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COMPUTER ENGINEERING
ASSIGNMENT 3:

1. Find the area bounded by curves $y = 3e^{2x}$ and $y = 3e^{-x}$ and the ordinates at $x = 1$ and $x = 2$

Solution.

For $y = 3e^{2x}$

$$Area = \int_1^2 y\,dx$$

$$= \int_1^2 3e^{2x}\,dx$$

$$= \left[\frac{3e^{2x}}{2}\right]_1^2$$

$$= \frac{3}{2}\left(e^{2x}\right]_1^2$$

$$= \frac{3}{2}\left[e^4 - e^2\right]$$

$$= \frac{3}{2}(47.2091)$$

$$= 70.8136\,unit^2 //$$

For $y = 3e^{-x}$

$$\int_1^2 3e^{-x}\,dx$$

$$= \left(-3e^{-x}\right]_1^2$$

$$= -3\left[e^{-2} - e^{-1}\right]$$

$$= -3(-0.2325)$$

$$= 0.6976$$

∴ The area bounded by the curve is

$$Area = (70.8136 - 0.6976)$$

$$= 70.116\,unit^2 //$$

2. The parametric equation of a curve are $y = 2\sin\frac{\pi}{10}t$ and $x = 2 + 2t - 2\cos\frac{\pi}{10}t$

Find the area under the curve between $t = 0$ and $t = 10$.

Solution:

$$A = \int_0^{10} y\,dx$$

$$= \int_0^{10} 2\sin\frac{\pi}{10}t\,dx$$

Since $x = 2 + 2t - 2\cos\frac{\pi}{10}t$

$$\therefore \frac{dx}{dt} = 2 + \frac{2\pi}{10}\sin\frac{\pi}{10}t$$

$$\frac{dx}{dt} = 2 + \frac{\pi}{5}\sin\frac{\pi}{10}t$$

$$dx = \left(2 + \frac{\pi}{5}\sin\frac{\pi}{10}t\right)dt$$

$$\therefore A = \int_0^{10} \left(2\sin\frac{\pi}{10}t\right)\left(2 + \frac{\pi}{5}\sin\frac{\pi}{10}t\right)dt$$

$$= \int_0^{10} \left(4\sin\frac{\pi}{10}t\right) + \left(\frac{2\pi}{5}\sin^2\frac{\pi}{10}t\right)dt$$

$$= \int_0^{10} \left(4\sin\frac{\pi}{10}t\right)dt + \int_0^{10} \left(\frac{2\pi}{5}\sin^2\frac{\pi}{10}t\right)dt$$

→ Integrating

$$\int_0^{10} \left(4\sin\frac{\pi}{10}t\right)dt$$

$$= \left[-\frac{40}{\pi}\cos\frac{\pi}{10}t\right]_0^{10}$$

→ Integrating

$$\int \left(\frac{2\pi}{5}\sin^2\frac{\pi}{10}t\right)dt$$

$$= \frac{2\pi}{5}\int \sin^2\frac{\pi}{10}t\,dt$$

$$= \frac{2\pi}{5} \int \left(\frac{1}{2} \left(1 - \cos \frac{\pi}{5} t\right) \right) dt$$

$$= \frac{\pi}{5} \left[t - \frac{5}{\pi} \sin \frac{\pi}{5} t \right]_0^{10}$$

$\therefore$

$$= \left[-\frac{40}{\pi} \cos \frac{\pi}{10} t + \frac{\pi}{5} t - \frac{\sin \pi t}{5} \right]_0^{10}$$

Since $\pi = 180$ {for angles}

$$= \left(\frac{80}{\pi} + 2\pi \right)$$

$$\pi = \frac{22}{7}$$

$$= \left(\frac{80 + 2\pi^2}{\pi} \right)$$

$A = 31.748 \text{ unit}^2$ //