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Elect - Elect

ENG 281

Engineering Mathematics

$$i) y = 3e^{2x} \quad b=2, a=1$$

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

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

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

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

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

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

$$A = 3 \left[\frac{54.60}{2} - \frac{7.39}{2} \right]$$

$$A = 3 (27.3 - 3.695)$$

$$A = 3 (23.605)$$

$$A = 70.815 \text{ units} \times \text{units}^2$$

$$ii) y = 3e^{-x} \quad b=2, a=1$$

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

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

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

$$A = 3 \left[\frac{e^{-x}}{-1} \right]_1^2$$

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

$$A = 3 \cdot [-e^{-2} - (-e^{-1})]$$

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

$$A = 3(-0.135 + 0.368)$$

$$A = 3(0.233)$$

$$A = 0.699$$

$$A \approx 0.7 \text{ units}^2$$

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

$$x = 2 + 2t - 2 \cos \frac{\pi}{10} t, \quad b = 10, \quad a = 0$$

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

$$A = \int_{t_1=0}^{t_2=10} 2 \sin \frac{\pi}{10} t \cdot dx$$

~~A~~

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

$$\frac{dx}{dt} = 0 + 2 + 2 \frac{\pi}{10} \sin \frac{\pi}{10} t$$

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

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

$$A = \int_0^{10} 4 \sin \frac{\pi}{10} t + \frac{4\pi}{10} \sin^2 \frac{\pi}{10} t$$

$$\text{Recall, } \cos \left(2 \frac{\pi}{10} t + \frac{\pi}{10} t \right) = \cos \frac{\pi}{10} t \cos \frac{\pi}{10} t - \sin \frac{\pi}{10} t \sin \frac{\pi}{10} t$$

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

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

$$\text{Recall that; } \sin^2 \frac{\pi}{10} t + \cos^2 \frac{\pi}{10} t = 1$$

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

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

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

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

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

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

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

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

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

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

$$A = 4 \left[\frac{-\cos \frac{\pi}{10} t}{\pi/10} \right]_0^{10} + \frac{\pi}{5} \left[t - \frac{\sin \frac{2\pi}{10} t}{2\pi/10} \right]$$

$$A = 4 \left[\frac{10}{\pi} \times -\cos \frac{\pi}{10} t \right]_0^{10} + \frac{\pi}{5} \left[t - \sin \frac{2\pi}{10} t \times \frac{10}{2\pi} \right]$$

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

$$+ \frac{\pi}{5} \left[\left(10 \times -\sin \frac{2\pi}{10} \times \frac{10}{2\pi} \right) - \left(0 \times -\sin \frac{2\pi}{10} \times \frac{10}{2\pi} \right) \right]$$

$$A = 4 \left[\left(\frac{10}{\pi} \times -\cos \pi \right) - \left(\frac{10}{\pi} \times -\cos 0 \right) \right] + \frac{\pi}{5} \left[\left(10 \times -\sin \frac{2\pi}{10} \times \frac{10}{2\pi} \right) - \left(0 - \sin 0 \times \frac{10}{2\pi} \right) \right]$$

$$A = 4 \left[\left(\frac{10 \times (-1)}{\pi} \right) - \left(\frac{10 \times (-1)}{\pi} \right) \right] + \frac{\pi}{5} \left[(10 - 0 \times \frac{10}{2\pi}) \right] -$$

$$A = 4 \left[\left(\frac{10 \times 1}{\pi} \right) - \left(\frac{-10}{\pi} \right) \right] + \frac{\pi}{5} \left[(10 - 0) \right] - (0 - 0)$$

$$A = 4 \left[\frac{10}{\pi} + \frac{10}{\pi} \right] + \frac{\pi}{5} [10]$$

$$A = 4 \left[\frac{20}{\pi} \right] + \frac{10\pi}{5}$$

$$A = \frac{80}{\pi} + 2\pi$$

$$A = 25.46 + 6.28$$

$$A = 31.74 \text{ sq units}^2$$