

Note: – You have four choices for each objective type question as A, B, C and D. The choice which you think is correct; fill that circle in front of that question number in your answer book. Use marker or pen to fill the circles. Cutting or filling up two or more circles will result no mark.

SECTION-A

Q.1	Questions	A	B	C	D
1.	$\int 2^x dx =$	$2^x + c$	$2^x \cdot \ln 2 + c$	$\frac{\ln 2}{2^x} + c$	$\frac{1}{\ln 2} \cdot 2^x + c$
2.	$\int_0^3 \frac{1}{9+x^2} dx =$	$\frac{\pi}{4}$	$\frac{\pi}{6}$	$\frac{\pi}{12}$	$\frac{\pi}{8}$
3.	Slope of vertical line is:	0	∞	1	-1
4.	Two lines $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$, are perpendicular if:	$a_1a_2 + b_1b_2 = 0$	$a_1a_2 - b_1b_2 = 0$	$a_1b_2 + a_2b_1 = 0$	$a_1b_2 - a_2b_1 = 0$
5.	The distance of the line $4x - 3y - 25 = 0$ from the origin is:	1	5	25	2
6.	Normal form of the equation of straight line is:	$y = mx + c$	$y - y_1 = m(x - x_1)$	$\frac{x}{a} + \frac{y}{b} = 1$	$x \cos \alpha + y \sin \alpha = p$
7.	$2x + y < 6$ is satisfied by which point?	(3,1)	(1,3)	(0,7)	(4,0)
8.	Equation of the tangent to the circle $x^2 + y^2 = 4$ at (1,3) is:	$x + 3y = 4$	$x - 3y = 4$	$3x + y = 4$	$3x - y = 4$
9.	$\sinh^{-1}x =$	$\frac{e^x + e^{-x}}{2}$	$\frac{e^x - e^{-x}}{2}$	$\frac{e^x - e^{-x}}{e^x + e^{-x}}$	$\frac{e^x + e^{-x}}{e^x - e^{-x}}$
10.	If $g(x) = \frac{1}{x^2}$, $x \neq 0$, then $g \circ g(x) =$	x^2	$\frac{1}{x^2}$	x^4	$\frac{1}{x^4}$
11.	Derivative of $(x^3 + 1)^9$ w.r.t. x^3 equals:	$9(x^3 + 1)^8$	$27x^2(x^3 + 1)^8$	$3x(x^3 + 1)^8$	$27(x^3 + 1)^8$
12.	If $\lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}$ exists, then it is equal to:	$f'(x)$	$f'(a)$	zero	∞
13.	Length of latus-rectum of ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, is:	$\frac{2a^2}{b}$	$\frac{2b^2}{a}$	$\frac{b^2}{2a}$	$\frac{b}{2a^2}$
14.	Centre of the Hyperbola $\frac{(x+1)^2}{9} - \frac{(y-2)^2}{4} = 1$, is:	(1,2)	(2,1)	(-1,2)	(1,-2)
15.	Unit vector perpendicular to \underline{a} and \underline{b} is:	$\frac{\underline{a} \times \underline{b}}{ \underline{a} \underline{b} }$	$\frac{\underline{a} \cdot \underline{b}}{ \underline{a} \underline{b} }$	$\frac{\underline{a} \cdot \underline{b}}{\underline{a} \times \underline{b}}$	$\frac{\underline{a} \times \underline{b}}{ \underline{a} \times \underline{b} }$
16.	$2\hat{i} \cdot \hat{j} \times \hat{k} =$	2	Zero	$\frac{1}{2}$	∞
17.	$\int e^{\tan^{-1}x} \cdot \frac{1}{1+x^2} dx =$	$e^{\tan^{-1}x} + c$	$\frac{1}{1+x^2} + c$	$e^{\cos^{-1}x} + c$	$e^{\sec^2x} + c$
18.	$\int e^x(1+x) dx =$	$e^x + c$	$xe^x + c$	$x^2 + c$	$\frac{1}{2}x^2e^x + c$
19.	If $y = \ln(x^2)$, then $\frac{dy}{dx} =$	$\frac{1}{x^2}$	$\frac{1}{2x^2}$	$\frac{2}{x}$	$\frac{2}{x^2}$
20.	$\frac{d}{dx}(\cos x^2) =$	$-\sin x^2$	$-2x \sin x^2$	$2x \sin x^2$	$-x \sin x^2$

Note: - Section B is compulsory. Attempt any three questions from section C.

