sin x + \cos x}{\sqrt{\sin 2x}}$ dx | 5 |
| 33 | Find the value of '$p$', so that the lines<br>$l_1: \frac{1-x}{3} = \frac{7y-14}{p} = \frac{z-3}{2}$ and $l_2: \frac{7-7x}{3p} = \frac{y-5}{1} = \frac{6-z}{5}$ are perpendicular to each other. Also find the vector and cartesian equations of a line passing through a point $(3,2,-4)$ are parallel to line $l_1$. | 5 |
| 34 | Given A = $\begin{bmatrix} 1 & -1 & 0 \\ 2 & 3 & 4 \\ 0 & 1 & 2 \end{bmatrix}$ and B = $\begin{bmatrix} 2 & 2 & -4 \\ -4 & 2 & -4 \\ 2 & -1 & 5 \end{bmatrix}$, verify that BA = 6*I*, use the result to solve the system $x - y = 3$, $2x + 3y + 4z = 17$, $y + 2z = 7$. | 5 |
| 35 | A) Solve the differential equation<br>$(x\,dy - y\,dx)y \sin\left(\frac{y}{x}\right) = (y\,dx + x\,dy)x \cos\left(\frac{y}{x}\right)$<br>**OR** | |

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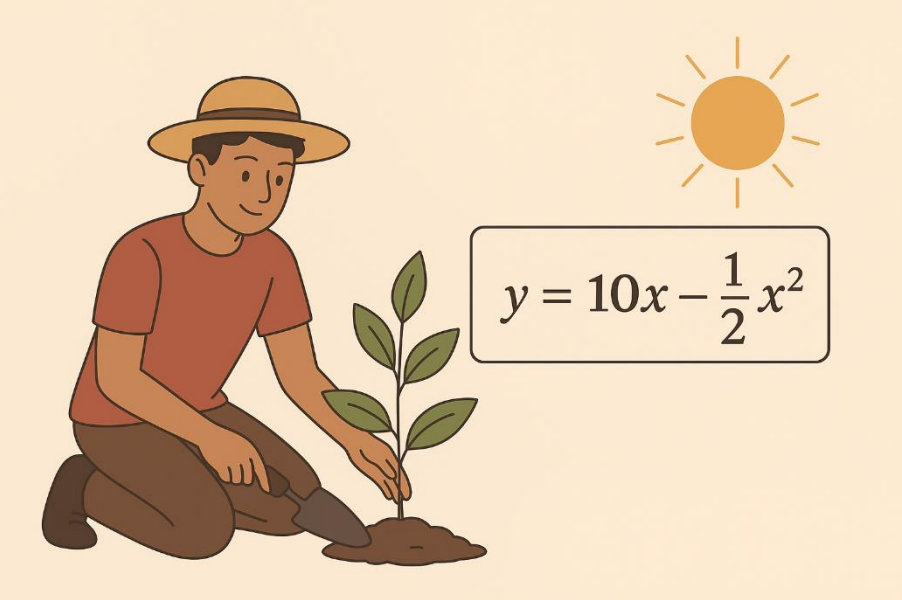
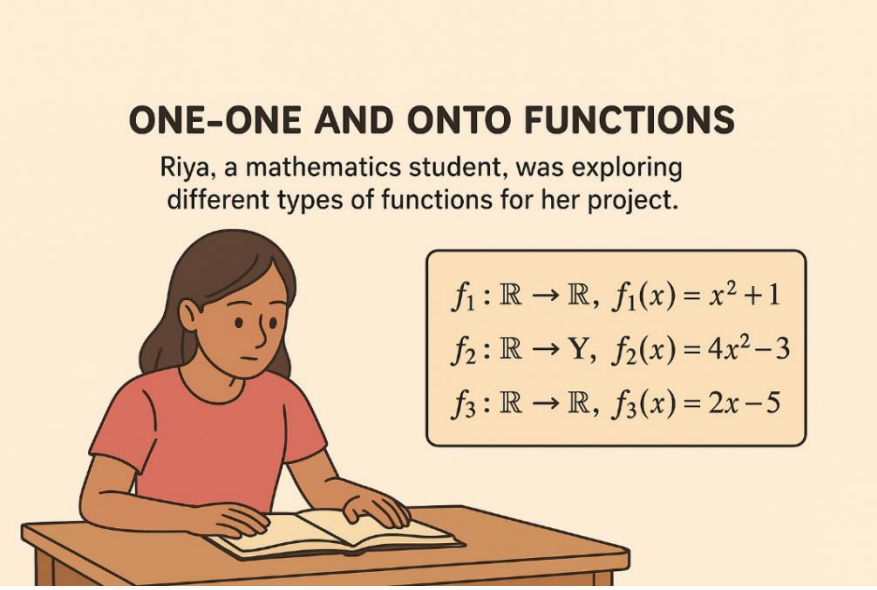
| | B) Show that the general solution of the differential equation $\frac{dy}{dx} + \frac{y^2+y+1}{x^2+x+1} = 0$ is given by $y + x + 1 = A(1 - x - y - 2xy)$, where A is parameter. | |
| | **SECTION E** | |
| 36 | **Case Study.1**<br>Gardening is a good habit. It helps in controlling pollution also and at the same time we can get organic vegetables/fruits. But it requires a constant care also. In one such case, a plant was planted and the relation between the<br>  <br><br>height of the plant (y in cm) with respect to its exposure to sunlight is given by the following equation $y = 10x - \frac{1}{2}x^2$ where x is the number of days it is exposed to sunlight.<br>Based on above information, answer the following:<br>(a) Find the rate of growth of the plant with respect to exposure to sunlight.<br>(b) After how many days plant will grow to maximum height?<br>(c) What is the maximum height of the plant?<br>**OR**<br>(c) What will be the height of the plant after 2 days? | 1<br>1<br>2 |
| 37 | **Case Study .2**<br>Her teacher asked her to identify whether these functions are one-one, onto, or bijective, and to justify her reasoning based on their domain and range. | |




Based on above information, answer the following:

(a) For the function $f_1(x) = x^2 + 1$, check whether the function is one-one or not. 1

(b) If the function $f_2(x) = 4x^2 - 3$ is onto, find its codomain $Y$. 1

(c) For the function $f_3(x) = 2x - 5$, check whether it is bijective. Justify your answer. 2

**OR**

(c) For the function $f_1(x) = x^2 + 1$, find its range and justify whether it is onto when codomain is $\mathbb{R}$.

38 **Case Study.3**

Read the following passage and answer the questions given below: In an Office three employees Ram, Shyam and Sohan process a calculation in an excel form. Probability that Ram, Shyam and Sohan process the calculation respectively is 50%, 20% and 30% . Ram has a probability of making a mistake as 0.06, Shyam has probability 0.04 to make a mistake and Sohan has a probability 0.03.

Based on the above information, answer the following questions.

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| |  <br>(a) Find the total probability of committing a mistake in processing the calculation.<br>(b) The boss wants to do a good check. During check, he selects a calculation form at random from all the days. If the form selected at random has a mistake, find the probability that the form is not processed by Ram. | 2<br><br>2 |

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