## FIRST PRE-BOARD EXAMINATION QUESTION PAPER

## SUBJECT:MATHEMATICS (041) CLASS -XII (2026-27)

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

**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 case based Questions of 4 marks each with sub-parts.**

**SECTION – A** **(20 x 1 = 20)**

**This section comprises of 18 multiple choice questions and two assertion and reason type questions of 1 mark each.**

**Q1.** If $\begin{bmatrix}2 & 1 & 3\end{bmatrix}\begin{bmatrix}-1 & 0 & -1\\ -1 & 1 & 0\\ 0 & 1 & 1\end{bmatrix}\begin{bmatrix}1\\ 0\\ -1\end{bmatrix} = A$, then write the order of the matrix A

(a) $1\times 2$ (b) $1\times 1$ (c) $3\times 3$ (d) $3\times 1$

**Q2.** If $A = \begin{bmatrix}1 & 0\\ 5 & 6\end{bmatrix}$ $then\ |A^{-1}| = ----$

(a) $\frac{-1}{6}$ (b) 6 (c) -6 (d) $\frac{1}{6}$

**Q3.** Value of $\cot^{-1}\left(2Cos\left(\frac{1}{2}\left(\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)\right)\right)\right)$ is

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{2}$

**Q4.** The matrix $\begin{bmatrix}0 & -5 & 8\\ 5 & 0 & 12\\ -8 & -12 & 0\end{bmatrix}$ is

(a) Diagonal matrix (b) Symmetric matrix

(c) Skew symmetric matrix (d) Scalar matrix

**Q5.**

Let f: N $\rightarrow$ N defined by f(x) = 2x then f is

a) **1-1** **b) onto** **c) both 1-1 & on to** **d) f is not a function**

**Q6. Which of the following triplets gives the direction cosines of a line which is equally inclined to the coordinate axes**

**(a) (1,1,1)** **(b) (1,-1,1)** **(c) (1,-1,-1)** **(d)** $\left(\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}},\frac{1}{\sqrt{3}}\right)$

**Q7.** Find the value of k if f(x) = $\begin{cases} 3x - 8 \text{ , if } x \leq 5 \\ 2k \text{ ,if } x > 5 \end{cases}$ is given to be continuous at x = 5 .

**(a)k=** $\frac{5}{2}$ **(b) k=** $\frac{7}{2}$ **(c) 7** **(d) 5**

**Q8.** $\int \frac{1}{Sin^2x\,.Cos^2x}\,dx$ ***is equal to***

**(a) Tan x + cot x +c** **(b)** $(\tan x + \cot x)^2 + c$

**(C) tan x - cot x +c (d)** $(\tan x - \cot x)^2 + C$

**Q9. Area of the region bounded by the curve** $y^2 = 4x$**,y axis and the line y=3 is**

**(a)** $\frac{9}{4}$ **sq. units** **(b)** $\frac{9}{5}$ **sq.units** **(c)** $\frac{9}{2}$ **sq.units** **(d) 2 sq.units**

**Q10. . The area bounded by the curve y=sin x between the ordinates x=0 and x=** $\frac{\pi}{2}$ **and the x-axis is**

**(a) 2 square units(b) 3 square units(c) 4 square units(d) 1 square unit**

**Q11. The sum of order and degree of the differential equation** $\frac{d}{dx}\left\{\left(\frac{dy}{dx}\right)^4\right\} = 0$ **is**

**(a) 3** **(b) 4** **(c) 5** **(d) 2**

**Q12. The general solution of** $\frac{dy}{dx} = \left(\frac{y}{x}\right)^{\frac{1}{3}}$ **is**

**(a)** $y^{\frac{2}{3}} - x^{\frac{2}{3}} = C$ **(b)** $y^{\frac{2}{3}} + x^{\frac{2}{3}} = C$ **(c)** $y^{\frac{1}{3}} - x^{\frac{1}{3}} = C$ **(d)** $y^{\frac{1}{3}} + x^{\frac{1}{3}} = C$

**Q13. The cross product of the vectors** $\hat{\imath} - \hat{\jmath} - 2\hat{k}$ **and** $\hat{\imath} + \hat{\jmath}$ **is**

**(a)** $2\hat{\imath} - 2\hat{\jmath} - 2\hat{k}$ **(b)** $2\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ **(c)** $2\hat{\imath} + 2\hat{\jmath} - 2\hat{k}$ **(d)** $2\hat{\imath} - 2\hat{\jmath} + 2\hat{k}$

**Q14. Let** $\vec{a} = \alpha\hat{\imath} + 3\hat{\jmath} - 6\hat{k}$ **and** $\vec{b} = 2\hat{\imath} - \hat{\jmath} - \beta\hat{k}$ **,if** $\vec{a}$ **and** $\vec{b}$ **are collinear vectors, then the value of** $\alpha + \beta$ **is**

