RUBRICS: HSSC 1st ANNUAL EXAMINATION 2024
SUBJECT: MATHEMATICS HSSC-II (D)

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
2(i)	Finding values of p and q	Correctly applying $f(3) = -5$ **AND** Correctly finding an equation in p & q (1)	Correctly applying $f(3) = -5$ **AND** Finding an incorrect equation in p & q (0.5)	Applying incorrectly $f(3) = -5$ (0)			
		Correctly applying $f(-2) = 5$ **AND** Correctly finding an equation in p & q (1)	Correctly applying $f(3) = -5$ **AND** Finding an incorrect equation in p & q (0.5)	Applying incorrectly $f(3) = -5$ (0)			
		Correctly finding the values of p **AND** q (2)	Correctly finding the value of p **OR** q (1)	Wrong Findings (0)			
2(i)	Showing that $\dfrac{dy}{dx} = \dfrac{y}{x}$	Correctly differentiating L.H.S $w.r.t.x$ (1)	Wrong Differentiation (0)				
		Correctly differentiating R.H.S $w.r.t.x$ (1)	Wrong Differentiation (0)				
		Correctly simplifying the equation **AND** Correctly showing the resultant (2)	Correctly simplifying the equation **AND** Showing incorrect resultant (1)	Wrong Simplification (0)			
2(ii)	Differentiating $x^{\frac{3}{4}}$ w. r. t. x by definition and calculating the derivative at $x = 16$	Correctly assuming $y = x^{3/4}$ **AND** Correctly finding δy (1)	Correctly assuming $y = x^{3/4}$ **AND** Finding δy partially correct (0.5)	Wrong Assumption (0)			
		Correctly applying the Binomial Series Expansion on δy **AND** Correctly finding $\dfrac{\delta y}{\delta x}$ (1.5)	Correctly applying the Binomial Series Expansion on δy **AND** Finding incorrect $\dfrac{\delta y}{\delta x}$ (1)	Applying the Binomial Series Expansion on δy partially correct **AND** Finding incorrect $\dfrac{\delta y}{\delta x}$ (0.5)	Applying incorrect Binomial Expansion (0)		

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		Correctly finding $\frac{dy}{dx}$ **AND** Correctly finding $\left(\frac{dy}{dx}\right)_{x=16}$ (1.5)	Correctly finding $\frac{dy}{dx}$ **AND** Finding incorrect value of $\left(\frac{dy}{dx}\right)_{x=16}$ (1)	Finding $\frac{dy}{dx}$ partially correct (0.5)	Wrong Differentiation (0)		
$2(ii)$	Finding the value of a if $\lim_{x\to 2} f(x)$ exists	Correctly evaluating $\lim_{x\to 2^-} f(x)$ **AND** Correctly evaluating $\lim_{x\to 2^+} f(x)$ (2)	Correctly evaluating $\lim_{x\to 2^-} f(x)$ **OR** Correctly evaluating $\lim_{x\to 2^+} f(x)$ (1)	Wrong Evaluation (0)			
		Correctly stating $\lim_{x\to 2^-} f(x) = \lim_{x\to 2^+} f(x)$ **AND** Correctly finding value of a (2)	Correctly stating $\lim_{x\to 2^-} f(x) = \lim_{x\to 2^+} f(x)$ **AND** Finding partially correct value of a (1.5)	Correctly stating $\lim_{x\to 2^-} f(x) = \lim_{x\to 2^+} f(x)$ **AND** Finding incorrect value of a (1)	Wrong Statement (0)		
$2(iii)$	Evaluating $\int_0^{\pi/2} cos^3 x \sqrt{sinx}\, dx$	Correctly using the identity $cos^2 x = 1 - sin^2 x$ AND Correctly forming two integrating terms (1)	Correctly using the identity $cos^2 x = 1 - sin^2 x$ AND Forming incorrect integrating terms (0.5)	Wrong Identity (0)			
		Correctly integrating the two terms (2)	Correctly integrating one term (1)	Partially correct (0.5)	Wrong Integration (0)		
		Correctly finding the value of integrands (1)	Partially correct values (0.5)	Wrong Answer (0)			
$2(iii)$	Evaluating $\lim_{\theta\to 0}\left(\frac{1 - Cos3\theta}{1 - Cos5\theta}\right)$	Correctly applying half angle identity on the numerator **AND** Correctly applying half angle identity on the denominator (1)	Correctly applying half angle identity on the numerator **OR** Correctly applying half angle identity on the denominator (0.5)	Wrong Identity (0)			

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		Correctly applying the sandwich theorem on the numerator **AND** Correctly applying the sandwich theorem on the denominator (2)	Correctly applying the sandwich theorem on the numerator **OR** Correctly applying the sandwich theorem on the denominator (0.5)	Wrong Theorem (0)			
		Correctly finding the limit value (1)	Partially Correct Response (0.5)	Wrong Answer (0)			
$2(iv)$	Finding a point on the curve $y = x^2 + 2$ closest to $(18,2)$	Correctly stating distance equation in x between a point on the curve and the given point (1)	Partially correct (0.5)	Wrong Answer (0)			
		Correctly applying the first derivative test **AND** Correctly finding the value of x (2)	Correctly applying the first derivative test **AND** Finding incorrect value of x (1)	Applying the first derivative test partially correct (0.5)	Wrong Application (0)		
		Correctly applying the second derivative test **AND** Correctly finding the required point (1)	Correctly applying the second derivative test **AND** Finding incorrect point (0.5)	Wrong Application (0)			
$2 (iv)$	Evaluating $\int \ln(x + \sqrt{x^2 + 1}) dx$ (by parts)	Correctly integrating $\int 1\, dx$ twice (1)	Partially correct Response (0.5)	Wrong Answer (0)			
		Correctly differentiating $\ln\left(x + \sqrt{x^2 + 1}\right)$ (2)	Partially correct Response (1)	Wrong Answer (0)			
		Correctly integrating $\int \frac{x}{\sqrt{x^2+1}} dx$ (1)	Wrong answer (0)				

