Pre – Board Exam Question Paper Class XII Session 2026-27

SUBJECT: Mathematics (041)

Time: 3 Hours **Maximum Marks: 80**

General Instructions:

Read the following instructions very carefully and strictly follow them:

(i) **This Question paper contains 38 questions. All questions are compulsory.**
(ii) **This Question paper is divided into five Sections - A, B, C, D and E.**
(iii) **In Section A, Questions no. 1 to 18 are multiple choice questions (MCQs) and Questions no. 19 and 20 are Assertion-Reason based questions of 1 mark each.**
(iv) **In Section B, Questions no. 21 to 25 are Very Short Answer (VSA)-type questions, carrying 2 marks each.**
(v) **In Section C, Questions no. 26 to 31 are Short Answer (SA)-type questions, carrying 3 marks each.**
(vi) **In Section D, Questions no. 32 to 35 are Long Answer (LA)-type questions, carrying 5 marks each.**
(vii) **In Section E, Questions no. 36 to 38 are Case study-based questions, carrying 4 marks each.**
(viii) **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.**
(ix) **Use of calculators is not allowed.**

SECTION-A **[20 X 1 = 20]**

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

Select the correct option (Question 1 - Question 18):

Q1	**The domain of $\sin^{-1}(|x|-1)$ is** **(A) [-1,1}** **(B) $[-2,2]$** **(C) [0,1]** **(D) [0,2]**
Q2	***If P and Q are square matrices of same order such that $|PQ| = 12$ and $P = \begin{pmatrix} 5 & 11 \\ 1 & 3 \end{pmatrix}$, then $|Q|$ is*** **(A) 2** **(B) 6** **(C) -4** **(D) 3**
Q3	**If a function f defined by f(x) = $\frac{k\cos x}{2x-\pi}$, $x \neq \frac{\pi}{2}$** **= -5 , x = $\frac{\pi}{2}$** **Is continuous at x = $\frac{\pi}{2}$, then the value of k is**

	(A) 10 (B) -10 (C) $\frac{5}{2}$ (D) $\frac{-5}{2}$
Q4	The sum of hypotenuse and one side of a right angled triangle is 12 cm, The length of hypotenuse when the area of the triangle is maximum is (A) 4 cm (B) 10 cm (C) 8 cm (D) 6 cm
Q5	If A = {1,2,3}, then number of reflexive relations on A is (A) 64 (B) 32 (C) 9 (D) 3
Q6	$\int \frac{sec\ x}{sec\ x - tan\ x}$ dx equals (A) sec x – tan x + C (B) sec x + tan x + C (C) tan x -sec x + C (D)-(sec x + tan x) + C
Q7	If y = $\frac{cos\ x - sin\ x}{cos\ x + sin\ x}$ then $\frac{dy}{dx}$ is (A) - sec $^2(\frac{\pi}{4} - x)$ (B) sec^2 $(\frac{\pi}{4} - x)$ (C) log $\left\lvert \sec(\frac{\pi}{4} - x) \right\rvert$ (D) - log $\left\lvert \sec = (\frac{\pi}{4} - x) \right\rvert$
Q8	If $\begin{vmatrix} x & sin\emptyset & cos\emptyset \\ -sin\emptyset & -x & 1 \\ cos\emptyset & 1 & x \end{vmatrix} = 8, then\ the\ value\ of\ x\ is$ (A) 1 (B) -2 (C) 2 (D) -1
Q9	$\int_1^3 \frac{e^{3logx} + e^{5logx}}{e^{logx} + e^{3logx}}$ dx, is equal to (A) $\frac{25}{3}$ (B) 9 (C) $\frac{29}{3}$ (D) $\frac{26}{3}$
Q10	The area of the region enclosed by the curve $\frac{x^2}{16} + \frac{y^2}{9}$ =1 (A) $\frac{13}{2}\pi$ sq units (B) 12π sq units (C) 48π sq units (D) 9π sq units
Q11	If the area of triangle is 35 sq.units with vertices (2 , - 6), (5 , 4) and (k, 4) then k is (A) 12 (B) -2 (C) -12, - 2 (D) 12, - 2
Q12	The product of the order and degree of the differential equation $\left(\frac{d^2y}{dx^2}\right)^5$ sin y + $(\frac{dy}{dx})^8$ = $\sqrt{y}$ (A) 16 (B) 10 (C) 5 (D) 4
Q13	The value of $\hat{\imath} \cdot (\hat{\jmath} \times \hat{k}) + \hat{\jmath} \cdot (\hat{\imath} \times \hat{k}) + \hat{k} \cdot (\hat{\imath} \times \hat{\jmath})$ is (A) 0 (B) - 1 (C) 1 (D) 3

