

Note: There are three sections in this paper i.e A, B & C.

VERSION: A

Instructions:

- Please attempt Section-A on the MCQs Answer Sheet only.
- Only black ball point or marker may be used for shading the relevant circle.
- Please make sure that there is no cutting, over writing, erasing, or multiple circles shading.

Time Allowed: 20 Minutes

"Section - A"

Marks: 20

Q.1. Choose the correct option i.e A, B, C or D.

- $\int \frac{dx}{\sqrt{1-x^2}} =$ _____
 (A) $\cos^{-1}x$ (B) $\sin^{-1}x + c$ (C) $\tan^{-1}x + c$ (D) $-\frac{1}{2}(1-x^2)$
- The distance between $P(x_1, y_1)$ and $P(x_2, y_2)$ where $x_1 = x_2$ is $d =$ _____
 (A) $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ (B) $\sqrt{(y_2 - y_1)^2}$ (C) $\sqrt{(x_2 - x_1)^2}$ (D) $\sqrt{(x_1 - x_2)^2}$
- The x - intercept of $2x + 4y + 6 = 0$ is _____
 (A) 2 (B) -3 (C) 4 (D) 6
- Two lines with slopes m_1 and m_2 are perpendicular if _____
 (A) $m_1 m_2 = -1$ (B) $m_1 = m_2$ (C) $m_1 + m_2 = 0$ (D) $m_1 = -m_2$
- The equation $ax + by + c = 0$ is called standard form of equation of a _____
 (A) Line (B) Circle (C) Parabola (D) Ellipse
- If $g^2 + f^2 - c < 0$ then the circle is _____
 (A) Real (B) Imaginary (C) Point Circle (D) None of these
- $(x - k)^2 + (y - k)^2 = a^2$ is called standard form of equation of a _____
 (A) Parabola (B) Hyperbola (C) Circle (D) Ellipse
- $xx_1 + yy_1 = a^2$ is called _____ equation.
 (A) Normal (B) Circle (C) Tangent (D) Parabola
- If $C = 2, m = 2$ then equation of the line is _____
 (A) $y = 2x + 2$ (B) $y = x + 2$ (C) $y = \frac{x}{2}$ (D) $2y = \frac{x}{2}$
- Let $f(x, y) = x^2y + y^2x$ then $f_x =$ _____
 (A) $x^2y + 2xy$ (B) $2xy + xy^2$ (C) $x^2y + xy^2$ (D) $2xy + y^2$
- When $f(x) = 0$ then the roots of $f(x) = 6x^2 + 5x - 6$ are _____
 (A) $\left\{ \frac{-2}{3}, \frac{3}{2} \right\}$ (B) $\left\{ \frac{2}{3}, \frac{-2}{3} \right\}$ (C) $\left\{ \frac{2}{3}, \frac{-3}{2} \right\}$ (D) $\left\{ \frac{-3}{2}, \frac{-2}{3} \right\}$
- If $e = 1$ then the conic is _____
 (A) Hyperbola (B) Circle (C) Ellipse (D) Parabola
- The general solution of $\frac{dy}{dx} = y$ is _____
 (A) $y = e^x + c$ (B) $y = e^{-x} + c$ (C) $y = ce^x$ (D) $y = x$
- $a^x = b^x$ if and only if _____
 (A) $a \neq b$ (B) $a = b$ (C) $a = x$ (D) $b = x$
- $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is called standard form of the _____ equation.
 (A) Ellipse (B) Circle (C) Parabola (D) Hyperbola
- If $f(x) = e^{2x}$ then $\frac{d}{dx} f(x) =$ _____
 (A) e^x (B) $2xe^{2x-1}$ (C) e^{2x} (D) $2e^{2x}$
- $f(x, y) = 3x + 4y$ is a Homogeneous function of degree _____
 (A) 3 (B) 4 (C) 0 (D) 1
- If $f(x, y) = x^2y + xy^2$ then $F(-1, 0) =$ _____
 (A) 1 (B) 2 (C) 0 (D) 3
- A function $f(x)$ is said to be decreasing in (a, b) if _____ Mqrc-11168
 (A) $f'(x) > 0$ (B) $f'(x) < 0$ (C) $f'(x) = 0$ (D) $f'(x) \geq 0$
- Let $f(x, y, z) = \sqrt{x^2 + y^2} - z$ then $f(1, 0, 1) =$ _____
 (A) 0 (B) 1 (C) -1 (D) 2

Time Allowed: 2.40 Hours

"Section – B"

Marks: 50

Q-2. Attempt any ten (10) parts each part carries equal marks:-

- (i) Find the solution curve of the differential equation $xyy' = 3y^2 + x^2$ which passes through the point $P(-1, 2)$.
- (ii) Prove that $\lim_{x \rightarrow 0} \frac{\sqrt{x+a} - \sqrt{a}}{x} = \frac{1}{2\sqrt{a}}$
- (iii) Find $\frac{dy}{dx}$ if $y = \tan^{-1}\left(\frac{x}{p}\right)$.
- (iv) If $U = f\left(\frac{y}{x}\right)$ then show that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = 0$.
- (v) Differentiate the scalar function $g(x) = [\sin x \hat{i} - 2x \hat{j} + \cos x \hat{k}]$.
- (vi) Find two first-degree straight lines in x and y when the second degree homogeneous equation is $3x^2 - 2xy - 5y^2 = 0$. Mqrc-11168
- (vii) Find the centre and radius of the circle $x^2 + y^2 + 4x - 6y + 13 = 0$.
- (viii) Find the eccentricity of the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$.
- (ix) Find the tangent equation at a point $(1, 2)$ to the ellipse $\frac{x^2}{4} + \frac{y^2}{9} = 1$.
- (x) Find the vector derivative of $F(\theta) = \cos \theta [\hat{i} + \tan \theta \hat{j}] + 3\hat{k}$.
- (xi) Find the equation of the orthogonal trajectory of $y^2 = x^2 + c$.
- (xii) Verify Euler's theorem for $Z = f(x, y) = (x^2 + xy + y^2)^{-1}$.
- (xiii) Find the vertices, foci and eccentricity of the hyperbola $\frac{y^2}{4} - \frac{x^2}{32} = 1$.
- (xiv) Evaluate $\lim_{x \rightarrow 0} \frac{1 - \sin x}{\cos^2 x}$.

"Section – C"

Marks: 30

Note: Attempt any three (3) questions. Each question carries equal marks:-

- Q-3. (a) Differentiate $f(x) = \frac{e^{2x}}{\ln x}$.
- (b) If $Z = xy f\left(\frac{x}{y}\right)$ then show that $x \frac{\partial z}{\partial x} + y \frac{\partial z}{\partial y} = 2Z$.
- Q-4. (a) Find the speed, velocity and acceleration of a particle if its position is given by $\vec{r}(t) = \cos t \hat{i} + \sin t \hat{j} + 3t \hat{k}$, at $t = \frac{\pi}{4}$.
- (b) Solve the Homogeneous differential equation $\frac{dy}{dx} = \frac{xy - y^2}{x^2}$.
- Q-5. (a) Find the equation of the circle which passes through the origin and whose intercept on the co-ordinate axes are 3 and 4. Mqrc-11168
- (b) Find $f(g(x))$ if $f(x) = 2x + 7$ and $g(x) = 2x$.
- Q-6. (a) Evaluate $\int_1^4 x^2 dx$.
- (b) Find the equation of the ellipse whose vertices are at $(4, 2)$ and $(12, 2)$ and $b = 2$.