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2(v)	Finding $\frac{dy}{dx}$ if $y = ln\left[\frac{x(x^2-3)^2}{(x^2-4)^{1/2}}\right]$	Correctly simplifying the numerator **AND** Correctly applying the logarithmic law of derivatives (1)	Correctly simplifying the numerator **AND** Applying incorrect logarithmic law of derivatives (0.5)	Incorrect simplification of the numerator (0)			
		Correctly applying the quotient law of derivatives (2)	Applying partially correct quotient law of derivatives (1)	Wrong Answer (0)			
		Correctly applying the power rule of derivatives (1)	Incorrect application of the law (0)				
2(v)	Finding area above x-axis bounded by the curve $y^2 = 3 - x$ from $x = -1$ to $x = 2$	Correctly expressing y in terms of x **AND** Correctly formulating the bounded area (1)	Correctly expressing y in terms of x **AND** Formulating incorrect bounded area (0.5)	y is not expressed in terms of x (0)			
		Correctly integrating the bounded area function $w.r.t.x$ **AND** Correctly applying the boundary limits (2)	Correctly integrating the bounded area function $w.r.t.x$ **AND** Applying partially correct boundary limits (1.5)	Correctly integrating the bounded area function $w.r.t.x$ **AND** Applying incorrect boundary limits (1)	Correctly integrating the bounded area function $w.r.t.x$ (0.5)		
		Correctly finding the bounded area (1)	Partially correct Response (0.5)	Wrong Answer (0)			
2(vi)	Finding the equation of ellipse with vertices $(-1,1)$ & $(5,1)$ and foci $(4,1)$ & $(0,1)$	Correctly stating equation of the horizontal ellipse $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$ with $a > b$ **AND** Correctly finding the center (h,k) (2)	Correctly stating equation of the horizontal ellipse $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$ with $a > b$ **AND** Finding partially correct coordinates of the center (1.5)	Correctly stating equation of the horizontal ellipse $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$ with $a > b$ **AND** Finding incorrect coordinates of the center (1)	Stating Wrong Equation (0)		

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		Correctly finding the value of $'a'$ **AND** Correctly finding the value of $'c'$ (1)	Correctly finding the value of $'a'$ **OR** Correctly finding the value of $'c'$ (0.5)	Wrong Answer (0)			
		Correctly finding the value of $'b'$ (1)	Partially Correct Response (0.5)	Wrong Answer (0)			
2(vi)	Finding the third vertex of an equilateral triangle ABC Finding possible number of such triangles	Correctly stating $|AB| = |BC|$ **AND** Correctly finding an equation in the coordinates of vertex C (1)	Correctly stating $|AB| = |BC|$ **AND** Finding incorrect equation in the coordinates of vertex C (0.5)	Wrong Statement (0)			
		Correctly stating $|AB| = |CA|$ **AND** Correctly finding another equation in the coordinates of vertex C (1)	Correctly stating $|AB| = |CA|$ **AND** Finding incorrect equation in the coordinates of vertex C (0.5)	Wrong Statement (0)			
		Correctly solving the obtained equations to find both correct coordinates of vertex C (2)	Correctly solving the obtained equations to find one correct coordinate of vertex C (1)	Finding incorrect coordinates of vertex C (0)			
2(vii)	Graphing the feasible region subject to the given constraints and finding the corner points	Correctly finding x-intercepts **AND** y-intercepts of the corresponding equations of constraints (1)	Finding x-intercepts **OR** y-intercepts of the corresponding equations of constraints (0.5)	Wrong Intercepts (0)			
		Correctly plotting two corresponding equations of constraints **AND** Correctly shading the feasible region (2)	Correctly plotting two corresponding equations of constraints **AND** Shading incorrect feasible region (1.5)	Correctly plotting one corresponding equation of constraint **AND** Shading incorrect feasible region (1)	Wrong plotting (0)		
		Correctly stating **Four OR Three** corner points (1)	Correctly stating **Two OR One** corner point (0.5)	Wrong Answer (0)			

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
2(vii)	Finding joint equation of the straight line through origin represented by $2x^2 - 5xy + 3y^2 = 0$	Correctly factoring the homogeneous equation (3)	Correctly making any one factor 1.5	Wrong Answer (0)			
		Correctly finding the joint equation (1)	Correctly finding any one slope (0.5)	Wrong Answer (0)			
2($viii$)	Finding straight line equation through the intersection of lines $x + 2y + 3 = 0$, $3x + 4y + 7 = 0$ and making equal intercepts on the coordinate axes	Correctly stating straight line equation through the intersection of given lines **AND** Correctly finding two intercepts of coordinate axes (2)	Correctly stating straight line equation through the intersection of given lines **AND** Correctly finding one intercept of coordinate axes (1.5)	Correctly stating straight line equation through the intersection of given lines **AND** Correctly finding incorrect intercepts of coordinate axes (1)	Wrong Statement (0)		
		Correctly finding the value of k **AND** Correctly finding the required straight-line equation (2)	Correctly finding the value of k **AND** Finding incorrect straight-line equation (1)	Finding incorrect value of k (0)			
2($viii$)	Graphing feasible region subject to the given constraints and finding corner points	Correctly finding x-intercepts **AND** y-intercepts of the corresponding equations of constraints (1)	Finding x-intercepts **OR** y-intercepts of the corresponding equations of constraints (0.5)	Wrong Intercepts (0)			
		Correctly plotting two corresponding equations of constraints **AND** Correctly shading the feasible region (2)	Correctly plotting two corresponding equations of constraints **AND** Shading incorrect feasible region (1.5)	Correctly plotting one corresponding equation of constraint **AND** Shading incorrect feasible region (1)	Wrong plotting (0)		
		Correctly stating **Four OR Three** corner points (1)	Correctly stating **Two OR One** corner point (0.5)	Wrong Answer (0)			
2(ix)	Proving Law of Cosines in triangle ABC $c^2 = a^2 + b^2 - 2abCosC$ (Using	Correctly stating $\underline{a} + \underline{b} + \underline{c} = \underline{0}$ **AND** Correctly stating $\underline{c} = -(\underline{a} + \underline{b})$ (1)	Correctly stating $\underline{a} + \underline{b} + \underline{c} = \underline{0}$ **AND** Stating incorrectly $\underline{c} = -(\underline{a} + \underline{b})$ (0.5)	Incorrect Statement (0)			

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	vector method and usual notations)	Correctly taking self-dot product on both sides **AND** Correctly applying properties of dot product of two vectors (2)	Correctly taking self-dot product on both sides **AND** Applying partially correct dot product properties (1.5)	Correctly taking self-dot product on both sides **AND** Applying incorrect dot product properties (1)	Correctly taking self-dot product on one side (0.5)	Incorrect dot product (0)	
		Correctly proving the Cosine Law (1)	Partially Correct Proof (0.5)	Wrong Proof (0)			
2(ix)	Writing the equation of parabola with given directrix and vertex	Correctly stating the equation of parabola $(x - h)^2 = -4a(y - k)$ (1)	Wrong Equation (0)				
		Correctly applying the distance formula **AND** Correctly finding $'a'$ distance between vertex and directrix (2)	Correctly applying the distance formula **AND** Finding incorrect distance between vertex and directrix (1)	Wrong formula (0)			
		Correctly writing equation of the parabola required (1)	Wrong Equation (0)				
2(x)	Solving the differential equation and finding a particular solution	Correctly separating the variables **AND** Correctly finding the solution in general (2)	Correctly separating the variables **AND** Finding partially correct general solution (1.5)	Correctly separating the variables **AND** Finding wrong solution in general (1)	Variables not separated (0)		
		Correctly finding the constant of integration **AND** Correctly finding the Particular solution (2)	Correctly finding the constant of integration **AND** Finding partially correct particular solution (1.5)	Correctly finding the constant of integration **AND** Finding wrong solution (1)	Wrong value of the constant (0)		

