

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- Show that the parametric equations $x = a \cos \theta$, $y = b \sin \theta$ represent the equation of ellipse

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

ii- Let the real valued functions 'f' and 'g' be defined by $f(x) = 2x + 1$ and $g(x) = x^2 - 1$, obtain the expressions $f \circ g(x)$ and $f^2(x)$

iii- Evaluate the limit $\lim_{x \rightarrow 0} \frac{1 - \cos 2x}{x^2}$

iv- Differentiate w.r.t.x $\frac{2x-1}{\sqrt{x^2+1}}$

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

vi- Find $\frac{dy}{dx}$ if $4x^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$

vii- If $\tan y(1 + \tan x) = 1 - \tan x$, show that $\frac{dy}{dx} = -1$

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

ix- Determine the intervals in which f is increasing or decreasing for the domain mentioned.
 $f(x) = \sin x$; $x \in (-\pi, \pi)$

x- Find two positive integers whose sum is 30 and their product will be maximum.

xi- Define feasible region and feasible solution.

xii- Graph the feasible region of the following system of linear inequalities and find the corner points

$$x + y \leq 5$$

$$-2x + y \geq 2$$

$$x \geq 0$$

3. Write short answers to any EIGHT questions:

(2 x 8 = 16)

i- Find δy if $y = x^2 - 1$ and x changes from 3 to 3.02

ii- Evaluate $\int \frac{(1-\sqrt{x})^2}{\sqrt{x}} dx$

iii- Find the anti-derivative of $x^2 \ln x$

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

v- Evaluate $\int_{\pi/6}^{\pi/3} \cos t dt$

vi- Find the area between x-axis and the curve $y = \sin 2x$ from $x = 0$ to $x = \frac{\pi}{3}$

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

viii- If $\underline{y} = 3\hat{i} - 2\hat{j} + 2\hat{k}$ and $\underline{w} = 5\hat{i} - \hat{j} + 3\hat{k}$ then find $|3\underline{y} + \underline{w}|$

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- ix- Find direction cosines of vector $\vec{PQ}$ where $P(2,1,5)$ and $Q(1,3,1)$ ایف جی اسٹڈی ڈاٹ کام
- x- Find a vector perpendicular to each of the vectors $\underline{u} = 2\mathbf{i} + \mathbf{j} + \mathbf{k}$ and $\underline{v} = 4\mathbf{i} + 2\mathbf{j} - \mathbf{k}$ FGSTUDY.COM
- xi- Prove that $\underline{a} \times (\underline{b} + \underline{c}) + \underline{b} \times (\underline{c} + \underline{a}) + \underline{c} \times (\underline{a} + \underline{b}) = 0$ ایف جی اسٹڈی ڈاٹ کام
- xii- Calculate the projection of $\underline{a} = \mathbf{i} - \mathbf{k}$ along $\underline{b} = \mathbf{j} + \mathbf{k}$ FGSTUDY.COM

4. Write short answers to any NINE questions: (2 x 9 = 18)
- i- Find the point three-fifth of the way along the line segment from $A(-5,8)$ to $B(5,3)$ ایف
- ii- By means of slopes show that the points $(-4,6)$, $(3,8)$ and $(10,10)$ lie on the same line.
- iii- Find an equation of line with x-Intercept = -9 and slope is -4 FGSTUDY.COM
- iv- Find measure of angle between the lines represented by $10x^2 - 23xy - 5y^2 = 0$ ایف جی اسٹڈی ڈاٹ کام
- v- Find h such that the points $A(-1,h)$, $B(3,2)$ and $C(7,3)$ are collinear. FGSTUDY.COM
- vi- Find an equation of the line through $(11,-5)$ and parallel to a line with slope -24 .
- vii- Find the co-ordinates of the point that divides the join of $A(-6,3)$ and $B(5,-2)$ externally in ratio $2:3$
- viii- Find centre and radius of the circle $4x^2 + 4y^2 - 8x + 12y - 25 = 0$ FGSTUDY.COM
- ix- Write down an equation of the parabola with focus $(2,5)$ and directrix $y = 1$ ایف جی اسٹڈی ڈاٹ کام
- x- Find an equation of circle of radius a and lying in 2nd Quadrant such that it is tangent to both the axes.
- xi- Find focus, vertex of the parabola $x^2 = 4(y-1)$ ایف جی اسٹڈی ڈاٹ کام
- xii- Find an equation of the hyperbola with given foci $(0, \pm 6)$, $e = 2$
- xiii- Find centre and foci of the hyperbola $\frac{y^2}{4} - x^2 = 1$ ایف جی اسٹڈی ڈاٹ کام

SECTION II

Note: Attempt any three (3) questions.

- 5- (a) Express the limit in terms of e $\lim_{x \rightarrow 0} \frac{e^{1/x} - 1}{e^{1/x} + 1}$ $x > 0$ ایف جی اسٹڈی ڈاٹ کام 5
- (b) Find $\frac{dy}{dx}$ of the parametric equations $x = \frac{a(1-t^2)}{1+t^2}$, $y = \frac{2bt}{1+t^2}$ ایف جی اسٹڈی ڈاٹ کام 5
- 6- (a) Show that $\int \sqrt{a^2 - x^2} dx = \frac{a^2}{2} \sin^{-1}\left(\frac{x}{a}\right) + \frac{x}{2} \sqrt{a^2 - x^2} + c$ ایف جی اسٹڈی ڈاٹ کام 5
- (b) Find an equation of the line through the point $(2,-9)$ and intersection of the lines $2x + 5y - 8 = 0$ and $3x - 4y - 6 = 0$ ایف جی اسٹڈی ڈاٹ کام 5
- 7- (a) Evaluate $\int_0^{\pi/4} \cos^4 t dt$ ایف جی اسٹڈی ڈاٹ کام 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) If $y = (\cos^{-1} x)^2$, prove that $(1-x^2)y_2 - xy_1 - 2 = 0$ ایف جی اسٹڈی ڈاٹ کام 5
- (b) Write down an equation of the circle that passes through the given points $A(-7,7)$, $B(5,-1)$, $C(10,0)$ ایف جی اسٹڈی ڈاٹ کام 5
- 9- (a) Find centre, foci, eccentricity, vertices and directrices of $x^2 + 16x + 4y^2 - 16y + 76 = 0$ ایف جی اسٹڈی ڈاٹ کام 5
- (b) Prove that in any ΔABC ; $a = b \cos C + c \cos B$ ایف جی اسٹڈی ڈاٹ کام 5