



1st Question 12 marks (4, 4, 4)

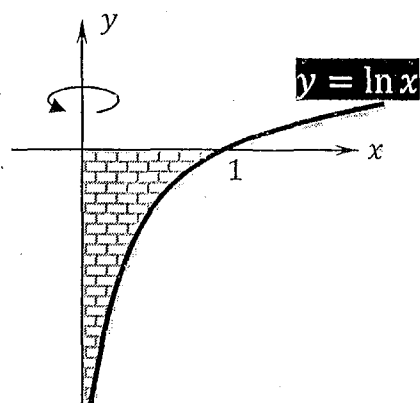
Find the following integrals

(A) $\int \left(\frac{\cosh^2 x - \sinh^2 x + \left(\frac{1}{1+x^2} \right)}{1+x+\tan^{-1}x} \right) dx$ (B) $\int_0^{\pi} (x^2 + x) \cos x \, dx$ (C) $\int_0^{\infty} x e^{-x^2} dx$

2nd Question 8 marks (4, 4)

(A) Find *the volume* of the solid generated by revolving *the shaded area* about the *y-axis*..

(B) Evaluate this area, and find the equation of the horizontal line bisecting this area.



3rd Question 8 marks (4, 4)

(A) Find the **length of the arc**

$$x = 4 + t, y = \cosh t, 0 \leq t \leq 1.$$

(B) Find the **area of the surface** generated by rotating this arc about the *x-axis*

4th Question 13 marks (3, 3, 3, 4)

(A) Find intersection of the line $L: x = 1 + 2t, y = t, z = -1 + 2t$ and the cylinder $y^2 = z$

(B) For the surface $\frac{x^2}{4} + \frac{y^2}{9} - \frac{(z-2)^2}{4} = 0$ complete the following

i) The name of the surface is (paraboloid, ellipsoid, hyperboloid, cone)

ii) The vertex of the surface is (, ,)

iii) The parametric equation of its axis is $x =$, $y =$, $z =$

(C) Sketch the plane $x + 2y = 4$

(D) Choose the correct answer for the surface $(x+1)^2 + y^2 = -4z$

a) The name of the surface is

i) hyperboloid 1 sheet ii) ellipsoid iii) paraboloid iv) cylinder

b) The center is

i) $(-1, 0, 0)$ ii) $(0, 0, 0)$ iii) $(1, -1, -4)$ iv) $(-1, 0, -1)$

c) The intersection of the surface with the *xy-plane* is

i) point ii) plane iii) parabola iv) hyperbola

d) The intersection of the surface with the plane $x = -1$ has eccentricity

i) $e = 0$ ii) $e = 1/2$ iii) $e = 1$ iv) $e = \sqrt{2}$

5th Question 11 marks (6, 5)

(A) (i) Sketch a parabola with focus is $(0, 0)$ and directrix is $y - x = 4$.

(ii) Find the equation of its axis .iii) Find the distance between the vertex and the focus.

(B) Sketch the hyperbola $\frac{(x+1)^2}{16} - \frac{(y-1)^2}{9} = 1$