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2(x)	Finding equation of normal to the parabola $y^2 = 8x$, parallel to $2x + 3y = 10$	Correctly stating the equation of normal **AND** Correctly finding slope of normal (2)	Correctly stating the equation of normal **AND** Finding incorrect slope of normal (1)	Incorrect normal equation (0)			
		Correctly finding coordinates of the tangent point **AND** Correctly finding equation of the normal (2)	Correctly finding coordinates of the tangent point **AND** Finding incorrect equation of normal (1)	Finding correct abscissa or correct ordinate of the tangent point **AND** Finding incorrect equation of normal (0.5)	Incorrect tangent point (0)		
2(xi)	Finding the equation of the hyperbola with given elements	Correctly stating the equation of horizontal hyperbola $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$ **AND** Correctly finding values of $'a'$ and $'c'$ (2)	Correctly stating the equation of horizontal hyperbola $\frac{(x-h)^2}{a^2} - \frac{(y-k)^2}{b^2} = 1$ **AND** Finding the correct value of $'a'$ or $'c'$ (1.5)	Correctly stating the equation of horizontal hyperbola $\frac{(x - h)^2}{a^2} - \frac{(y - k)^2}{b^2} = 1$ **AND** Finding incorrect values of $'a'$ and $'c'$ (1)	Stating incorrect hyperbola (0)		
		Correctly finding the value of $'b'$ **AND** Correctly finding the equation of hyperbola (2)	Correctly finding the value of $'b'$ **AND** Finding incorrect equation of hyperbola (1)	Finding incorrect value of $'b'$ (0)			
2(xi)	Finding a unit vector perpendicular to the plane containing $\underline{a}$ & $\underline{b}$ and finding sine of the angle between $\underline{a}$ & $\underline{b}$	Correctly finding vector $\underline{a} \times \underline{b}$ **AND** Correctly finding the magnitude $|\underline{a} \times \underline{b}|$ (2)	Correctly finding vector $\underline{a} \times \underline{b}$ **OR** Correctly finding the magnitude $|\underline{a} \times \underline{b}|$ (1)	Partially correct (0.5)	Wrong Answer (0)		
		Correctly finding unit vector along $\underline{a} \times \underline{b}$ **AND** Correctly finding sine of the angle between $\underline{a}$ & $\underline{b}$ (2)	Correctly finding unit vector along $\underline{a} \times \underline{b}$ **OR** Correctly finding sine of the angle between $\underline{a}$ & $\underline{b}$ (1)	Partially correct (0.5)	Wrong Answer (0)		

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2(xii)	Writing the equation of tangent line to the circle $x^2 + y^2 + 4x + 2y = 0$ drawn from $(-1,2)$ and finding the tangential distance	Correctly finding equation of tangent line through $(-1,2)$ with slope m (1)	Partially Correct Response (0.5)	Wrong Findings (0)			
		Correctly finding two slope values of tangents **AND** Correctly finding equations of two tangents (2)	Correctly finding two slope values of tangents **AND** Finding one correct tangent equation (1.5)	Correctly finding two slope values of tangents **AND** Finding incorrect tangent equation (1)	Finding one correct slope value (0.5)	Incorrect slope value (0)	
		Correctly finding the tangential distance (1)	Finding partially correct distance (0.5)	Incorrect distance (0)			
2(xii)	Finding the volume of tetrahedron with given vertices	Correctly finding all three coterminous edge vectors (2)	Finding any two correctly stated aspects (1.5)	Finding any one correctly stated aspect (1)	Wrong Answer (0)		
		Correctly formulating the volume of tetrahedron **AND** Correctly finding the volume of tetrahedron (2)	Correctly formulating the volume of tetrahedron **AND** Finding partially correct volume of tetrahedron (1.5)	Correctly formulating the volume of tetrahedron **AND** Finding incorrect volume of tetrahedron (1)	Wrong Formula (0)		
3	Finding values of l and m such that $f(x)$ is continuous at $x = 1$ and $x = 2$ and sketching the graph of $f(x)$	Correctly setting $\lim\limits_{x \to 1^-} f(x) = \lim\limits_{x \to 1^+} f(x)$ **AND** Correctly stating a relation in $l \& m$ (2)	Correctly setting $\lim\limits_{x \to 1^-} f(x) = \lim\limits_{x \to 1^+} f(x)$ **AND** Stating a partially correct relation in $l \& m$ (1.5)	Correctly setting $\lim\limits_{x \to 1^-} f(x) = \lim\limits_{x \to 1^+} f(x)$ **AND** Stating an incorrect relation in $l \& m$ (1)	Setting $\lim\limits_{x \to 1^-} f(x)$ **OR** $\lim\limits_{x \to 1^+} f(x)$ (0.5)	Setting Wrong Limit (0)	
		Correctly setting $\lim\limits_{x \to 2^-} f(x) = \lim\limits_{x \to 2^+} f(x)$ **AND** Correctly stating a relation in $l \& m$ (2)	Correctly setting $\lim\limits_{x \to 2^-} f(x) = \lim\limits_{x \to 2^+} f(x)$ **AND** Stating a partially correct relation in $l \& m$ (1.5)	Correctly setting $\lim\limits_{x \to 2^-} f(x) = \lim\limits_{x \to 2^+} f(x)$ **AND** Stating an incorrect relation in $l \& m$ (1)	Setting $\lim\limits_{x \to 2^-} f(x)$ **OR** $\lim\limits_{x \to 2^+} f(x)$ (0.5)	Setting Wrong Limit (0)	