Q14	**If A.(adj A) =** $\begin{bmatrix} 4 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & 4 \end{bmatrix}$ **, then the value of** $\lvert A \rvert + \lvert adj\ A \rvert$ **is equal to** **(A) 4 (B)12 (C) 20 (D) 16**
Q15	**The vector in the direction of the vector** $\hat{i} - 2\ \hat{j}\ + 2\ \hat{k}$ **that has magnitude 27 is** **(A)** $\hat{i} - 2\ \hat{j}\ + 2\ \hat{k}$ **(B)** $27(\ \hat{i} - 2\ \hat{j}\ + 2\ \hat{k}\ )$ **(C) 3(** $\hat{i} - 2\ \hat{j}\ + 2\ \hat{k}\ )$ **(D) 9(** $\hat{i} - 2\ \hat{j}\ + 2\ \hat{k}\ )$
Q16	**A matrix P=[p_{ij}] of order 3x3 is defined as** $p_{ij} = \begin{cases} 2i + 3j, & i < j \\ 5, & i = j \\ 3i - 2j, & i > j \end{cases}$ **, the number of elements in P which are more than 5, is** **(A) 3 (B) 4 (C) 6 (D) 5**
Q17	**The value of** $tan^{-1}\left[2sin\left(2cos^{-1}\frac{\sqrt{3}}{2}\right)\right]$ is **(A)** $\frac{\pi}{2}$ **(B)** $\frac{\pi}{4}$ **(C)** $\frac{\pi}{3}$ **(D)** π
Q18	**The absolute maximum value of the function f(x)=4x -** $\frac{1}{2}x^2$ **in the interval [-2,**$\frac{9}{2}$**] is** **(A) 4 (B) 8 (C) 12 (D) 6**

ASSERTION-REASON BASED QUESTIONS

(Question numbers 19 and 20 are Assertion-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 options (A), (B), (C) and (D) as given below.)

(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.

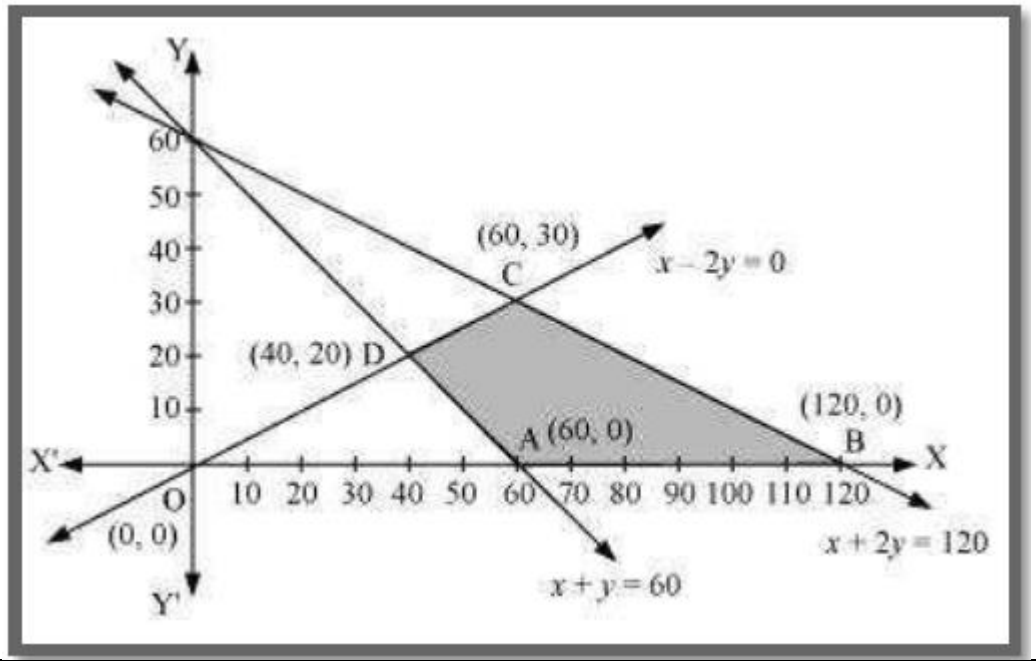
(D) (A) is false but (R) is true.

