INTERMEDIATE PART-II (12th Class)	**2025 (1st-A)**	**Roll No: _____**
MATHEMATICS PAPER-II GROUP-I		
TIME ALLOWED: 2.30 Hours	**SUBJECTIVE**	**MAXIMUM MARKS: 80**

NOTE: Write same question number and its parts number on answer book, as given in the question paper.

SECTION-I

2. Attempt any eight parts. **$8 \times 2 = 16$**

(i) Evaluate $\lim_{x \to 1} \dfrac{x^3 - 3x^2 + 3x - 1}{x^3 - x}$

(ii) Determine whether the given function f is even or odd. $f(x) = \dfrac{x^3 - x}{x^2 + 1}$

(iii) Find $f^{-1}(-1)$, when $f(x) = 3x^3 + 7$

(iv) Discuss the continuity of $f(x)$ at $x = c$,
where $f(x) = \begin{cases} 3x - 1, & if \quad x < 1 \\ 4, & if \quad x = 1 \\ 2x, & if \quad x > 1 \end{cases}$, $c = 1$

(v) Prove that $\cosh^2 x - \sinh^2 x = 1$

(vi) Differentiate $\left(\sqrt{x} - \dfrac{1}{\sqrt{x}}\right)^2$ w.r.t x

(vii) Find $\dfrac{dy}{dx}$, if $x^2 - 4xy + 5y = 0$

(viii) Differentiate $\sin^{-1} x$ w.r.t $\cos^{-1} x$

(ix) Expand $f(x) = \dfrac{1}{1+x}$ in the Maclaurin Series.

(x) Find the extreme values for the function defined as $f(x) = 3x^2 - 4x - 5$

(xi) Find y_2, if $x = at^2$, $y = bt^4$

(xii) Find $\dfrac{dy}{dx}$, if $y = \cosh^{-1}(\sec x)$, $0 \le x \le \pi/2$

3. Attempt any eight parts. **$8 \times 2 = 16$**

(i) Find δy and dy in the given $y = x^2 + 2x$ when x changes from 2 to 1.8.

(ii) Evaluate the given integral. $\displaystyle\int \frac{(1 - \sqrt{x})^2}{\sqrt{x}} dx$, $(x > 0)$

(iii) Evaluate $\displaystyle\int \frac{e^x}{e^x + 3} dx$

(iv) Evaluate $\displaystyle\int e^{-x}(\cos x - \sin x) dx$

(v) Evaluate $\displaystyle\int_{-1}^{1} (x^3 + 3x^2)\, dx$

(vi) What is order of a differential equation give an example?

(vii) Solve the differential equation $\dfrac{dy}{dx} = \dfrac{y^2 - 1}{e^x}$

(viii) Transform the equation $5x - 12y + 39 = 0$ into slope intercept form.

(ix) Find h such that the points $A(h, 1), B(2, 7)$ and $C(-6, -7)$ are vertices of a right triangle with right angle at the vertex A.

(x) Find K so that the line joining $A(7, 3)$; $B(K, -6)$ and the line joining $C(-4, 5)$; $D(-6, 4)$ are perpendicular.

(xi) Find an equation of the horizontal line through $(7, -9)$

(xii) Check whether the lines $4x - 3y - 8 = 0$; $3x - 4y - 6 = 0$; $x - y + 2 = 0$ are concurrent.

4. Attempt any nine parts. **$9 \times 2 = 18$**

(i) Define Linear inequality.

(ii) Draw the graph $3x - 2y > 6$

(iii) Write standard form of equation of a circle.

(iv) Check the position of point (5, 6) with respect to circle $2x^2 + 2y^2 - 12x - 8y + 1 = 0$

(v) Write an equation of parabola with focus $(-3, 1)$, directrix $x = 3$

(vi) Find the focus and vertex of $y^2 = 8x$

(vii) Find eccentricity of hyperbola $x^2 - y^2 = 9$

(viii) If $\vec{u} = 2\hat{i} - 7\hat{j}$, $\vec{v} = \hat{i} - 6\hat{j}$, $\vec{w} = -\hat{i} + \hat{j}$ find the value of $2\vec{u} - 3\vec{v} + 4\vec{w}$

(ix) Find a vector whose magnitude is 4 and parallel to the vector $2\hat{i} - 3\hat{j} + 6\hat{k}$

(x) Find $\underline{a} \times \underline{b}$ if $\underline{a} = 2\hat{i} - \hat{j} - \hat{k}$, $\underline{b} = 4\hat{i} + 2\hat{j} - \hat{k}$

(xi) Calculate work done if force is $\underline{F} = \hat{i} + 3\hat{j} + 5\hat{k}$ and displacement $\underline{d} = 2\hat{i} + 4\hat{j} - \hat{k}$

(xii) Find the value of $[\hat{i} \quad \hat{j} \quad \hat{k}]$

(xiii) Find the projection of vector $\vec{v} = a\hat{i} + b\hat{j} + c\hat{k}$ along vector $\hat{i}$

SECTION-II

NOTE: Attempt any three questions. **$3 \times 10 = 30$**

5.(a) Define continuous function and discuss the continuity of function $f(x) = \begin{cases} \dfrac{x^2 - 9}{x - 3}, & if \quad x \ne 3 \\ 6, & if \quad x = 3 \end{cases}$ at $x = 3$

(b) Find $\dfrac{dy}{dx}$ by making suitable substitution if $y = \sqrt{\dfrac{1 - x}{1 + x}}$

6.(a) Show that $y = \dfrac{\ln x}{x}$ has maximum value at $x = e$

(b) Evaluate $\displaystyle\int \frac{1}{\sqrt{a^2 + x^2}} dx$, $a > 0$

7.(a) Solve the differential equation $\sec^2 x \tan y\, dx + \sec^2 y \tan x\, dy = 0$

(b) Minimize $z = 3x + y$, subject to the constraints $3x + 5y > 15$, $x + 6y > 9$, $x \ge 0$, $y \ge 0$

8.(a) Find the equations of tangent to the circle $x^2 + y^2 = 2$ parallel to the line $x - 2y + 1 = 0$

(b) If two vertices of an equilateral triangle are $A(-3, 0)$ and $B(3, 0)$. Find the third vertex. How many such triangles are possible?

9.(a) Find centre, foci, vertices, eccentricity and equation of directrices $\dfrac{y^2}{4} - x^2 = 1$

(b) Prove that $\cos(\alpha + \beta) = \cos\alpha \cos\beta - \sin\alpha \sin\beta$