

TUNDE-ADEJUNTA SIMISOLUNGB

18/ENGR 08/022

BIOMEDICAL

$$1. \quad \begin{array}{ll} y = 3e^{2x} & f(x) = 3e^{2x} \\ y = 3e^{-x} & g(x) = 3e^{-x} \end{array}$$

$$A = \int_{x_1}^{x_2} f(x) - g(x) dx$$

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

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

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

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

$$= 3(8.11 + 0.14) - 3(11.08 + 1.10)$$

$$= 32.31 - 12.18$$

$$= 70.13 \text{ square unit}$$

$$2) \quad y = 20 \sin \frac{\pi}{10} t$$

$$x = 2 + 2t - 2 \cos \frac{\pi}{10} t, \quad \frac{dx}{dt} = 2 + \frac{2\pi}{5} \sin \frac{\pi}{10} t$$

$$A = \int_{t_1}^{t_2} y(t) \cdot \frac{dx}{dt} dt$$

$$A = \int_0^{10} \left(\frac{20 \sin \frac{\pi}{10} t}{10} \times 2 \right) + \left(\frac{2\pi}{5} \sin \frac{\pi}{10} t}{10} dt \right)$$

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

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

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

Recall;

$$\sin^2 \frac{\pi}{10} t = \frac{1 - \cos \frac{\pi}{5} t}{2}$$

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

Integrating by parts;

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

$$A = 4 \left[\frac{-10}{\pi} \frac{\cos \frac{\pi}{10} t}{10} + \frac{\pi}{5} \left(t - \frac{5}{\pi} \sin \frac{\pi}{5} t \right) \right]_0^{10}$$

$$A = \left[4 \left(\frac{-10}{\pi} \frac{\cos \frac{\pi}{10} (10)}{10} + \frac{\pi}{5} \left(10 - \frac{5}{\pi} \sin \frac{\pi}{5} (10) \right) \right) \right] - \left[4 \left(\frac{-10}{\pi} \frac{\cos \frac{\pi}{10} (0)}{10} + \frac{\pi}{5} \left(0 - \frac{5}{\pi} \sin \frac{\pi}{5} (0) \right) \right) \right]$$

$$A = (12.73 + 2\pi) - (-12.73 + 0)$$

$$(12.73 + 6.28) - (-12.73)$$

$$19.01 + 12.73$$

$$= 31.74 \text{ square units}$$