Mathematics ICS XII

Mock Paper 1 (2026)

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

General Instructions:

This Question Paper consists of three sections A, B and C.

Candidates are required to attempt all questions from ***Section A*** *and all questions*

EITHER *from* ***Section B OR Section C.***

Section A*: Internal choice has been provided in* ***two questions of two marks each, two questions of four marks each and two questions of six marks each.***

Section B: *Internal choice has been provided in* ***one question of two marks and one question of four marks.***

Section C: *Internal choice has been provided in* ***one question of two marks and one question of four marks.***

All working, including rough work, should be done on the same sheet as, and adjacent to the rest of the answer.

The intended marks for questions or parts of questions are given in brackets [ ].

Mathematical tables and graph papers are provided.

SECTION A - 65 MARKS

1. **In subparts (i) to (x) choose the correct options and in subparts (xi) to (xv), answer the questions as instructed.** **[15]**

(a) If $|A| = 2$, where A is a 2×2 matrix, then $|4A^{-1}|$ equals: **[1]**

a) 2 b) 4

c) 8 d) $\frac{1}{32}$

(b) $\int \frac{1}{(1+x^2)\sqrt{\tan^{-1} x}}$ **[1]**

a) $\frac{1}{2}\log|\tan^{-1} x| + C$ b) $\frac{1}{2\sqrt{\tan^{-1} x}} + C$

c) $\frac{1}{4}\log|\tan^{-1} x| + C$ d) $2\sqrt{\tan^{-1} x} + C$

(c) $\tan^{-1}3 - \tan^{-1}2 =$ **[1]**

a) $\tan^{-1}\left(\frac{1}{5}\right)$ b) $\tan^{-1}\left(\frac{1}{7}\right)$

c) $\tan^{-1}\left(\frac{3}{2}\right)$ d) $\tan^{-1}\left(\frac{2}{3}\right)$

(d) Find the degree of the differential equation: $\left(\frac{d^4y}{dx^4}\right)^3 - 5\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} - 8\frac{dy}{dx} + 5 = 0$ **[1]**

a) 5 b) 3

c) 4 d) 2

(e) A bag contains 5 red and 3 blue balls. If 3 balls are drawn at random without replacement the **[1]** probability of getting exactly one red ball is

a) $\frac{15}{56}$
b) $\frac{45}{196}$
c) $\frac{15}{29}$
d) $\frac{135}{392}$

(f) Let A = {1, 2, 3} and B = {2, 4, 6, 8}. Consider the rule f : A $\rightarrow$ B, defined f(x) = 2x, $\forall x \in$ A, then range of f is given by set **[1]**

a) {2, 4, 6}
b) {2, 4, 6, 8}
c) {1, 2, 3}
d) {6, 4, 8}

(g) The values of the constants a, b and c for which the function $f(x)=\begin{cases}(1+ax)^{1/x} & ,x<0\\ b & ,x=0\\ \frac{(x+c)^{1/3}-1}{(x+1)^{1/2}-1} & ,x>0\end{cases}$ may be continuous at x = 0, are **[1]**

a) $a=\log_e\left(\frac{2}{3}\right), b=\frac{2}{3}, c=1$
b) $a=\log_e\left(\frac{2}{3}\right), b=-\frac{2}{3}, c=1$
c) $a=\log_e\left(\frac{2}{3}\right), b=\frac{2}{3}, c=-1$
d) $a=\log_e\left(\frac{4}{3}\right), b=-\frac{4}{3}, c=-1$

(h) If y = $\log_{10}$ x then $\frac{dy}{dx}$ = ? **[1]**

a) $\frac{1}{x(\log 10)}$
b) $\frac{1}{x}$
c) $\frac{1}{2x}$
d) $\frac{1}{x}$ (log 10)

(i) If A is an invertible matrix of any order, then which of the following options is NOT true? **[1]**

a) $|A^{-1}| = |A|^{-1}$
b) $(A^T)^{-1} = (A^{-1})^T$
c) $(A^2)^{-1} = (A^{-1})^2$
d) $|A| \neq 0$

(j) **Assertion (A):** If $\begin{bmatrix} x & 2 \end{bmatrix}\begin{bmatrix} 2 & 0 \\ -4 & 0 \end{bmatrix} = 0$, then x = 2 **[1]**

Reason (R): If $\begin{bmatrix} x & 2 \end{bmatrix}\begin{bmatrix} 2 & 0 \\ -4 & 0 \end{bmatrix} = 0$, then x = 4.

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.

(k) Find the domain of function given by $f(x)=\frac{1}{\sqrt{x+|x|}}$. **[1]**

(l) If A is a square matrix such that $A^2 = A$, then write the value of $7A - (I + A)^3$, where I is an identity matrix. **[1]**

(m) If f : R $\rightarrow$ R is defined by f(x) = x^2, write f^{-1} (25). **[1]**

(n) Given two independent events A and B such that P (A) = 0.3 and P (B) = 0.6. Find P (A/B) **[1]**

(o) If E_1 and E_2 are independent events such that $P(E_1) = 0.3$ and $P(E_2) = 0.4$, find $P\left(\overline{E}_1 \cap E_2\right)$. **[1]**

2. Examine the differentiability of f, where f is defined by **[2]**

$$f(x)=\begin{cases} x[x], & if\, 0 \leqslant x < 2 \\ (x-1)x, & if\, 2 \leqslant x < 3 \end{cases} \text{ at } x = 2.$$

OR

A ladder 13 m long is leaning against a vertical wall. The bottom of the ladder is dragged away from the wall along the ground at the rate of 2 cm/sec. How fast is the height on the wall decreasing when the foot of the ladder is 5 m away from the wall?

