20 Equation of latus rectum of the parabola $x^2 = 4ay$ is:

Ⓐ $x = a$ Ⓑ $y = a$
Ⓒ $x = -a$ Ⓓ $y = -a$

UNSOLVED

Mathematics	Inter Part-II, 2025 Lahore Board	Group – II
Time: 2.30 hrs.	Essay Type	Marks : 80

SECTION – I

Q.2 **Write short answers to any EIGHT (8) questions: 16**

i Show that the parametric equations $x = a\sec\theta$, $y = b\tan\theta$ represent the equation of hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

ii Without finding the inverse, state the domain and range of f^{-1}, where $f(x) = 2 + \sqrt{x-1}$

iii Define continuity of a function at a number C.

iv Evaluate $\lim_{\theta \to 0} \frac{1-\cos\theta}{\sin\theta}$

v Find $fog(x)$ and $gof(x)$, when $f(x) = 2x + 1$ and $g(x) = \frac{3}{x-1}$, $x \neq 1$

vi Find $\frac{dy}{dx}$, if $x = at^2$ and $y = 2at$

vii Prove that $\frac{d}{dx}(\tan^{-1}x) = \frac{1}{1+x^2}, \forall x \in R$

viii If $x = y\sin y$, find $\frac{dy}{dx}$

ix Find y_2, if $y = \ln\left(\frac{2x+3}{3x+2}\right)$

x Apply the Maclaurin Series expansion to prove that $\cos x = 1 - \frac{x^2}{\underline{|2}} + \frac{x^4}{\underline{|4}} - \frac{x^6}{\underline{|6}} + - - -$

xi Determine the intervals in which f is increasing or

decreasing, $f(x) = \cos x; x \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

xii Differentiate $x^2 - \frac{1}{x^2}$ w.r.t x^4

Q.3 **Write short answers to any EIGHT (8) questions: 16**

i Find δy of the function $y = x^2 - 1$ when x changes from 3 to 3.02.

ii Evaluate $\int \frac{\sin\theta}{1+\cos^2\theta} d\theta$

iii Find $\int x\sin x\, dx$

iv Evaluate the integral $\int \frac{1}{x\ln x} dx$

v Find the definite integral $\int_1^2 \frac{x}{x^2+2} dx$

vi Evaluate $\int \frac{e^{m\tan^{-1}x}}{1+x^2} dx$

vii Solve the differential equation $(x-1)dx + y\,dy = 0$

viii Define inclination of a line.

ix Check whether the lines $4x - 3y - 8 = 0$, $3x - 4y - 6 = 0$ and $x - y - 2 = 0$ are concurrent.

x Find an equation of line through A (–6, 5) having slope 7.

xi Convert $15y - 8x + 3 = 0$ into normal form of line

xii Define homogeneous function.

Q.4 **Write short answers to any NINE (9) questions: 18**

i Write the procedure for graphing a linear inequality in two variables.

ii Draw a graph of linear inequality $x + 2y < 6$

iii Show that the equation $5x^2 + 5y^2 + 24x + 36y + 10 = 0$ represents a circle. Also find its centre and radius.

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 (1, 2) and vertex (3, 2).

vi Find foci and eccentricity of ellipse $9x^2 + y^2 = 18$

vii Find the centre and directrix of hyperbola $\frac{x^2}{4} - \frac{y^2}{9} = 1$

viii Find a unit vector in the direction of the vector $\underline{v} = 2\underline{i} + 6\underline{j}$

ix Find the vector from the point A to the origin where $\overline{AB} = 4\underline{i} - 2\underline{j}$ and B is the point (–2, 5)

x Find a and b so that the vectors $3\underline{i} - \underline{j} + 4\underline{k}$ and $a\underline{i} + b\underline{j} - 2\underline{k}$ are parallel.

xi Find the projection of $\underline{a}$ along $\underline{b}$ when $\underline{a} = 3\underline{i} + \underline{j} - \underline{k}$, $\underline{b} = 2\underline{i} - \underline{j} + \underline{k}$

xii Find a vector perpendicular to vectors $\underline{a} = 2\underline{i} + \underline{j} + \underline{k}$, $\underline{b} = 4\underline{i} + 2\underline{j} - \underline{k}$

xiii Differentiate between scalar quantity and vector quantity.

SECTION – II

Note: Attempt any THREE questions.

Q.5(a) If $f(x) = \begin{cases} 3x & \text{if } x \le -2 \\ x^2 - 1 & \text{if } -2 < x < 2 \\ 3 & \text{if } x \ge 2 \end{cases}$ 5

Discuss continuity at x = 2 and x = –2

(b) Differentiate $\frac{x^2+1}{x^2-1}$ w.r.t. $\frac{x-1}{x+1}$ 5

Q.6(a) Find the extreme values of the function defined by $f(x) = x^3 - 6x^2 + 9x$ 5

(b) Evaluate the integral $\int \frac{5x+8}{(x+3)(2x-1)} dx$ 5

Q.7(a) Evaluate $\int_0^{\frac{\pi}{4}} \cos^4 t\, dt$ 5

(b) Maximize $f(x,y) = 2x + 3y$ subject to the constraints $2x + y \le 8$, $x + 2y \le 14$; $x \ge 0$, $y \ge 0$ 5

Q.8(a) Find a joint equations of the lines through the origin and perpendicular to the lines $x^2 - 2xy\tan\alpha - y^2 = 0$ 5

(b) Find an equation of circle which passes through the points A (5,10), B (6, 9) and C (–2, 3) 5

Q.9(a) If $\underline{a} = 4\underline{i} + 3\underline{j} + \underline{k}$ and $\underline{b} = 2\underline{i} - \underline{j} + 2\underline{k}$, find a unit vector perpendicular to both $\underline{a}$ and $\underline{b}$. Also find the sine of angle between them. 5

(b) Show that an equation of the parabola with focus at (a cos α, a sin α) and directrix $x\cos\alpha + y\sin\alpha + a = 0$ is $(x\sin\alpha - y\cos\alpha)^2 = 4a(x\cos\alpha + y\sin\alpha)$. 5