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		Correctly finding the values of l & m (2)	Correctly finding the value of l **OR** m (1)	Partially Correct Response (0.5)	Wrong Values (0)		
		Correctly tabulating $y = f(x)$ **AND** Correctly sketching the $y = f(x)$ (2)	Correctly tabulating $y = f(x)$ **AND** Sketching partially correct graph (1.5)	Correctly tabulating $y = f(x)$ **AND** Sketching incorrect graph (1)	Partially correct tabulation **AND** Sketching incorrect graph (0.5)	Incorrect tabulation (0)	
3	Discussing $f(x) = Sinx + \dfrac{1}{2\sqrt{2}} Cosx$ for extreme values in $(0,2\pi)$	Correctly finding $f'(x), f''(x)$ **AND** Correctly setting $f'(x) = 0$ (2)	Correctly finding $f'(x)$ **AND** $f''(x)$ (1.5)	Correctly finding $f'(x)$ **OR** $f''(x)$ (1)	Partially correct differentiation (0.5)	Wrong Differentiation (0)	
		Correctly finding two values of x (2)	Correctly finding one value of x (1)	Wrong Values (0)			
		Correctly applying 2nd derivative test **AND** Correctly finding f_{max} (2)	Correctly applying 2nd derivative test **AND** Finding partially correct value of f_{max} (1.5)	Correctly applying 2nd derivative test **AND** Finding incorrect value of f_{max} (1)	Wrong application of the test (0)		
		Correctly applying 2nd derivative test **AND** Correctly finding f_{min} (2)	Correctly applying 2nd derivative test **AND** Finding partially correct value of f_{min} (1.5)	Correctly applying 2nd derivative test **AND** Finding incorrect value of f_{min} (1)	Wrong application of the test (0)		
4	Finding the centre, foci, eccentricity, vertices and directrices of the conic $9x^2 - 18x + 4y^2 + 8y - 23 = 0$	Correctly writing the equation of vertical ellipse in standard form (2)	Partially Correct Response (1)	Incorrect equation of ellipse (0)			
		Correctly finding the values of a, b **AND** Correctly finding value of c (1)	Correctly finding the values of a, b **AND** Finding incorrect value of c (0.5)	Wrong values (0)			

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		Correctly finding value of eccentricity, coordinates of center, foci, vertices and equations of directrices (5)	Any four correctly stated aspects (4)	Any three correctly stated aspects (3)	Any two correctly stated aspects (2)	Any one correctly stated aspect (1)	No correct aspect (0)
4	Showing that $\int e^{ax} Sinbx\, dx$ $= \frac{1}{\sqrt{a^2 + b^2}} Sin\left(bx - \tan^{-1}\left(\frac{b}{a}\right)\right) + c$ Evaluating $\int e^{2x} Sin3x\, dx$	Correctly integrating $sinbx$ twice **AND** Correctly differentiating e^{ax} (3)	Correctly integrating $sinbx$ once **AND** Correctly differentiating e^{ax} (2)	Incorrect integration of $sinbx$ **AND** Correct differentiation of e^{ax} (1)	Incorrect stated aspects (0)		
		Correctly integrating $cosbx$ twice **AND** Correctly differentiating $\frac{ae^{ax}}{b}$ $w.r.t.x$ (3)	Correctly integrating $cosbx$ once **AND** Correctly differentiating $\frac{ae^{ax}}{b}$ (2)	Incorrect integration of $cosbx$ **AND** Correct differentiation of $\frac{ae^{ax}}{b}$ (1)	Incorrect stated aspects (0)		
		Correctly evaluating $\int e^{2x} Sin3x\, dx$ (2)	Partially correct response (1)	Wrong Answer (0)			
5	Finding distance between the parallel lines $12x + 5y - 6 = 0$ and $12x + 5y + 13 = 0$ (a) Sketching the lines (b) Finding equation of line lying midway between the parallel lines (c) Writing the obtained line in two intercepts form	Correctly finding x and y-intercepts of the 1ˢᵗ given line **AND** Correctly sketching the line (1.5)	Correctly finding x and y-intercepts of the 1ˢᵗ given line **AND** Sketching the line wrong (1)	Correctly finding x - intercept **OR** y-intercept of the 1ˢᵗ given line (0.5)	Finding incorrect intercepts (0)		
		Correctly finding x and y-intercepts of 2ⁿᵈ given line **AND** Correctly sketching the line (1.5)	Correctly finding x and y-intercepts of the 2ⁿᵈ given line **AND** Sketching the line wrong (1)	Correctly finding x - intercept **OR** y-intercept of the 2ⁿᵈ given line (0.5)	Finding incorrect intercepts (0)		
		Correctly formulating distance formula between point and line **AND** Correctly finding distance between the parallel lines (2)	Correctly formulating distance formula between point and line **AND** Finding incorrect distance between the parallel lines (1)	Wrong formulation (0)			

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		Correctly finding mid-point of x or y-intercept **AND** Correctly finding slope of the parallel lines (1)	Correctly finding mid-point of x or y-intercept **OR** Correctly finding slope of the parallel lines (0.5)	Wrong Answer (0)			
		Correctly finding equation of the line lying midway between the parallel lines **AND** Correctly writing the equation in two intercepts form (2)	Correctly finding equation of the line lying midway between the parallel lines **AND** Writing the equation in two intercepts form incorrectly (1)	Finding the required equation incorrect (0)			
5	Maximizing the profit by Linear Programming	Correctly expressing the profit function **AND** Correctly stating the constraints (2)	Correctly expressing the profit function **AND** Stating partially correct constraints (1.5)	Correctly expressing the profit function **OR** Correctly stating the constraints (1)	Expressing incorrect profit function **AND** Stating partially correct constraints (0.5)	Both stated aspects wrong (0)	
		Correctly sketching two straight lines (2)	Correctly sketching any one straight line (1)	Incorrect Sketching of straight lines (0)			
		Correctly shading the feasible region **AND** Correctly stating the corner points (2)	Correctly shading the feasible region **AND** Stating partially correct corner points (1.5)	Correctly shading the feasible region **AND** Stating incorrect corner points (1)	Incorrect feasible region (0)		
		Correctly tabulating the corner points **AND** Correctly finding number of toys to get maximum profit (2)	Correctly tabulating the corner points **AND** Finding incorrect maximum profit (1)	Tabulating corner points partially correct (0.5)	Wrong tabulation of corner points (0)		
6	Evaluating $\int \frac{2x^2 - x - 7}{(x+3)(x-2)(x^2 - 2x + 3)} d$	Correctly stating the given rational function as an identity of partial fractions (1)	Partially correct (0.5)	Wrong Answer (0)			

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		Correctly finding values of the four identity constants (3)	Correctly finding the three correctly stated aspects (2)	Correctly finding the two correctly stated aspects (1)	Correctly finding the one correctly stated aspect (0.5)	No Correct Aspect (0)	
		Correctly finding the integrals of the first two terms (2)	Any one correct aspect (1)	No correct aspect (0)			
		Correctly finding the integral of the last term (2)	Partially Correct Response (1)	Wrong Answer (0)			
6	Finding equations of tangent and normal to the hyperbola $\frac{x^2}{9} - \frac{y^2}{16} = 1$ at $\left(5, \frac{16}{9}\right)$. Finding the value of c when line $y = -x + c$ touches the hyperbola	Correctly comparing the given hyperbola with standard form and finding correct values of a and b (2)	Finding the correct values of a **OR** b (1)	Finding wrong values (0)			
		Correctly formulating equation of the tangent line at (x_1, y_1) **AND** Correctly finding equation of the tangent line at $\left(5, \frac{16}{9}\right)$ (2)	Correctly formulating equation of the tangent line at (x_1, y_1) **AND** Finding partially correct equation of the tangent line (1.5)	Correctly formulating equation of the tangent line at (x_1, y_1) **AND** Finding incorrect equation of the tangent line (1)	Wrong Formula (0)		
		Correctly formulating equation of the normal line at (x_1, y_1) **AND** Correctly finding equation of the normal line at $\left(5, \frac{16}{9}\right)$ (2)	Correctly formulating equation of the normal line at (x_1, y_1) **AND** Finding partially correct equation of the normal line (1.5)	Correctly formulating equation of the normal line at (x_1, y_1) **AND** Finding incorrect equation of the normal line (1)	Wrong Formula (0)		
		Correctly applying the condition of tangency **AND** Correctly finding value of c (2)	Correctly applying the condition of tangency **AND** Finding partially correct value of c (1.5)	Correctly applying the condition of tangency **AND** Finding incorrect value of c (1)	Applying Wrong Condition (0)		