3. Evaluate: $\int \frac{\cos 2x+2\sin^2 x}{\sin^2 x}dx$ **[2]**

4. Find the interval in function 6 - 9x - x^2 is increasing or decreasing. **[2]**

5. Evaluate: $\int_0^{\pi/2} \frac{\sin x \cos x}{\cos^2 x+3\cos x+2}dx$ **[2]**

OR

Evaluate the integral: $\int \sin^4 2x dx$

6. Prove that the relation R on the set N of all natural numbers defined by (x, y) ∈ R ⇔ x divides y, for all x ,y ∈ N is transitive. **[2]**

7. Solve the equation for x: $\sin^{-1} x + \sin^{-1} (1 - x) = \cos^{-1} x$, $x \neq 0$ **[4]**

8. Evaluate: $\int \frac{x^3}{(x^2-4)}dx$. **[4]**

9. Differentiate $\sin^{-1}(2ax\sqrt{1-a^2x^2}$ with respect to $\sqrt{1-a^2x^2}$, if $-\frac{1}{\sqrt{2}} < ax < \frac{1}{\sqrt{2}}$. **[4]**

OR

If x = 2 cosθ - cos 2θ and y = 2 sin θ - sin 2θ, then prove that $\frac{dy}{dx} = \tan\left(\frac{3\theta}{2}\right)$.

10. **Read the text carefully and answer the questions:** **[4]**

Akash and Prakash appeared for first round of an interview for two vacancies. The probability of Nisha's selection is $\frac{1}{3}$ and that of Ayushi's selection is $\frac{1}{2}$.

(a) Find the probability that the selected student has failed in Economics, if it is known that he has failed in Mathematics?

(b) Find the probability that the selected student has failed in Mathematics, if it is known that he has failed in Economics?

(c) Find the probability that the selected student has passed in Mathematics, if it is known that he has failed in Economics?

(d) Find the probability that the selected student has passed in Economics, if it is known that he has failed in Mathematics?

OR

Read the text carefully and answer the questions: **[4]**

Akash and Prakash appeared for first round of an interview for two vacancies. The probability of Nisha's selection is $\frac{1}{3}$ and that of Ayushi's selection is $\frac{1}{2}$.

(a) Find the probability that both of them are selected.

(b) The probability that none of them is selected.

(c) Find the probability that only one of them is selected.

(d) Find the probability that atleast one of them is selected.

11. **Read the text carefully and answer the questions:** **[6]**

On her birthday, Shanti decided to donate some money to children of an orphanage home. If there were 8 children less, everyone would have got ₹ 10 more. However, if there were 16 children more, everyone would have got ₹ 10 less. Let the number of children be x and the amount distributed by Shanti for one child be y (in ₹).

(a) Find the equations related to the given problem in terms of x and y.

(b) Find the number of children. How much amount is given to each child by Shanti?

(c) Write the equations in form of matrix representation for the information given above?

12. Solve: $x\frac{dy}{dx} = y(\log y - \log x + 1)$ **[6]**

OR

Show that the differential equation of $\left(x^2 - y^2\right) dx + 2xydy = 0$ is homogeneous and solve it.

13. The perimeter of a triangle is 8 cm. If one of the sides of the triangle be 3 cm, what will be the other two sides for maximum area of the triangle? **[6]**

OR

Show that the height of the cone of maximum volume that can be inscribed in a sphere of radius 12 cm is 16 cm.

14. **Read the text carefully and answer the questions:** **[6]**

In an office three employees Govind, Priyanka and Tahseen process incoming copies of a certain form. Govind process 50% of the forms, Priyanka processes 20% and Tahseen the remaining 30% of the forms. Govind has an error rate of 0.06, Priyanka has an error rate of 0.04 and Tahseen has an error rate of 0.03.

(a) The manager of the company wants to do a quality check. During inspection he selects a form at random from the days output of processed forms. If the form selected at random has an error, find the probability that the form is NOT processed by Govind.

(b) Find the probability that Priyanka processed the form and committed an error.

(c) Find the total probability of committing an error in processing the form.

(d) Let A be the event of committing an error in processing the form and let E_1, E_2 and E_3 be the events that Govind, Priyanka and Tahseen processed the form. The value of $\sum_{i=1}^{3} P(E_i \mid A)$?

