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DEPT - CIVIL ENGINEERING
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i) $y = 3e^{2x}$

$y = 3e^{-x}$, $x = 1$

$x = 2$

$$\text{Area} = \int_a^b y_a\,dx - \int_a^b y_b\,dx$$

$y_a = 3e^{2x}$

$$\int_1^2 3e^{2x} = \left[\frac{3e^{2x}}{2}\right]_1^2$$

$$\Rightarrow \frac{3e^4}{2} - \frac{3e^2}{2} = 70.81 \text{ square units}$$

$y_b = 3e^{-x}$

$$\int_1^2 3e^{-x} \Rightarrow \left[\frac{3e^{-x}}{-1}\right]_1^2$$

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

$$\Rightarrow 0.698 \text{ square units}$$

∴ Area bounded by the curves;

$= 70.81 - 0.68 = 70.112$ square units

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

$x = 2 + 2t - 20\cos \frac{\pi}{10} t$

$$\text{Area} = \int_a^b y\,dx \quad b = 10, \; a = 0$$

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

$$\therefore \text{Area} = \int_0^{10} 2\sin \frac{\pi}{10} + \left[2 + \frac{\pi}{5}\sin \frac{\pi}{10} t\right]$$

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

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

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

$$\Rightarrow \left[\frac{-40\cos\left(\frac{\pi t}{10}\right)}{\pi} + \left(\frac{2\pi}{5} \times \pi t - 5\sin\frac{\left(\frac{\pi t}{5}\right)}{2\pi}\right)\right]_0^{10}$$

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

$$\Rightarrow \left[\frac{-40\cos\left(\frac{\pi(10)}{10}\right)}{\pi} + \pi(10) - 5\sin\left(\frac{\pi 10}{5}\right)\right.$$

$$\left. - \left[-40\cos\left(\frac{0\times\pi}{10}\right) + \pi(0) - 5\sin\left(\frac{0}{5}\right)\right.\right.$$

$$\Rightarrow \left[\frac{40}{\pi} + 2\pi\right] - \left[-\frac{40}{\pi} + 0\right]$$

$$\Rightarrow \frac{40}{\pi} + 2\pi + \frac{40}{\pi}$$

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

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