

SUBJECTIVE

Note: Section I is compulsory. Attempt any three (3) questions from Section II.

SECTION I

2. Write short answers to any EIGHT questions:

(2 x 8 = 16)

- i- Let $f(x) = x^2 - x$, find the value of $f(x - 1)$.
- ii- State the domain and range of f^{-1} if $f(x) = \frac{1}{x+3}$
- iii- Evaluate $\lim_{x \rightarrow \pi} \frac{\sin x}{\pi - x}$
- iv- Express $\lim_{n \rightarrow \infty} \left(1 + \frac{3}{n}\right)^{2n}$ in term of e.
- v- Differentiate $\frac{x^2 + 1}{x^2 - 3}$ w.r.t. 'x'
- vi- Find $\frac{dy}{dx}$ if $x = at^2$ and $y = 2at$
- vii- Prove that $\frac{d}{dx}(\cot^{-1} x) = \frac{-1}{1+x^2}$
- viii- Differentiate $(\cos \sqrt{x} + \sqrt{\sin x})$ w.r.t 'x'
- ix- Find $\frac{dy}{dx}$ if $y = \sin h^{-1}(ax + b)$
- x- Find $\frac{dy}{dx}$ if $y = \log_{10}(ax^2 + bx + c)$
- xi- Find $f'(x)$ if $f(x) = \frac{e^x}{e^{-x} + 1}$
- xii- Define a stationary point.

3. Write short answers to any EIGHT questions:

(2 x 8 = 16)

- i- Use differential to find $\frac{dy}{dx}$, if $xy - \ln x = c$
- ii- Evaluate $\int \frac{(1 - \sqrt{x})^2}{\sqrt{x}} dx$, ($x > 0$)
- iii- Find $\int \sec x dx$
- iv- Integrate $\int \sin^{-1} x dx$
- v- Evaluate $\int e^x (\cos x - \sin x) dx$
- vi- Calculate $\int_1^2 \frac{x}{x^2 + 2} dx$
- vii- Solve the differential equation $\frac{dy}{dx} = \frac{1-x}{y}$
- viii- Find an equation of vertical line through $(-5, 3)$.
- ix- Write the equation of line in two intercepts form.
- x- Convert $15y - 8x + 3 = 0$ in slope intercept form.
- xi- Find the equation of line passing through $A(-6, 5)$ having slope 7.
- xii- Show that the points $A(-1, 2)$, $B(7, 5)$ and $C(2, -6)$ are vertices of right triangle.

4. Write short answers to any NINE questions:

(2 x 9 = 18)

- i- What is feasible region?
- ii- Derive equation of circle in standard form.
- iii- Write an equation of circle with centre $(-3, 5)$ and radius 7.
- iv- Check the position of point $(5, 6)$ with respect to circle: $2x^2 + 2y^2 + 12x - 8y + 1 = 0$
- v- Find equation of hyperbola with foci $(0, \pm 9)$, directrices $y = \pm 4$.
- vi- Find the focus and directrix of the parabola if $x^2 = 5y$.
- vii- Find an equation of ellipse with foci $(\pm 3, 0)$ and minor axis length 10.
- viii- Indicate the solution set of system of linear inequality by shading $4x - 3y \leq 12$; $x \geq -\frac{3}{2}$
- ix- Define equal vector, give an example.
- x- Find the magnitude and direction cosines of $\underline{v} = 4\underline{i} - 5\underline{j}$
- xi- Find scalar " α " so that the vectors $2\underline{i} + \alpha\underline{j} + 5\underline{k}$ and $3\underline{i} + \underline{j} + \alpha\underline{k}$ are perpendicular.
- xii- Which vectors, if any, are parallel or perpendicular
 $\underline{u} = \underline{i} + 2\underline{j} - \underline{k}$, $\underline{v} = -\underline{i} + \underline{j} + \underline{k}$, $\underline{w} = \frac{-\pi}{2}\underline{i} - \pi\underline{j} + \frac{\pi}{2}\underline{k}$
- xiii- Prove that the vectors $\underline{i} - 2\underline{j} + 3\underline{k}$, $-2\underline{i} + 3\underline{j} - 4\underline{k}$ and $\underline{i} - 3\underline{j} + 5\underline{k}$ are coplanar.

SECTION II

- 5- (a) Evaluate $\lim_{\theta \rightarrow 0} \frac{\tan \theta - \sin \theta}{\sin^3 \theta}$ 5
- (b) If $\tan y(1 + \tan x) = 1 - \tan x$, show that $\frac{dy}{dx} = -1$ 5
- 6- (a) If $\dot{x} = \sin \theta$, $y = \sin m\theta$, show that $(1 - x^2)y_2 - xy_1 + m^2y = 0$ 5
- (b) Evaluate $\int \frac{\sqrt{2}}{\sin x + \cos x} dx$ 5
- 7- (a) Evaluate $\int_0^{\frac{\pi}{4}} \frac{1}{1 + \sin x} dx$ 5
- (b) Maximize $f(x, y) = 2x + 5y$, subject to the constraints $2y - x \leq 8$; $x - y \leq 4$; $x \geq 0$; $y \geq 0$. 5
- 8- (a) Find the length of the chord cut off from the line $2x + 3y = 13$ by the circle $x^2 + y^2 = 26$. 5
- (b) Prove that in any $\triangle ABC$, $b^2 = c^2 + a^2 - 2ca \cos B$ 5
- 9- (a) Find the interior angles of a triangle with vertices $A(-2, 11)$, $B(-6, -3)$ and $C(4, -9)$ 5
- (b) Find the centre, foci, eccentricity, vertices and directrices of the Ellipse $x^2 + 4y^2 = 16$ 5