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2 (Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
2(i)	Finding $f^{-1}(x)$ and verifying $f^{-1}(f(x)) = x$	Correctly expressing x in terms of y (1)	Partially Correct Response (0.5)	Wrong Answer (0)			
		Correctly finding the value of $f^{-1}(x)$ (1)	Partially Correct Response (0.5)	Wrong Answer (0)			
		Correctly expressing $f^{-1}(f(x))$ in terms of $f(x)$ (1)	Partially Correct Response (0.5)	Wrong Answer (0)			
		Correctly verifying the expression $f^{-1}(f(x)) = x$ (1)	Partially Correct Response (0.5)	Wrong Answer (0)			
2(i)	Finding $\frac{dy}{dx}$ and value of $\left(\frac{dy}{dx}\right)_{(1,1)}$	Correctly differentiating the equation $w.r.t.x.$ (2)	partially correct differentiating of the equation (1)	Wrong Differentiation (0)			
		Correctly expressing $\frac{dy}{dx}$ as subject of the equation (1)	Partially correct response (0.5)	Wrong Answer (0)			
		Correctly finding value of $\frac{dy}{dx}$ at (1,1) (1)	Partially correct response (0.5)	Wrong Answer (0)			
2(ii)	Finding derivative of $y = (2\sqrt{x} + 2)(x - \sqrt{x})$	Correctly applying the Product Rule of derivatives **OR** Correctly simplifying the given expression (2)	Partially correct Applying the Product Rule of derivatives **OR** Partially correct Simplifying the given expression (1)	Wrong response (0)			
		Correctly finding the value of $\frac{dy}{dx}$ (2)	Finding partially correct value of $\frac{dy}{dx}$ (1)	Wrong response (0)			

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
2(ii)	Discussing continuity of the function $f(x)$ at $x = 1$	Correctly finding value of $f(1)$ (1)	Partially correct (0.5)	Wrong Answer (0)			
		Correctly finding value of L.H.L $\lim\limits_{x \to 1^-} f(x)$ **AND** Correctly finding value of R.H.L $\lim\limits_{x \to 1^+} f(x)$ (2)	Correctly finding value of L.H.L $\lim\limits_{x \to 1^-} f(x)$ **OR** Correctly finding value of R.H.L $\lim\limits_{x \to 1^+} f(x)$ (1)	Partially correct (0.5)	Wrong Answer (0)		
		Correctly setting $\lim\limits_{x \to 1} f(x) = f(1)$ (1)	Partially correct (0.5)	Wrong Answer (0)			
2(iii)	Showing that $(1 + x^2)y_1 - q(1 + y^2)$ for $y = \cot(q \cot^{-1} x)$	Correctly differentiating the equation $w.r.t.x$ (2)	Partially correct differentiating the equation (1)	Wrong Differentiation (0)			
		Correctly applying the identity $\csc^2 \emptyset = 1 + \cot^2 \emptyset$ (1)	Applying wrong identity (0)				
		Correctly verifying the result (1)	Partially correct (0.5)	Wrong Answer (0)			
2(iii)	Evaluating $\lim\limits_{\theta \to 0} \dfrac{Sec\theta - 1}{\theta sec\theta}$	Correctly expressing the limit as $\lim\limits_{\theta \to 0} \dfrac{1 - cos\theta}{\theta}$ (1)	Partially correct (0.5)	Wrong Answer (0)			
		Correctly applying half angle identity on the numerator (1)	Applying incorrect identity on the numerator (0)				
		Correctly applying the Sandwich Theorem **AND** Correctly finding the required limit value (2)	Correctly applying the Sandwich Theorem **AND** Finding incorrect limit value (1)	Applying incorrect Sandwich Theorem (0)			

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
2(iv)	Examining the given function for extreme values	Correctly finding 1st derivative of the function **AND** Correctly finding 2nd derivative of the function (1)	Correctly finding 1st derivative of the function **AND** Finding incorrect 2nd derivative of the function (0.5)	Finding 1st derivative incorrect (0)			
		Correctly setting 1st derivative zero **AND** Correctly finding two values of x (1.5)	Correctly setting 1st derivative zero **AND** Finding one correct value of x (1)	Correctly setting 1st derivative zero **AND** Finding incorrect values of x (0.5)	Incorrect Response (0)		
		Correctly applying the 2nd derivative test **AND** Correctly finding the two extreme values (1.5)	Correctly applying the 2nd derivative test **AND** Finding one extreme value (1)	Correctly applying the 2nd derivative test **AND** Finding incorrect extreme values (0.5)	Incorrect Response (0)		
2 (iv)	Using differentials to approximate $sin61°$	Correctly stating $y = sinx$ **AND** Correctly stating $x = 60°$ and $dx = 1°$ (1)	Correctly stating $y = sinx$ **AND** Stating incorrect values of x and dx (0.5)	Incorrect Response (0)			
		Correctly stating $dy = cosxdx$ **AND** Correctly finding value of dy (2)	Correctly stating $dy = cosxdx$ **AND** Finding partially correct value of dy (1.5)	Correctly stating $dy = cosxdx$ **AND** Finding incorrect value of dy (1)	Wrong statement of dy (0)		
		Correctly approximating $sin61°$ (1)	Partially correct response (0.5)	Wrong Answer (0)			

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
2(v)	Finding area bounded by the given curve and $x - axis$	Correctly finding x-intercepts **AND** Correctly formulating the two bounded areas (2)	Correctly finding x-intercepts **AND** Correctly formulating one bounded area (1.5)	Correctly finding the x-intercepts **AND** Formulating incorrect bounded areas (1)	Finding x-intercepts partially correct (0.5)	Wrong Answer (0)	
		Correctly finding the 1st bounded area value **AND** Correctly finding the 2nd bounded area value (2)	Correctly finding one bounded area value **AND** Finding other bounded area value partially correct (1.5)	Correctly finding 1st bounded area value **OR** Correctly finding 2nd bounded area value (1)	Finding any of the bounded area value partially correct (0.5)	Wrong Answer (0)	
2(v)	Finding area of the bounded region (triangular)	Correctly factoring the 2nd degree homogeneous equation **AND** Correctly finding a pair of straight lines (1)	Correctly factoring the 2nd degree homogeneous equation **AND** Finding incorrect pair of straight lines (0.5)	Wrong Factoring of the equation (0)			
		Correctly finding three points of intersection of the three straight lines (1.5)	Correctly finding two points of intersection of the three straight lines (1)	Correctly finding one point of intersection of the three straight lines (0.5)	Finding all incorrect points of intersection (0)		