SECTION B - 15 MARKS

15. **In subparts (i) and (ii) choose the correct options and in subparts (iii) to (v), answer the questions as instructed.** **[5]**

(a) A unit vector in the direction of the vector $\vec{a} = (2\hat{i} - 3\hat{j} + 6\hat{k})$ is **[1]**

a) $\left(\frac{2}{5}\hat{i} - \frac{3}{5}\hat{j} + \frac{6}{5}\hat{k}\right)$ b) $\left(\frac{1}{5}\hat{i} + \frac{2}{5}\hat{j} - \frac{6}{5}\hat{k}\right)$

c) $\left(1\hat{i} - \frac{3}{2}\hat{j} + 3\hat{k}\right)$ d) $\left(\frac{2}{7}\hat{i} - \frac{3}{7}\hat{j} + \frac{6}{7}\hat{k}\right)$

(b) If the angle between the lines $\frac{x-5}{\alpha} = \frac{y+2}{-5} = \frac{z+\frac{24}{5}}{\beta}$ and $\frac{x}{1} = \frac{y}{0} = \frac{z}{1}$ is $\frac{\pi}{4}$, find the relation between α and β. **[1]**

(c) Classify 20 kg weight measures as scalars and vectors. **[1]**

(d) Direction cosines of a line perpendicular to both x-axis and z-axis are: **[1]**

a) 0, 0, 1 b) 1, 1, 1

c) 1, 0, 1 d) 0, 1, 0

(e) Find the Cartesian equation of the plane $\vec{r}\,.\,[(5-2t)\hat{i} + (3-t)\hat{j} + (25+t)\hat{k}] = 15$ **[1]**

16. Find the angle between the vectors $\hat{i} - 2\hat{j} + 3\hat{k}$ and $3\hat{i} - 2\hat{j} + \hat{k}$. **[2]**

OR

Find the area of the triangle whose two adjacent sides are determined by the vectors $\vec{a} = 3\hat{i} + 4\hat{j}$ and $\vec{b} = -5\hat{i} + 7\hat{j}$.

17. Find the angle between the line $\frac{x-2}{3} = \frac{y+1}{-1} = \frac{z-3}{2}$ and the plane 3x + 4y + z + 5 = 0. **[4]**

OR

Find the shortest distance between the pairs of lines whose Cartesian equations are:
$\frac{x-1}{2} = \frac{y+1}{3} = z$ and $\frac{x+1}{3} = \frac{y-2}{1}; z = 2$

18. Find the area of the region bounded by the curve $y = x^2$ and the line y = x. **[4]**

SECTION C - 15 MARKS

19. **In subparts (i) and (ii) choose the correct options and in subparts (iii) to (v), answer the questions as** **[5]**

instructed.

(a) If the demand function is $p(x) = 20 - \frac{x}{2}$, then the marginal revenue when x = 10 is **[1]**

a) ₹ 150 b) ₹ 10

c) ₹ 15 d) ₹ 5

(b) The corner points of the feasible region of a linear programming problem are (0, 4), (8, 0) and $\left(\frac{20}{3}, \frac{4}{3}\right)$. If Z = 30x + 24y is the objective function, then (maximum value of Z - minimum value of Z) is equal to **[1]**

a) 96 b) 136

c) 120 d) 144

(c) Find the coefficient of correlation from the regression lines: x - 2y + 3 = 0 and 4x - 5y + 1 = 0 **[1]**

(d) The demand function for a certain commodity is given by p = 1000 - 15x - x, 0 < x < 25. What is the price per unit and the total revenue from the sale of 2 units? **[1]**

(e) Find the marginal cost function (MC), if the cost function is:$C(x) = \frac{x^3}{3} + 5x^2 - 16x + 2$ **[1]**

20. A firm paid ₹ 25000 as rent of its office and ₹ 15200 as the interest of the loan taken to produce x units of a commodity. If the cost of production per unit is ₹ 8 and each item is sold at a price of ₹ 75, find the profit function. Also, find the breakeven point. **[2]**

OR

A company sells pens at ₹ 5 per unit. The fixed cost for the company is ₹ 3200 and variable cost is estimated to run 25% of the total revenue. Determine:

i. the total revenue function
ii. the total cost function
iii. the number of pens for breakeven point and
iv. the number of pens the company must sell to cover its fixed cost.

21. The correlation coefficient between x and y is 0.6. If the variance of x is 225, the variance of y is 400, mean of xis 10 and mean of y is 20, find **[4]**

i. the equations of two regression lines,
ii. the expected value of y when x = 2.

22. Solve the Linear Programming Problem graphically: **[4]**

Maximize Z = 2x + 3y Subject to

$x + y \geq 1$

$10x + y \geq 5$

$x + 10y \geq 1$

$x, y \geq 0$

OR

An automobile manufacturer makes automobiles and trucks in a factory that is divided into two shops. Shop A, which performs the basic assembly operation, must work 5 man-days on each truck but only 2 man-days on each automobile. Shop B, which performs finishing operations, must work 3 man-days for each automobile or truck that it produces. Because of men and machine limitations, shop A has 180 man-days per week available while shop B has 135 man-days per week. If the manufacturer makes a profit of ₹ 30000 on each truck and ₹ 2000 on each automobile, how many of each should he produce to maximize his profit? Formulate this as an LPP.