Section-A

Mulitple Choice Questions (MCQ's)

Q.1 Choose the correct answer for each from the given options:

(i) $\lim_{n \to \infty} \frac{1}{4n} =$ _____

(a) 0 (b) ¼ (c) ∞ (d) 1

(ii) The point of intersection of the internal bisectors of the angles of a triangle is called _____

(a) Orthocenter (b) Centroid (c) In-center (d) Cir-cum center

(iii) The inclination of the bisector of the first and third quadrants is _____

(a) π/2 (b) 3 π/2 (c) π/4 (d) 3π/4

(iv) The measure of the angle between the limes $x^2 - xy - y^2 = 0$ is

(a) 145° (b) 150° (c) 90° (d) 45°

(v) The tangent of the angle measured from + ve x - axis to the line in counter-clock direction is called _____ of the line.

(a) Inclination (b) Slope (c) Gradient (d) Both (b) and (c)

(vi) If $f(x) = x^2 - 4x + 9$ has a:

(a) Maximum at (5, 2) (b) Minimum at (5, 2) (c) Maximum at (2, 5)

(d) Minimum at (2,5)

(vii) A conic section is a circle if:

(a) (2, 0) (b) (2, - 5) (c) (-2, 5) (d) (-2, -5)

(viii) A conic section is a circle if:

(a) e = 1 (b) e = 0 (c) e > 1 (d) e < 1

(ix) Projection of $\vec{b} - 2\hat{i} - \hat{j} + \hat{k}$ on $\vec{a} - 3\hat{i} + \hat{j} - \hat{k}$ is:

(a) $\frac{-8}{11}$ (b) $\frac{8}{11}$ (c) $\frac{11}{8}$ (d) $\frac{-11}{8}$

(x) Any point where f is neither increasing nor decreasing is called:

(a) Stationary point (b) Common point (c) Intersection point

(d) None of these

(xi) If $f(x) = x^2 - 1, x \geq 0$, then $f^{-1}(x) =$ _____

(a) $1/x^2 - 1, x \geq 0$ (b) $x2 - 1\ x, x \leq 0$ (c) $x + 1, x \geq 0$

(d) $x + 1, x \geq -1$

(xii) $\left[\frac{d}{dx} \cot^{-1} \frac{1 + \cos 4x}{1 - \cos 4x}\right] =$ _____

(a) 2 (b) 1 (c) 0 (d) 4

(xiii) If $f(x) = \sin x$, then $f''(\pi) =$ _____

(a) -1 (b) 0 (c) 1 (d) ∞

(xiv) $\int \frac{(x-1)^2}{x} dx =$ _____

(a) $x^{4/3} - 3x^{1/2} + 8x - 9 + c$ (b) $\frac{1}{2}(x-1)^4 + c$
(c) $2(x-1)^4 + c$ (d) $\frac{3}{4}(x-1)^4 + c$

(xv) $\int e^{\sin x}\cos x\,dx =$ _____
(a) $e^{\sin x} + c$ (b) $\sin e^{\sin x-1} + c$ (c) $e^{\sin x}/\cos x + c$
(d) $e^{\sin x}/\cos x + c$

(xvi) The foci of the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{c^2-a^2} = 1$ are:
(a) $(\mp c, 0)$ (b) $(0, \pm c)$ (c) $(\pm a, 0)$ (d) $(0, \pm a)$

(xvii) If the three vectors $\vec{a}, \vec{b}, \vec{c}$ are coplanar, then:
(a) $[\vec{a}, \vec{b}, \vec{c}] = 0$ (b) $[\vec{a}, \vec{b}, \vec{c}] = 1$ (c) $[\vec{a}, \vec{b}, \vec{c}] = -2$
(d) None of these

(xviii) The point (5, 5) lies _____ the straight line $10x - 12y + 17 = 0$
(a) on (b) above (c) below (d) None of these

(xix) If $A = \int_0^{\pi} 1 - \sin^2 x\,dx$, then A = ?
(a) 2 (b) 0 (c) 1 (d) -1

(xx) $\frac{d}{dx}(\log_{10} x) =$ _____
(a) 0.4343/x (b) $\log_{10} e/x$ (c) $\ln e^{10}/x$ (d) Both (a) and (b)

Section-B

Note: Solve any TEN of the following questions. Each question carries 05 marks.

Q.2 Consider the sine function s and the polynomial function p: IR → IR, defined by p(x) =x2 + 1, ∀x ε IR. Find pos, sop and ps and show that no two of these are equal.

Q.3 Find the limit of : $\lim_{x \to 5} \frac{x^2 - 3x - 10}{2x^2 - 13x + 15}$

Q.4 Derive the equation of the straight line in the form of : $\frac{x}{a} + \frac{x}{b} = 1$

Q.5 Find the angle between the lines represented by $x^2 - 5x + 6y^2 = 0$

Q.6 Evaluate : $\int x^3 \sqrt{7 + x^2}\,dx$

Q.7 If $2x^2 - 3xy + y^2 = 5$, find $\frac{dy}{dx}$

Q.8 Let f :IR be defined by $f(x) = x^{\sin x}$, ∀x ∈ IR+. Find f'(x)

Q.9 Determine the pint on the curve $y = 2x^3 - 15x^2 + 36x + 10$ at which the tangent is parallel to x-axis.

Q.10 Solve the differential equation: $y\frac{dy}{dx} = \sqrt{y^2 + 1}\,\sqrt{2x + 3}$ given $y = \sqrt{3}$ when x = 11.

Q.11 Find the equation of the circle which passes through the two points (a, 0), (-a, 0) and whose radius is $\sqrt{a^2 + b^2}$

Q.12 Find the centre, vertices, foci and eccentricity of the ellipse $4x^2 - 16x + 25y^2 + 200t + 316 = 0$

Q.13 Find the equation of the tangent and normal to the hyperbola $x^2 - y^2 = 49$ at (8 , 15)

Q.14 The Position vectors of three points A, B, C are respectively $\vec{a}$, $\vec{b}$ and $2\vec{a} - \vec{b}$. D divides $\overrightarrow{AC}$ in the ratio 2 : 3 and E divides $\overrightarrow{BD}$ in the ratio 4 : 1. Find the position vector of E.

Section-C

Note: Solve any THREE of the following questions. Each question carries 10 (6 + 4) marks.

Q.15 (a) Derive the distance formula of a point (x^1, y^1) from a line l : ax + by + c = 0.

(b) Find the equation of the Parabola, the coordinates of any point on which are given by

$x = tu\cos\alpha$, $y = tu\sin\alpha - 1/2\,gt^2$

Q.16 (a) If $y = \tan 2x$, find dy/dx by definition.

(b) Evaluate : $\int e^{2x}\sin 3x\,dx$.

Q.17 (a) Find the acute angle between the following pairs of straight lines:
$x + 2y + 1 = 0$; $x - y = 0$

(b) Evaluate: $\int_{\pi}^{\pi} \sin^2 x\,dx$

Q.18 (a) Find the extreme values, if any, of the function f: IR+→ IR when
$f(x) = \frac{(x-2)(x-3)}{x^2}$

(b) Find the extreme of the parallelepiped with edges $\vec{OA}$, $\vec{OB}$ and $\vec{OC}$, where A, B, C are the points (0, 1, 1) (-2, 1, 3), (2, -2, 0) respectively.