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
		Correctly formulating area of the triangular region **AND** Correctly finding area of the triangular region (1.5)	Correctly formulating area of the triangle **AND** Partially correct Finding area of the triangular region (1)	Correctly formulating area of the triangle **AND** Finding incorrect area of the triangular region (0.5)	Wrong Formulation (0)		
2(*vi*)	Solving the differential equation	Correctly separating the variables **AND** Correctly integrating the equation (2)	Correctly separating the variables **AND** partially correct Integrating the equation (1.5)	Correctly separating the variables **AND** Integrating the equation wrong (1)	Partially correct (0.5)	Wrong Answer (0)	
		Correctly finding the constant of integration AND Correctly finding the solution (2)	Correctly finding the constant of integration AND partially correct Finding the solution (1.5)	Correctly finding the constant of integration AND Finding wrong solution (1)	Partially correct (0.5)	Wrong Answer (0)	
2(*vi*)	Finding coordinates of a point on the opposite sides of the join of two given points	Correctly stating the internal/external division of $\overline{AB}$ (1)	Wrong Answer (0)				
		Correctly formulating x-coordinate of P **AND** Correctly finding x-coordinate of P (1.5)	Correctly formulating x-coordinate of P **AND** Finding x-coordinate Partially correct (1)	Correctly formulating x-coordinate of P **AND** Finding incorrect x-coordinate (0.5)	Wrong Formulation (0)		

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
		Correctly formulating y-coordinate of P **AND** Correctly finding y-coordinate of P (1.5)	Correctly formulating y-coordinate of P **AND** Finding y-coordinate Partially correct (1)	Correctly formulating y-coordinate of P **AND** Finding incorrect y-coordinate (0.5)	Wrong Formulation (0)		
2(*vii*)	Finding slope and y-intercept of the line with given data	Correctly stating the equation of straight line in normal form **AND** Correctly placing the values of α and p (2)	Correctly stating the equation of straight line in normal form **AND** Placing the value of α **OR** p (1.5)	Correctly stating the equation of straight line in normal form **AND** Placing the incorrect values of α and p (1)	Wrong Equation (0)		
		Correctly finding equation of the straight line **AND** Correctly finding slope and y-intercept of the line (2)	Correctly finding equation of the straight line **AND** Correctly finding slope **OR** y-intercept of the line (1.5)	Correctly finding equation of the straight line **AND** Finding incorrect slope and y-intercept of the line (1)	partially correct Finding equation of the straight line (0.5)	Wrong Equation (0)	
2(*vii*)	Evaluating $\int \dfrac{x \sin^{-1} x}{\sqrt{1-x^2}}\, dx$	Correctly setting $(\sin^{-1} x)$ as 1st function and $x(1-x^2)^{-\frac{1}{2}}$ as 2nd function (1)	Wrong Formulation (0)				

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
		Correctly integrating the 2nd function **AND** Correctly differentiating the 1st function (2)	Correctly differentiating the 1st function **AND** Integrating the 2nd function partially correct (1.5)	Correctly integrating the 2nd function **OR** Correctly differentiating the 1st function (1)	Partially correct (0.5)	Wrong Answer (0)	
		Correctly evaluating $2 \int 1 dx$ **AND** Correctly simplifying (1)	Partially correct (0.5)	Wrong Answer (0)			
$2(viii)$	Finding equation of a circle passing through $(-2, -5)$ and having tangent line $3x + 4y - 24 = 0$ at $(4,3)$	Correctly stating the circle equation **AND** Correctly finding coordinates of the center (2)	Correctly stating the circle equation **AND** Finding partially correct coordinates of the center (1.5)	Correctly stating the circle equation **AND** Finding incorrect coordinates of the center (1)	Wrong circle equation (0)		
		Correctly finding value of the radius **AND** Correctly finding the circle equation (2)	Correctly finding value of the radius **AND** Finding circle equation partially correct (1.5)	Correctly finding value of the radius **AND** Finding incorrect circle equation (1)	Wrong radius value (0)		
$2(viii)$	Graphing the feasible region subject to constraints by shading and finding the corner points	Correctly finding x-intercepts **AND** y-intercepts of the corresponding equations of constraints (1)	Finding x-intercepts **OR** y-intercepts of the corresponding equations of constraints (0.5)	Wrong Intercepts (0)			

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
		Correctly plotting two corresponding equations of constraints **AND** Correctly shading the feasible region (2)	Correctly plotting two corresponding equations of constraints **AND** Shading incorrect feasible region (1.5)	Correctly plotting one corresponding equation of constraint **AND** Shading incorrect feasible region (1)	Wrong plotting (0)		
		Correctly stating **Four OR Three** corner points (1)	Correctly stating **Two OR One** corner point (0.5)	Wrong Answer (0)			
2(ix)	Graphing the feasible region subject to constraints by shading and finding the corner points	Correctly finding x-intercepts **AND** y-intercepts of the corresponding equations of constraints (1)	Finding x-intercepts **OR** y-intercepts of the corresponding equations of constraints (0.5)	Wrong Intercepts (0)			
		Correctly plotting two corresponding equations of constraints **AND** Correctly shading the feasible region (2)	Correctly plotting two corresponding equations of constraints **AND** Shading incorrect feasible region (1.5)	Correctly plotting one corresponding equation of constraint **AND** Shading incorrect feasible region (1)	Wrong plotting (0)		
		Correctly stating **Three** corner points (1)	Correctly stating **Two OR One** corner point (0.5)	Wrong Answer (0)			
2(ix)	Writing the equation of parabola with given focus and directrix	Correctly stating an arbitrary point on the parabola **AND** Correctly finding distance between point and focus (1)	Partially correct (0.5)	Wrong (0)			

