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DEPT: MECHATRONICS ENGINEERING.

MAT. NO: DE (99139705FE).

① $y_2 = 3e^{2x}$; $y_1 = 3e^{-x}$ $b=2, a=1$

$$A = \int_a^b y_2 \, dx - \int_a^b y_1 \, dx$$

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

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

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

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

$= 70$ square units. Ans.

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

$A = \int_a^b y \cdot dx$ Let $\pi/10 = c$; to make resolution easier.

$\frac{dx}{dt} = 2 + 2c\sin ct$

$dx = 2 + 2c\sin ct \cdot dt$

$A = \int_0^{10} 2\sin ct(2 + 2c\sin ct) \cdot dt$

$= 4\int_0^{10} \sin ct + c\sin^2 ct \cdot dt$

Recall $\sin^2\theta = \frac{1}{2}(1 - \cos 2\theta)$

$= 4\int_0^{10} \left[\sin ct + \frac{c}{2}(1 - \cos 2ct)\right] dt$

$= 4\left[\frac{-\cos ct}{c} + \frac{ct}{2} - \frac{c}{4c}\sin 2ct\right]_0^{10}$

Recall; $c = \pi/10$.

$= \cancel{4\left[\frac{\pi}{4}\right.}\ 4\left[\frac{\pi t}{20} - \frac{10}{\pi}\cos\frac{\pi}{10}t - \frac{1}{4}\sin\frac{\pi}{5}t\right]_0^{10}$

$= \left[\frac{\pi t}{5} - \frac{40\cos\pi t}{\pi 10} - \frac{\sin\pi t}{5}\right]_0^{10}$

$= \cancel{\left(\frac{\pi(10)}{5} - \frac{\sin\pi(10)}{5} - \frac{40\cos\pi(10)}{\pi 10}\right.}$

$= \left(\frac{\pi(10)}{5} - \frac{\sin\pi(10)}{5} - \frac{40}{\pi}\cos\frac{\pi(10)}{10}\right) - \left(\frac{\pi(0)}{5} - \frac{\sin\pi(0)}{5} - \frac{40}{\pi}\cos\frac{\pi}{10}(0)\right)$

$= 2\pi + \frac{40}{\pi} + \frac{40}{\pi} = 31.75$ square units.