RAJI UMMI-SALMA ONIZE
18/ENG08/020
BIOMEDICAL ENGINEERING
ENG 281
ASSIGNMENT

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

2) The parametric equations 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 $t=0$ & $t=10$

Soln

1) $y=3e^{2x}$ & $y=3e^{-x}$

$$A=\int_a^b y\,dx$$

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

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

$$=\left(\frac{3e^{2(2)}}{2}\right)-\left(\frac{3e^{2(1)}}{2}\right)$$

$$81.9-11.1$$

$$A=70.8 \text{ unit}^2$$

For the area bounded by curve $y=3e^{-x}$

$$A=\int_a^b y\,dx$$

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

$$A=[-3e^{-x}]_1^2$$

$$A=(-3e^{-2})-(-3e^{-1})$$

$$A=-0.4-(-1.1)$$

$$A=0.7 \text{ unit}^2$$

$$\therefore A=70.8-0.7$$

$$A=70.1 \text{ unit}^2$$

2) $y=2\sin\frac{\pi}{10}t \quad x=2+2t-2\cos\frac{\pi}{10}t$

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

$$A = \int_a^b y\,dx = \int_{t_1}^{t_2} y\cdot\frac{dx}{dt}\,dt$$

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

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

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

~~A2=4~~ If $A = (\pi/10\,t)$

$$\cos(A+A) = \cos A\cos A - \sin A\sin A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$\cos 2A = (1-\sin^2 A) - \sin^2 A$$

$$\cos 2A = 1 - 2\sin^2 A$$

$$\cos 2A - 1 = -2\sin^2 A$$

$$1 - \cos 2A = 2\sin^2 A$$

$$1 - \cos 2A/2 = \sin^2 A$$

$$A = 4\int_0^{10}\sin\left(\frac{\pi}{10}t\right) + \frac{2\pi}{5}\cdot\frac{1}{2}\int_0^{10} 1 - \cos 2\left(\frac{\pi}{10}t\right)$$

$$A = \underbrace{-4\cos\left(\frac{\pi}{10}t\right)}_{\pi/10} + \left[\frac{2\pi}{10}\right]\left[t - \frac{\sin 2(\pi/10\,t)}{\pi/10}\right]$$

$$A = \left[\frac{-4\cos(\pi/10)}{\pi/10} + \left[\frac{2\pi}{10}\right]\left[\frac{10 - \sin 2(\pi/10)(10)}{\pi/10}\right]\right]$$

$$A = 19.01 - (-12.73)$$

$$A = 31.74\ \text{unit}^2$$