**(a) -6** **(b) -2** **(c) -8** **(d) 12**

**Q15. Q16.If $\vec{a}$ and $\vec{b}$ denote the position vectors of points A and B respectively and P is a point on AB such that AP =2 PB ,Then the position vector of P is**

**(a)** $\frac{\vec{a}+2\vec{b}}{3}$ **(b)** $\frac{2\vec{a}+\vec{b}}{3}$ **(c)** $\frac{\vec{a}+3\vec{b}}{3}$ **(d)** $\frac{2\vec{a}+2\vec{b}}{3}$

**Q16. The x -co ordinate of a point on the line** $\frac{x-2}{3}=\frac{y-2}{-1}=\frac{z-1}{-3}$ **is 4,then its z - co ordinate is**

**(a)** $\frac{4}{3}$ **(b) 4 (c) -1 (d) 1**

**Q17. The corner points of the feasible region determined by the system of linear inequalities are (0,0),(4,0),(2.4) and (0,5).If the maximum value of Z = ax + by ,where a, b $>$ 0 occurs at both (2,4) and (4,0),then**

**(a) a=2b (b) 2a =b (c) a= b (d) 3a=b**

**Q18.If Z=ax +b has minimum value 100 at A and B , then what is the value of Z at the midpoint of line segment AB ?**

**(a) 200 (b) 100 (c) 50 (d) 300.**

## ASSERTION -REASON BASED QUESTIONS

**In the following 2 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): f(x) =** $-|x+1|+3$ **is defined for all real values of x, except at x= -1**

**REASON (R): Maximum value of f(x) is 3 and minimum value of f(x) does not exist.**

**Q20. ASSERTION (A): The number of on to functions from a set P containing 5 elements to a set Q containing 2 elements is 30**

**REASON (R): Number of on to functions from a set containing m elements to**

**a set containing n elements is $n^m$**

## SECTION B : EACH QN CARRIES 2 MARKS

**Q21.If y=$(\tan^{-1} x)^2$, *show that* $(x^2+1)^2 y_2 + 2x(x^2+1)y_1 = 2$.**

**Q22. Find $\int e^x(tan^{-1} x + \frac{1}{1+x^2})\, dx$**

**OR**

**Find $\int \frac{x^3\, sin(\tan^{-1} x^4)}{1+x^8} dx$**

**Q23.If $\vec{a}$ = $\hat{\imath}$-2$\hat{\jmath}$+5$\hat{k}$ and $\vec{b}$ = 5$\hat{\imath}$-3$\hat{\jmath}$-2$\hat{k}$ then show that $\vec{a}+\vec{b}$ and $\vec{a}-\vec{b}$ are perpendicular to each other.**

**Q24.If $\vec{a}$ and $\vec{b}$ are perpendicular vectors, $|\vec{a}+\vec{b}|$ =13 and $|\vec{a}|$=5, then find the value of $|\vec{b}|$ ?**

**Q25.Find the equation of a line in vector and cartesian formwhich passes through the point (1,2,3) and is parallel to the vector $3\hat{\imath}+2\hat{\jmath}-2\hat{k}$**

**OR**

**If the equation of a line AB is $\frac{3-x}{-3} = \frac{y+2}{-2} = \frac{z+2}{6}$ ,find the direction cosines of the line parallel to AB ?**

## SECTION C : EACH QN CARRIES 3 MARKS

**Q26. Express $\tan^{-1}\left(\frac{\cos x - \sin x}{\cos x + \sin x}\right)$, x< $\pi$, in simplest form**

**Q27. If x= a sin 2t, y = a (cos 2t + log tan t), then find $\frac{dy}{dx}$ ?**

**OR**

**Differentiate with respect to x : $\sin^{-1}\left(\frac{2^{x+1}}{1+(4)^x}\right)$**

**Q28. If $x^y + y^x = a^b$, *then find* $\frac{dy}{dx}$ ?**

**Q29. Find the maximum profit that a company can make, if the profit function is given by**

**P(x)= 41 +24 x-18$x^2$**

**Q 30. Show that the differential equation $2y\, e^{\frac{x}{y}}\, dx + \left(y - 2xe^{\frac{x}{y}}\right) dy = 0$ is homogeneous and find its particular solution, given that, x = 0 when y = 1**

**OR**

**Find the particular solution of the differential equation $\frac{dy}{dx} + y \cot x = 2x + x^2 \cot x$ (x ≠ 0) given that y = 0 when x = $\frac{\pi}{2}$**

