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ENUG 281

1) $y = 3e^{2x}$ at the coordinates $B=1$ and $B=2$
Area bounded by the curve $AD = \int_1^2 3e^{2x} dx = \int_1^2 3e^{2x} dx$

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

$$A = \left[\frac{3}{2} (e^4 - e^2) + c - c \right] - \left[-3e^{-2} + 3e^{-1} + c - c \right]$$

$$A = [70.81] - [0.698]$$

$$A = 70.112 \text{ units}^2$$

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

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

$$\frac{dx}{dt} = 4 \times \frac{\pi}{10} \sin\left(\frac{\pi t}{10}\right)$$

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

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

Area bounded by the parametric equations $AD = \int_{x_1}^{x_2} y dx$

$$A = \int_{x_1}^{x_2} 2 \sin\left(\frac{\pi t}{10}\right) dx$$

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

$$A = \int_{t_1}^{t_2} 2 \sin\left(\frac{\pi t}{10}\right) \left[2t \frac{2\pi}{5} \sin\left(\frac{\pi t}{10}\right) \right] dt$$

$$t_2 = 10, t_1 = 0$$

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

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

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

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

$$\cos 2x - \sin 2x = \cos 2x$$

$$1 - \sin 2x - \sin 2x = \cos 2x$$

$$1 - 2 \sin 2x = \cos 2x$$

$$\sin 2x = 1 - \cos 2x$$

$$\int \sin^2 x dx = \int \frac{1 - \cos 2x}{2} dx = \frac{1}{2} \int [1 - \cos 2x] dx$$

$$= \frac{1}{2} \left[x - \frac{1}{2} \sin 2x + C \right]$$

$$A = \left[\frac{4 \times 10}{\pi} \cos\left(\frac{\pi t}{10}\right) + C \right]_0^{10} + \left[\frac{\frac{2\pi \times 10 \times 1}{2} \frac{\pi t}{10} - \frac{1}{2} \sin\left(\frac{2 \times \pi t}{10}\right) + C \right]_0^{10}$$

$$= \left[\frac{40}{\pi} \cos \frac{\pi t}{10} + C \right]_0^{10} + \left[4 \left(\frac{\pi t}{10} - \frac{1}{2} \sin\left(\frac{\pi t}{5}\right) + C \right) \right]_0^{10}$$

$$= \left[\frac{40}{\pi} \cos\left(\frac{\pi \times 10}{10}\right) - \frac{40}{\pi} \cos\left(\frac{\pi \times 0}{10}\right) + 4 \left(\frac{\pi \times 10}{10} - \frac{1}{2} \sin\left(\frac{\pi \times 10}{5}\right) - \left(\frac{\pi \times 0}{10} - \frac{1}{2} \sin\left(\frac{\pi \times 0}{5}\right) \right) \right) \right]$$

$$= \left[\frac{40}{\pi} - \frac{40}{\pi} \right] + \left[4\pi - \frac{4}{2} \sin 2\pi - 4 \left(0 - \frac{1}{2} \sin 0 \right) \right]$$

$$= \frac{-80}{\pi} + [4\pi - 0 - 0]$$

$$A = \frac{-80}{\pi} + 4\pi$$

$$\therefore A = \frac{4\pi^2 - 80}{\pi} \text{ units}^2$$