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Mecatronics Engineering
ENG 281

① Find the area bounded by the curves $y = 3e^{2x}$ and $y = 3e^{-x}$ and the ordinates at $x = 1$ and $x = 2$

Solution

① $y_1 = 3e^{2x}$ and $y_2 = 3e^{-x}$

$x = 1$ and $x = 2$

$dA = (y_1 - y_2)dx$

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

intergral

$3e^{2x} = \frac{3e^{2x}}{2}$

$3e^{-x} = -3e^{-x}$

$\int_1^2 \frac{3e^{2x}}{2} + 3e^{-x}$

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

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

$82.30 - 11.490 = \underline{70.81}$

② The parametric equations of a curve are $y = 25\sin\frac{\pi}{10}t$ and $x = 2 + 2t\cos\frac{\pi}{10}t$. Find the area under the curve between $t = 0$ and $t = 10$

Solution

$y = 25\sin\frac{\pi}{10}t$ $\quad t = 0$

$\quad t = 10$

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

$$\frac{dx}{dt} = -\frac{20}{\pi}\left(\frac{\pi}{10}\right)$$

$$\frac{dx}{dt} = 2t + \frac{20}{\pi} t \sin\left(\frac{\pi}{10} t\right) + \frac{200}{\pi^2} \cos\left(\frac{\pi}{10} t\right)$$

$$\int_0^{10} \cdot \frac{20}{\pi}\left(\frac{\pi}{10}\right) \cdot 2t + \frac{20}{\pi} t \sin\left(\frac{\pi}{10} t\right) + \frac{200}{\pi^2} \cos\left(\frac{\pi}{10} t\right)$$

$$\left[\frac{20}{\pi}\left(\frac{\pi}{10}\right) \cdot 20(10) + \frac{20}{\pi}(10) \sin\left(\frac{\pi}{10} \times 10\right) + \frac{200}{\pi^2} \cos\left(\frac{\pi}{10} \times 10\right)\right] - \left[\frac{20}{\pi}\left(\frac{\pi}{10}\right)\right.$$

$$\times\, 2(0) + \frac{20}{\pi} t \sin\left(\frac{\pi}{10}(0)\right) + \frac{200}{\pi^2} \cos\left(\frac{\pi}{10}(0)\right)$$

$$423.72 - 0 = \underline{\underline{423.72}}$$