

SECTION – I

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

16

(i) For $f(x) = \frac{2x+1}{x-1}$, find $f^{-1}(x)$

(ii) Evaluate $\lim_{\theta \rightarrow 0} \frac{1-\cos \theta}{\sin \theta}$

(iii) Discuss the continuity of $f(x)$ at $x = c = 2$, $f(x) = \begin{cases} 2x+5 & \text{if } x \leq 2 \\ 4x+1 & \text{if } x > 2 \end{cases}$

(iv) Differentiate w.r.t 'x' $(x-5)(3-x)$

(v) Find $\frac{dy}{dx}$ if $y^2 - xy - x^2 + 4 = 0$

(vi) Differentiate w.r.t. 'θ' $(\sin 2\theta - \cos 3\theta)^2$

(vii) Find $\frac{dy}{dx}$ if $y = x^2 \ln \frac{1}{x}$

(viii) Find y_4 if $y = (2x+5)^{\frac{3}{2}}$

(ix) Apply Maclaurin series expansion to prove that $\cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \dots$

(x) Find extreme values for $f(x) = x^2 - x - 2$

(xi) Define feasible region.

(xii) Graph the inequality $x + 2y \leq 6$

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

16

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

(ii) Evaluate $\int \frac{1}{\sqrt{x}(\sqrt{x}+1)} dx$, $x > 0$

(iii) Evaluate $\int a^{x^2} x dx$ ($a > 0, a \neq 1$)

(iv) Evaluate $\int \sqrt{4-5x^2} dx$

(v) Evaluate $\int_0^{\frac{\pi}{6}} x \cos x dx$

(vi) Find area below the curve $y = 3\sqrt{x}$ and above the x-axis between $x = 1$ and $x = 4$

(vii) Solve the differential equation $x^2(2y+1) \frac{dy}{dx} - 1 = 0$

(viii) Find the position vector of the point of division of the line segments joining the following pair of points, in the given ratio, point C with position vector $2\hat{i} - 3\hat{j}$ and point D with position vector $3\hat{i} + 2\hat{j}$ in the ratio 4 : 3

(ix) If $\underline{u} = 2\hat{i} + 3\hat{j} + 4\hat{k}$, $\underline{v} = -\hat{i} + 3\hat{j} - \hat{k}$ and $\underline{w} = \hat{i} + 6\hat{j} + \hat{z}\hat{k}$ represent the sides of a triangle, find the value of z .

5. (x) Find the angle between the vectors $\underline{u} = 2\underline{i} - \underline{j} + \underline{k}$ and $\underline{v} = -\underline{i} + \underline{j}$
 (xi) 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 the vectors \underline{a} and \underline{b} .
 (xii) Find the area of the triangle with vertices A (1, -1, 1), B (2, 1, -1) and C (-1, 1, 2)

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

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(i) Show that the points A (0, 2), B ($\sqrt{3}$, -1) and C (0, -2) are vertices of a right triangle.
 (ii) Find k so that the line joining A (7, 3), B (k , -6) and line joining C (-4, 5), D (-6, 4) are parallel.
 (iii) Find an equation of line if its slope is 2 and y-intercept is 5.
 (iv) Transform the equation $5x - 12y + 39 = 0$ into two-intercept form.
 (v) Find the distance from the points P (6, -1) to the line $6x - 4y + 9 = 0$
 (vi) Find the point of intersection of lines $3x + y + 12 = 0$ and $x + 2y - 1 = 0$
 (vii) Find the angle between the lines represented by $x^2 - xy - 6y^2 = 0$
 (viii) Find an equation of circle with centre at $(\sqrt{2}, -3\sqrt{3})$ and radius $2\sqrt{2}$
 (ix) Find centre and radius of circle $x^2 + y^2 + 12x - 10y = 0$
 (x) Find vertex and directrix of parabola $x^2 = 16y$
 (xi) Find the focus and vertex of parabola $x^2 = 4(y - 1)$
 (xii) Find centre and foci of $4x^2 + 9y^2 = 36$
 (xiii) Find eccentricity and vertices of $\frac{y^2}{16} - \frac{x^2}{9} = 1$

SECTION - II

Note : Attempt any THREE questions.

5. (a) Evaluate $\lim_{\theta \rightarrow 0} \frac{1 - \cos p\theta}{1 - \cos q\theta}$ 5
 (b) If $\frac{y}{x} = \tan^{-1} \frac{x}{y}$ then prove that $\frac{dy}{dx} = \frac{y}{x}$ 5

6. (a) Evaluate $\int \frac{x}{x^4 + 2x^2 + 5} dx$ 5
 (b) Find equations of two parallel lines perpendicular to $2x - y + 3 = 0$ such that the product of the x-intercept and y-intercept of each is 3. 5

7. (a) Evaluate $\int_0^{\frac{\pi}{4}} (1 + \cos^2 \theta) \tan^2 \theta d\theta$ 5
 (b) Minimize $z = 2x + y$ subject to the constraints $x + y \geq 3$, $7x + 5y \leq 35$, $x \geq 0$, $y \geq 0$ 5

8. (a) If $y = (\cos^{-1} x)^2$, prove that $(1 - x^2)y_2 - xy_1 - 2 = 0$ 5
 (b) Find equations of the tangents to the circle $x^2 + y^2 = 2$ and parallel to the line $x - 2y + 1 = 0$ 5

9. (a) Find volume of the tetrahedron with the vertices (0, 1, 2), (3, 2, 1), (1, 2, 1) and (5, 5, 6) 5
 (b) Find the centre, foci, eccentricity and directrices of ellipse $\frac{(2x-1)^2}{4} + \frac{(y+2)^2}{16} = 1$ 5