Sol (i) (a) $\frac{\partial z}{\partial x} = 2x, \quad \frac{\partial z}{\partial y} = -2y$

$\frac{dx}{dt} = -e^t \sin t + e^t \cos t, \quad \frac{dy}{dt} = e^t \sin t + e^t \cos t$

$\therefore \frac{dz}{dt} = z_x \frac{dx}{dt} + z_y \frac{dy}{dt} = 2x e^t (\cos t - \sin t) + (-2y) e^t (\sin t + \cos t)$

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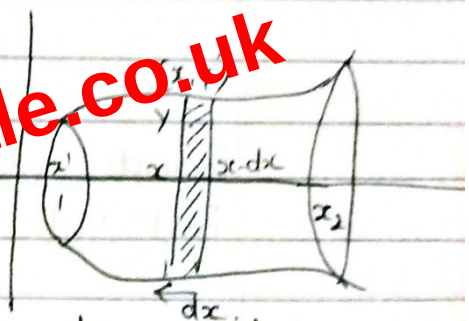
Volume of solid generated by revolving.

Vol. (elementry) $= \pi y^2 dx$

$\Rightarrow \boxed{V = \int_{x_1}^{x_2} \pi y^2 dx}$



Volume of solid obtained by revolution of curve

1) $y = f(x)$ about x-axis is -

$$V = \int_{x_1}^{x_2} \pi y^2 dx$$

$$\boxed{V = \int_{x_1}^{x_2} \pi (f(x))^2 dx}$$

2) $y = f(x)$ (or $x = g(y)$ about y-axis

$$V = \int_{y_1}^{y_2} \pi x^2 dy$$

$$V = \int_{y_1}^{y_2} \pi (g(y))^2 dy$$