Q19	**Assertion (A): The integrating factor of** $\frac{dy}{dx} + \frac{1}{xlogx}y = 2$ **is logx.** **Reason (R): The** $\int \frac{1}{x}dx$**= logx+C**
Q20	**Assertion (A): To solve** $\int \frac{x^3}{(x-1)(x+3)}dx$**, we proceed for partial fractions as** $\frac{x^3}{(x-1)(x+3)} = \frac{A}{x-1} + \frac{B}{x+3}$ **Reason (R): To solve** $\int \frac{P(x)}{Q(x)}dx$**, using partial fractions deg P(x) < deg of Q(x).**

SECTION B [2 X 5 = 10]

(This section comprises of 5 very short answer (VSA) type questions of 2 marks each.)

Q21	**Find the value of Sin (cos^{-1}** $\left(\frac{4}{5}\right)$**+ tan^{-1}** $\left(\frac{2}{3}\right)$**)**

Q22	**If y=$e^{sin^{-1}\theta}$ and x=$e^{cos^{-1}\theta}$, then show that $\frac{dy}{dx} = \frac{-y}{x}$** **OR** **Find $\frac{dy}{dx}$ if $y = sin^{-1}\left(\frac{2x}{1+x^2}\right)$**
Q23	**Find the area of parallelogram whose diagonals are determined by the vectors $\vec{a} = \hat{i} - \hat{j} + 3\hat{k}$ and $\vec{b} = 2\hat{i} - 7\hat{j} + \hat{k}$** **OR** **Find a unit vector perpendicular to each of the vectors $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$ where $\vec{a} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$**
Q24	**Write the vector equation of the line passing through the point (3,2,-4) and parallel to the line $\frac{3x+1}{6} = \frac{y-5}{7} = \frac{9-z}{-3}$**
Q25	**Write the system of constraints represents the feasible region given below.** 

SECTION C **[3 X 6 = 18]**

(This section comprises of 6 short answer (SA) type questions of 3 marks each.)

Q26	**If y= $(\cos x)^x + x^{\sin x}$, find $\frac{dy}{dx}$.**
Q27	**Show that the lines $\frac{x+1}{3} = \frac{y+3}{5} = \frac{z+5}{7}$ and $\frac{x-2}{1} = \frac{y-4}{3} = \frac{z-6}{5}$ intersect. Also find their point of intersection.** **OR** **Find the coordinates of the foot of perpendicular drawn from the point P(0,2,3) to the line $\vec{r} = -3\hat{i} + \hat{j} - 4\hat{k} + t(5\hat{i} + 2\hat{j} + 3\hat{k})$**

Q28	**The temperatures (in degrees Celsius) on three days in cities A, B and C are given as follows: in the city A- 31, 28 and 30, in the city B-27,24 and 26 and in the city C - 22, 26 and 23. Represent these data in matrix form and express the matrix as the sum of a symmetric and a skew symmetric matrices.** **OR** **If A=** $\begin{pmatrix} -4 & 4 & 4 \\ -7 & 1 & 3 \\ 5 & -3 & -1 \end{pmatrix}$ $and\ B = \begin{pmatrix} 1 & -1 & 1 \\ 1 & -2 & -2 \\ 2 & 1 & 3 \end{pmatrix}$ **find AB. Hence, find the inverse of B^T.**
Q29	**Find the intervals in which f(x) = sin x + cos x, 0 ≤ x ≤ 2π is increasing or decreasing** **OR** **Show that the function f(x)= $4x^3$-$18x^2$+27x-7 is always increasing on R.**
Q30	**Solve the following LPP graphically. Maximise Z=20x+10y subject to constraints x+2y≤28, 3x+y≤24, x≥2, y≥0**
Q31	**Write the projection of the vector ($\vec{b} + \vec{c}$) on the vector $\vec{a}$ = 2 $\hat{\imath}$- 2$\hat{\jmath}$ + $\hat{k}$ $where$ $\vec{b}$ = $\hat{\imath}$ + 2$\hat{\jmath}$ -2$\hat{k}$ and $\vec{c}$ = 2$\hat{\imath}$ - $\hat{\jmath}$ + 4 $\hat{k}$**