SECTION - B

2. Write short answers to any Eight parts.

(8 x 2 = 16)

- i. Determine whether the function $f(x) = \sin x + \cos x$ is even or odd.
- ii. Find the composition function $f \circ f(x)$ if $f(x) = \frac{1}{\sqrt{x-1}}$
- iii. Express $\lim_{n \rightarrow \infty} \left(1 + \frac{3}{n}\right)^{2n}$ in term of "e".
- iv. What is the implicit function?
- v. Evaluate $\lim_{x \rightarrow 0} \frac{\sin x^\circ}{x}$
- vi. Differentiate $\frac{2x-3}{2x+1}$ w.r.t. x
- vii. Find $\frac{dy}{dx}$ if $y^2 - xy - x^2 + 4 = 0$
- viii. Find derivative of $(\sin 2\theta - \cos 3\theta)^2$ w.r.t θ
- ix. If $y = x^2 \ln\left(\frac{1}{x}\right)$, find $\frac{dy}{dx}$
- x. Find y_2 if $y = x^2 e^{-x}$
- xi. Find the intervals in which $f(x) = 4 - x^2; x \in (-2, 2)$ is increasing or decreasing.
- xii. Differentiate $\log_{10}(ax^2 + bx + c)$ w.r.t. x

3. Write short answers to any Eight parts.

(8 x 2 = 16)

- i. Using differentials find $\frac{dy}{dx}$ in the equation $xy + x = 4$
- ii. Evaluate $\int \sin^2 x dx$
- iii. Evaluate $\int \frac{\sec^2 x}{\sqrt{\tan x}} dx$
- iv. Evaluate $\int \tan^{-1} x dx$
- v. Evaluate $\int e^{-x} (\cos x - \sin x) dx$
- vi. Evaluate $\int \frac{3x+1}{x^2-x+6} dx$
- vii. Evaluate $\int_1^2 \ln x dx$
- viii. Find the area between the x -axis and the curve $y = 4x - x^2$.
- ix. Show that the points $A(0, 2)$, $B(\sqrt{3}, -1)$ and $C(0, -2)$ are vertices of a right triangle.
- x. Find an equation of line passing through $A(-5, -3)$ and $B(9, -1)$.
- xi. Find an equation of the line through $(-4, 7)$ and parallel to the line $2x - 7y + 4 = 0$
- xii. Find lines represented by $3x^2 + 7xy + 2y^2 = 0$

4. Write short answers to any Nine parts.

(9 x 2 = 18)

- i. How would you obtain the optimal solution from feasible region?
- ii. Indicate the solution region of $3x - 2y \geq 6$
- iii. Find an equation of the circle passing through $A(1,4), B(-1,8)$ and tangent to the line $x + 3y - 3 = 0$
- iv. Write down the equation of normal to circle $3x^2 + 3y^2 + 5x - 13y + 2 = 0$ at $\left(1, \frac{10}{3}\right)$.
- v. Investigate vertex and directrix of $x + 8 - y^2 + 2y = 0$
- vi. Form the equation of ellipse from that data, foci $(\pm 3, 0)$ and minor axis of length 10.
- vii. Find foci and eccentricity of $\frac{y^2}{16} - \frac{x^2}{9} = 1$
- viii. Use vectors, to prove that the diagonals of a parallelogram bisect each other.
- ix. For what values of a and b from the given parallel vectors $3\mathbf{i} - \mathbf{j} + 4\mathbf{k}$ and $a\mathbf{i} + b\mathbf{j} - 2\mathbf{k}$
- x. Prove that in any triangle ABC: $a = b \cos C + c \cos B$
- xi. Find area of parallelogram, where vertices are $A(-1,1,1), B(-1,2,2), C(-3,4,-5)$ and $D(-3,5,-4)$.
- xii. Find α from the given coplanar vectors $\mathbf{i} - 2\alpha\mathbf{j} - \mathbf{k}$, $\mathbf{i} - \mathbf{j} + 2\mathbf{k}$ and $\alpha\mathbf{i} - \mathbf{j} + \mathbf{k}$
- xiii. A force $\mathbf{F} = 3\mathbf{i} + 2\mathbf{j} - 4\mathbf{k}$ is applied at the point $(1, -1, 2)$. Find the moment of the force about the point $(2, -1, 3)$

SECTION - C**(Each question carries 10 marks)**

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

Discuss the 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

6. (a) Evaluate $\int \frac{dx}{\sqrt{7 - 6x - x^2}}$ 5

(b) Find h such that the points $A(h, 1), B(2, 7)$ and $C(-6, -7)$ are vertices of a right triangle. 5

7. (a) Find area between the x -axis and the curve $y = \sqrt{2ax - x^2}$ when $a > 0$ 5

(b) Graph the feasible region of the following system of linear inequality and find corner points $2x + 3y \leq 18, 2x + y \leq 10, x + 4y \leq 12, x \geq 0, y \geq 0$ 5

8. (a) Find a joint equation of the straight lines through the origin and perpendicular to the lines represented by $x^2 + xy - 6y^2 = 0$ 5

(b) Find an equation of the parabola whose focus is $F(-3, 4)$ and directrix is $3x - 4y + 5 = 0$ 5

9. (a) Find centre, foci, eccentricity and vertices of hyperbola $4x^2 - 8x - y^2 - 2y - 1 = 0$ 5

(b) Prove that $\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$ 5