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
		Correctly finding the perpendicular distance between point and directrix (1)	Partially correct (0.5)	Wrong (0)			
		Correctly applying the definition for eccentricity (1)	Wrong (0)				
		Correctly finding the equation of parabola (1)	Partially correct (0.5)	Wrong (0)			
$2(x)$	Proving that altitudes of a triangle are concurrent [by vector method]	Correctly stating $p.v$ of the vertices of triangle **AND** Correctly stating $p.v$ of the sides of triangle (1)	Correctly stating $p.v$ of the vertices **AND** Stating incorrect $p.v$ of the sides (0.5)	Stating incorrect $p.v$ of the vertices (0)			
		Correctly stating $p.v$ of an altitude from vertex to reference point **AND** Correctly applying the condition of perpendicularity to altitude and opposite triangular side (1)	Correctly stating $p.v$ of an altitude from vertex to reference point **AND** Applying incorrect condition of perpendicularity (0.5)	Stating incorrect $p.v$ of an altitude from vertex to reference point (0)			
		Correctly stating $p.v$ of another altitude from vertex to reference point **AND** Correctly applying the condition of perpendicularity to altitude and opposite triangular side (1)	Correctly stating $p.v$ of another altitude from vertex to reference point **AND** Applying incorrect condition of perpendicularity (0.5)	Stating incorrect $p.v$ of another altitude (0)			
		Correctly adding the two conditions **AND** Correctly verifying for the third altitude (1)	Correctly adding the two conditions **AND** Incorrect Verification for the third altitude (0.5)	Incorrect addition of conditions (0)			

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
2(x)	Finding value of C when line $5x + 2y + C = 0$ touches a hyperbola $\frac{x^2}{4} - \frac{y^2}{9} = 1$	Correctly stating Slope and $y-$intercept from the given straight-line equation (1)	Correctly stating Slope **OR** $y-$intercept from the given straight-line equation (0.5)	Wrong Answer (0)			
		Correctly finding values of a **AND** b (1)	Correctly finding values of a **OR** b (0.5)	Wrong Answer (0)			
		Correctly applying the condition of tangency **AND** Correctly finding value of C (2)	Correctly applying the condition of tangency **AND** Finding incorrect value of C (1)	Wrong Condition (0)			
2(xi)	Finding intersecting points of the conics	Correctly multiplying the equations by LCM **AND** Correctly finding value of $x\ OR y$ (2)	Correctly multiplying the equations by LCM **AND** Finding incorrect value of $x\ OR y$ (1)	Wrong Multiplication (0)			
		Correctly substituting the value of $x OR y$ in any of the given equations **AND** Correctly finding the corresponding value of $y OR x$ (2)	Correctly substituting the value of $x OR y$ in any of the given equations **AND** Finding incorrect corresponding value of $y OR x$ (1)	Wrong Substitution (0)			
2(xi)	Finding value of λ when three given vectors represent sides of a triangle	Correctly adding three vector components (3)	Correctly adding any two components (2)	Correctly adding any one component (1)	Wrong addition of the components (0)		
		Correctly equating the resultant vector to third vector (1)	Partially Correct Response (0.5)	Wrong Answer (0)			

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
$2(xii)$	Finding equation of an ellipse with given foci and a passing through point	Correctly substituting $\left(\frac{3}{2}, \sqrt{3}\right)$ in $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ **AND** Correctly substituting value of c in $c^2 = a^2 - b^2$ (1.5)	Correctly substituting $\left(\frac{3}{2}, \sqrt{3}\right)$ in $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ **AND** Substituting incorrect value of c in $c^2 = a^2 - b^2$ (1)	Correctly substituting value of c in $c^2 = a^2 - b^2$ **AND** Substituting $\left(\frac{3}{2}, \sqrt{3}\right)$ incorrectly in $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ (0.5)	Incorrect Response (0)		
		Correctly finding values of a and b **AND** Correctly finding the equation of ellipse (2.5)	Correctly finding values of a and b **AND** Finding incorrect equation of ellipse (2)	Correctly finding value of a **OR** b (1)	Wrong Answer (0)		
$2(xii)$	Finding moment about $(1,1,1)$ of given concurrent forces concurrent at $P(2,0,1)$	Correctly finding moment arm $\underline{r}$ **AND** Correctly finding the resultant force $\vec{F}$ (2)	Correctly finding moment arm $\underline{r}$ **OR** Correctly finding the resultant force $\vec{F}$ (1)	Partially correct response (0.5)	Wrong Answer (0)		
		Correctly formulating the moment $\underline{m}$ **AND** Correctly finding the moment $\underline{m}$ (2)	Correctly formulating the moment $\underline{m}$ **AND** Correctly finding the moment $\underline{m}$ (1)	Partially correct response (0.5)	Wrong Answer (0)		

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
3	Finding values of p and q such that $f(x)$ is continuous at $x = 2$ and $x = 4$ and sketching the graph of $f(x)$	Correctly setting $\lim_{x\to 2^-} f(x) = \lim_{x\to 2^+} f(x)$ **AND** Correctly stating a relation in p and q (2)	Correctly setting $\lim_{x\to 2^-} f(x) = \lim_{x\to 2^+} f(x)$ **AND** Stating a partially correct relation in p and q (1.5)	Correctly setting $\lim_{x\to 2^-} f(x)$ $= \lim_{x\to 2^+} f(x)$ **AND** Stating an incorrect relation in p and q (1)	Setting $\lim_{x\to 2^-} f(x)$ **OR** $\lim_{x\to 2^+} f(x)$ (0.5)	Setting Wrong Limit (0)	
		Correctly setting $\lim_{x\to 4^-} f(x) = \lim_{x\to 4^+} f(x)$ **AND** Correctly finding the value of q (2)	Correctly setting $\lim_{x\to 4^-} f(x) = \lim_{x\to 4^+} f(x)$ **AND** Correctly finding partially correct value of q (1.5)	Correctly setting $\lim_{x\to 4^-} f(x)$ $= \lim_{x\to 4^+} f(x)$ **AND** Correctly finding incorrect value of q (1)	Setting $\lim_{x\to 4^-} f(x)$ **OR** $\lim_{x\to 4^+} f(x)$ (0.5)	Setting Wrong Limit (0)	
		Correctly finding the value of p (1)	Wrong Answer (0)				
		Correctly tabulating $y = f(x)$ **AND** Correctly sketching the graph of $y = f(x)$ (3)	Correctly tabulating $y = f(x)$ **AND** Sketching partially correct graph (2)	Correctly tabulating $y = f(x)$ **AND** Sketching incorrect graph (1.5)	Partially correct tabulation **AND** Sketching incorrect graph (1)	Incorrect tabulation (0)	

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
3	Finding dimensions of a square base open top box requiring least material with given volume	Correctly stating dimensions of the box as x, x, h **AND** Correctly stating volume of the box with given value (2)	Correctly stating dimensions of the box as x, x, h **AND** Correctly stating volume of the box (1.5)	Correctly stating dimensions of the box as x, x, h **AND** Stating incorrect volume of the box (1)	Stating incorrect dimensions of the box (0)		
		Correctly expressing surface area S in terms of base area dimension x **AND** Correctly finding $\frac{dS}{dx}$ (2)	Correctly expressing surface area S in terms of base area dimension x **AND** Finding $\frac{dS}{dx}$ partially correct (1.5)	Correctly expressing surface area S in terms of base area dimension x **AND** Finding incorrect $\frac{dS}{dx}$ (1)	Expressing incorrect surface area (0)		
		Correctly setting $\frac{dS}{dx} = 0$ **AND** Correctly finding the critical value of x (1)	Correctly setting $\frac{dS}{dx} = 0$ **AND** Finding incorrect value of x (0.5)	Wrong statement (0)			
		Correctly finding $\frac{d^2S}{dx^2}$ **AND** Correctly stating $\frac{d^2S}{dx^2}$ at the value of x (1.5)	Correctly finding $\frac{d^2S}{dx^2}$ **AND** Stating incorrectly $\frac{d^2S}{dx^2}$ at the value of x (1)	Finding $\frac{d^2S}{dx^2}$ partially correct (0.5)	Finding incorrect $\frac{d^2S}{dx^2}$ (0)		