SECTION D **[5 X 4 = 20]**

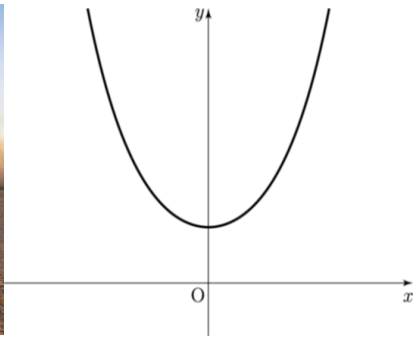
(This section comprises of 4 long answer (LA) type questions of 5 marks each)

Q32	**Evaluate** $\int_0^{\pi} log(1 + cosx)dx$
Q33	**Using integration, find the area of the region bounded by the triangle ABC when its sides are given by the lines 4x-y+5=0, x+y-5=0 and x-4y+5=0.** **OR** **Sketch the graph of f(x) =** $\|x - 3\|$ **and find** $\int_0^5 \|x - 3\| dx$.
Q34	**If R:NxN→** NxN **defined as (a,b)R(c,d) if and only if ad(b+c)=bc(a+d), Show that R is an equivalence relation** **OR** **If f:R-** $\{\frac{3}{5}\} \to R - \left\{\frac{-2}{5}\right\}$ **defined as f(x)=** $\frac{3-2x}{5x-3}$ **, then show that f(x) is one one and onto.**
Q35	**Find the particular solution of the differential equation** $2ye^{\frac{x}{y}}dx$ **+(**y**−2**$xe^{\frac{x}{y}}$**)**dy **= 0, given that x=0 when y=1**

SECTION- E **[4 X 3 = 12]**

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

Q36	**Case – Study 1 : (1+1+2 Marks)**

	Read the following passage and answer the questions given below.  **Gardening is a good habit. It helps in controlling pollution also and at the same time we can get organic vegetables/fruits.** **However, it requires a constant care also. In one such case, a plant was planted and relation between the height of the plant (y in cm) with respect to exposure to sunlight is given by the equation y = 10x - $\frac{x^2}{2} + 5$ where x represents the number of days it is exposed to Sun.** **Based on the above information, answer the following questions:** **(i) Find the rate of growth of the plant with respect to exposure to sunlight.** **(ii) After how many days will the plant attain its maximum height?** **(iii) Find the maximum height of the plant** **Or** **What will be the height of the plant after 6 days?**
Q37	**Case – Study 2 : (1+1+2 Marks)**   **It is important for a soldier to get exact location of the target, so that he can shoot the target. A Jet of an enemy is flying along the curve y = x^2 +2 and the soldier is placed at the point (3, 2) wants to shoot down the jet when the distance between his position and jet is minimum . Based on the above information and tracking path to be a mathematical statement , answer the following questions :** **(i) If P (x, y) is the position of jet then find distance between soldier and the jet** **(ii) Find distance between soldier and the jet in terms of x**

	(iii)	**Use Second Derivative Test to find the value of x for which distance between soldier and jet is minimum and find the minimum distance between soldier and jet**
Q38	**Case Study- 3 (2+2 Marks)**  **Surya decided to distribute some sweets to her friends on her birthday. If there were 8 children less, each one would have got 10 more. However, if there were 16 children more each one would have got 10 less. If we consider number of children to be x and the number of sweets each child gets is y, then based on above information answer the following:** **(i) Write the matrix equation related to above information.** **(ii) Find the total number of sweets distributed by Mehul. Use matrix method.**	