**Q31. Solve the following linear programming problem graphically:**

**Minimise Z = 200 x + 500 y**

**subject to the constraints:**

**x + 2y ≥ 10**

**3x + 4y ≤ 24**

**x ≥ 0, y ≥ 0**

**OR**

**Minimise Z = 3x + 5y subject to the constraints:**

**x + 2y ≥ 10**

**x + y ≥ 6**

**3x + y ≥ 8**

**x, y ≥ 0**

## SECTION D : EACH QN CARRIES 5 MARKS

**Q32. If A = $\begin{bmatrix} 2 & 3 & 10 \\ 4 & -6 & 5 \\ 6 & 9 & -20 \end{bmatrix}$ find $A^{-1}$. Using $A^{-1}$,solve the following system of equations.**

$\frac{2}{x} + \frac{3}{y} + \frac{10}{z} = 2$

$\frac{4}{x} - \frac{6}{y} + \frac{5}{z} = 5$

$\frac{6}{x} + \frac{9}{y} - \frac{20}{z} = -4$ , x, y, z ≠ 0

**OR**

**The sum of three numbers is 6. If we multiply third number by 3 and add second number to it , we get 11. By adding first and third numbers , we get double of the second number .Represent it algebraically and find the numbers using matrix method ?**

**Q 33. Evaluate** $\int \frac{x^2}{(x^2+1)(x^2+4)}\, dx$

OR

**Evaluate** $\int_0^{\frac{\pi}{4}} log(1+tanx)dx$

**Q34. An aeroplane is flying along the line** $\vec{r} = \hat{\imath} + \hat{\jmath} + \lambda\,(2\,\hat{\imath} - \hat{\jmath} + \hat{k})$ **where ' λ ' is a scalar and another aeroplane is flying along the line** $\vec{r} = 2\hat{\imath} + \hat{\jmath} - \hat{k} + \mu\,(3\,\hat{\imath} - 5\,\hat{\jmath} + 2\,\hat{k})$ **where ' μ ' is a scalar. Find the shortest possible distance between them.**

OR

**Find the co-ordinates of the foot of perpendicular drawn from the point A (1, 8, 4) to the line joining the points B (0, –1, 3) and C (2, –3, –1).**

**Q35. . Find the area of the region included between the parabola** $y = \frac{3x^2}{4}$ **and the line**

$3x - 2y + 12 = 0$

## SECTION E- CASE STUDY QN CARRIES 4 MARKS

**Q 36.**

**An organization conducted bike race under 2 different categories-boys and girls. Totally there were 250 participants. Among all of them finally three from Category 1 and two from Category 2 were selected for the final race. Ravi forms two sets B and G with these participants for his college project.**

Let B = $\{b_1, b_2, b_3\}$ G=$\{g_1, g_2\}$ where B represents the set of boys selected and G the set of girls who were selected for the final race.

**Ravi decides to explore these sets for various types of relations and functions**

1. **Ravi wishes to form all the relations possible from B to G. How many such relations are possible?(1 mark)**
2. **Ravi wants to know among those relations, how many functions can be formed from B to G? (1 mark)**

**3.Let R: B→B be defined by R = {$(x, y)$: $x$ and y are students of same sex}, Then check whether the relation is an equivalence relation? Justify your answer?**

**(2 marks)**

**Q37. Three schools DPS, CVC and KVS decided to organize a fair for collecting money for helping the flood victims. They sold handmade fans, mats and plates from recycled material at a cost of Rs. 25, Rs.100 and Rs. 50 each respectively. The numbers of articles sold are given as**

| School /Article | DPS | CVC | KVS |
|---|---|---|---|
| Handmade fans | 40 | 25 | 35 |
| Mats | 50 | 40 | 50 |
| Plates | 20 | 30 | 40 |

Based on the information given above, answer the following questions:

**Q1. What is the total money (in Rupees) collected by the school DPS? (1 MARK)**

**Q2. What is the total amount of money (in Rs.) collected by schools CVC and KVS?**

**OR**

**What is the total amount of money collected by all three schools DPS, CVC and KVS? (1MARK)**

**Q3. If the number of handmade fans and plates are interchanged for all the schools, then what is the total money collected by all schools?**

OR

**How many articles (in total) are sold by three schools? (2 MARKS)**

**Q 38. Read the following passage and answer the questions given below**



**A person wants to plant some trees in the community park of his area. The local nursery charges the cost of planting trees by the following formula C(x) = $x^3 - 45x^2 + 600x$, where x is the number of trees and C(x) is the cost of planting x trees in rupees. The owner of local nursery has imposed a restriction that it can plant 10 to 20 trees in one community park for a fair distribution**

(1) What is the derivative of C(x) with respect to x? Find the possible number of trees, if $C'(X)=0$ (2 MARKS)

(2) For how many trees should the person place order, so that his expenses are least? Also find the least amount (in rupees) that the person has to spend? (2 MARKS)

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