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
		Correctly finding dimensions of the box requiring least material (1.5)	Finding partially correct dimensions of the box (1)	Finding incorrect dimensions of the box (0)			
4	Evaluating $\int \frac{2x^2-x-7}{(x+2)^2(x^2+2x+5)} dx$	Correctly stating the rational function as an identity of partial fractions (1)	Partially correct identities (0.5)	Wrong Identities (0)			
		Correctly finding values of four identity constants (3)	Any three correctly stated aspects (2)	Any two correctly stated aspects (1)	Any one correctly stated aspect (0.5)	No correct aspect (0)	
		Correctly integrating the four integrands (4)	Correctly integrating any three integrands (3)	Correctly integrating any two integrands (2)	Correctly integrating any one integrand (1)	Partially correct response (0.5)	Wrong (0)
4	Finding equation of tangent to the given ellipse parallel to the given line and their point of contact	Correctly stating equation of tangent to the given ellipse **AND** Correctly finding slope m of the tangent (2)	Correctly stating equation of tangent to the given ellipse **AND** Correctly finding partially correct slope m of the tangent (1.5)	Correctly stating equation of tangent to the given ellipse **AND** Correctly finding incorrect slope m (1)	Stating wrong tangent equation (0)		
		Correctly finding values of a^2 & b^2 **AND** Correctly substituting values of m, a^2 and b^2 in the tangent equation (1)	Correctly finding values of a^2 & b^2 **AND** Incorrect Substitution of values (0.5)	Finding incorrect values of a^2 & b^2 (0)			

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
		Correctly finding equations of two tangents to the ellipse (2)	Finding one correct tangent equation (1)	Incorrect tangent equation (0)			
		Correctly finding point of contact of the 1st tangent and ellipse (1.5)	Finding correct abscissa / Coordinate of the point (1)	Finding incorrect point (0)			
		Correctly finding point of contact of the 2nd tangent and ellipse (1.5)	Finding correct abscissa / Coordinate of the point (1)	Finding incorrect point (0)			
5	In triangle ABC a. Writing equations of sides AB and AC b. Finding interior angle *A* c. Finding area of triangle ABC d. Finding perpendicular distance from C to AB	Correctly finding equation of side AB **AND** Correctly finding equation of side AC (2)	One of the aspects is Correct **AND** Other one is partially correct (1.5)	Correctly finding equation of side AB **OR** Correctly finding equation of side AC (1)	Any one partially correct aspect (0.5)	Wrong Answer (0)	
		Correctly finding slopes of sides AB, AC **AND** Correctly finding angle A (2)	Correctly finding slopes of sides AB, AC **AND** Finding partially correct angle *A* (1.5)	Correctly finding slopes of sides AB, AC **AND** Finding incorrect angle *A* (1)	Correctly finding slopes of sides AB **OR** AC (0.5)	Wrong Answer (0)	
		Correctly formulating the triangular area **AND** Correctly finding area of triangle ABC (2)	Correctly formulating the triangular area **AND** Finding partially correct area of triangle ABC (1.5)	Correctly formulating the triangular area **AND** Finding incorrect area of triangle ABC (1)	Wrong Formulation (0)		

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
		Correctly formulating the distance formula **AND** Correctly finding the perpendicular distance (2)	Correctly formulating the distance formula **AND** Finding partially correct perpendicular distance (1.5)	Correctly formulating the distance formula **AND** Finding incorrect perpendicular distance (1)	Wrong Formulation (0)		
5	Maximizing the profit by Linear Programming	Correctly expressing the profit function **AND** Correctly stating the constraints (2)	Correctly stating the profit function **AND** Stating partially correct constraints (1.5)	Correctly expressing the profit function **OR** Correctly stating the constraints (1)	Expressing incorrect profit function **AND** Stating partially correct constraints (0.5)	Both stated aspects wrong (0)	
		Correctly sketching two straight lines (2)	Correctly sketching any one straight line (1)	Incorrect Sketching of straight lines (0)			
		Correctly shading the feasible region **AND** Correctly stating corner points (2)	Correctly shading the feasible region **AND** Stating partially correct corner points (1.5)	Correctly shading the feasible region **AND** Stating incorrect corner points (1)	Incorrect feasible region (0)		
		Correctly tabulating the corner points **AND** Correctly finding number of units to get maximum profit (2)	Correctly tabulating the corner points **AND** Finding incorrect maximum profit (1)	Tabulating corner points partially correct (0.5)	Wrong tabulation of corner points (0)		
6	Finding the centre, foci, eccentricity, vertices and directrices of the conic	Correctly writing the equation of hyperbola in standard form (2)	Partially correct response (1)	Wrong Equation (0)			

Q.# /Part #	Criteria	Level 1 (Marks)	Level 2(Marks)	Level 3 (Marks)	Level 4 (Marks)	Level 5 (Marks)	Level 6 (Marks)
	$9x^2 - y^2 - 12x - 2y + 2 = 0$	Correctly finding the values of a, b **AND** c (1)	Correctly finding the values of a, b **OR** c (0.5)	Wrong Values (0)			
		Correctly finding value of eccentricity, coordinates of center, foci, vertices, and equations of directrices (5)	Any four correctly stated aspects (4)	Any three correctly stated aspects (3)	Any two correctly stated aspects (2)	Any one correctly stated aspect (1)	No correct aspect (0)
6	Evaluate $$\int_{\frac{\pi}{6}}^{\frac{\pi}{4}} cos^2\theta\, cot^2\theta\, d\theta$$	Correctly using three identities $cos^2\theta = 1 - sin^2\theta$ $cot^2\theta = csec^2\theta - 1$ and $cos^2\theta = \dfrac{1 + cos2\theta}{2}$ (3)	Any two correctly stated aspects (2)	Any one correctly stated aspect (1)	No correct aspect (0)		
		Correctly integrating the three integrands (3)	Any two correctly stated aspects (2)	Any one correctly stated aspect (1)	No correct aspect (0)		
		Correctly evaluating the upper and lower integrand limits (2)	Correctly evaluating the upper **OR** lower integrand limits (1)	Partially Correct Response (0.5)	Wrong Answer (0)		