## Answer All Questions

### Question 1 [25 Marks]

(a) Evaluate the integrals: (i) $\int \sqrt{3-x^2}\,dx$  (ii) $\int \sin^{-1} x\,dx$  (iii) $\int \frac{1}{x}\ln\sqrt{x}\,dx$   [11 marks]

(b) Evaluate the improper integral: $\int_{-\infty}^{\infty} \frac{1+x}{1+x^2}\,dx$.   [4 marks]

(c) Find the area between the parabola $y^2 = 16x$ and its Latus Rectum.   [4 marks]

(d) Find the area between the curve $y = e^{-x}$ and the x-axis on the interval $[0, \infty)$. If this area is revolved about x-axis, find the volume of the solid of revolution.   [6 marks]

### Question 2 [25 Marks]

(a) Find the equation of the circle whose center is the point of intersection of the two straight lines:

$x^2 + xy - 4x = 0$ and passing through the origin. Find also the angle between the two lines.
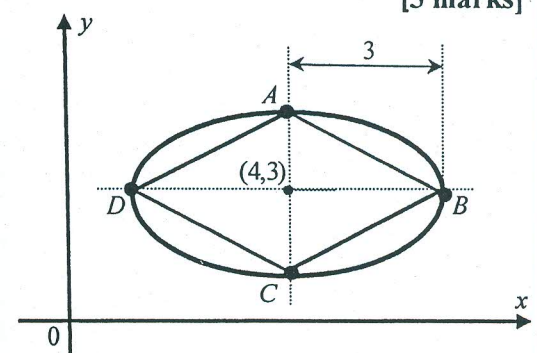
[5 marks]

(b) If the eccentricity of the ellipse shown in Fig. is $e = \frac{\sqrt{5}}{3}$

Find: (i) The equation of the ellipse

(ii) The area of the rhombus $ABCD$

[5 marks]



(c) For the hyperbola $x^2 - y^2 = 9$. Find (i) Eccentricity  (ii) Asymptotes  (iii) Conjugate hyperbola

[4 marks]

(d) Given the line $\frac{x-1}{2} = \frac{y}{4} = z+2$ and the plane $2x - y + z = 1$. Find: (i) The point of intersection

(ii) Equation of line perpendicular to this plane and passing through the point of intersection.

(ii) The angle between the two lines.   [6 marks]

(e) Identify the surface, $\frac{(x-1)^2}{4} + \frac{(y+3)^2}{4} - \frac{(z-2)^2}{9} = 0$. Find the intersection with the planes:

(i) $x = 1$   (ii) $z = 2$.   [5 marks]