ENG281

Engineering Mathematics I (Assignment III)

Name: Oyibo Michael Ogheneyerhovwo
Matric No: 18/ENG01/021
Department: Chemical Engineering

Question 1

i) $y = 3e^{2x}$ at $x=1$, $x=2$

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

$\int y = \int_1^2 3e^{2x}$

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

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

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

$\therefore A = 70.81$

ii) $y = 3e^{-x}$ at $x=1$ and $x=2$

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

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

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

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

$= \left[-3e^{-2} + 3e^{-1}\right]$

$\therefore A = 0.70$

Question 2

$y = 2\sin\frac{\pi}{10}t \qquad (t=0,\ t=10)$

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

$A = \int_a^b (y)\,dx$

$A = \int_0^{10} \left[2\sin\pi/10\, t\right] dx$

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

$dx = \left[2 + \frac{2\pi}{10}\sin\frac{\pi}{10}t\right] dt$

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

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

$A = \left[\int 4\sin\frac{\pi}{10}t + \int\frac{4\pi}{10}\left(\sin\frac{2}{10}\frac{\pi}{10}t\right)\right]_0^{10} dt$

From half identify angles;

$\sin^2 x = \frac{1-\cos 2x}{2}$

$\therefore \frac{4\pi}{10}\left\{\sin^2\frac{\pi}{10}t\right\} = \frac{4\pi}{10}\left[\frac{1-\cos 2\frac{\pi}{10}t}{2}\right]$

$A = \left[\frac{-40}{\pi}\cos\frac{\pi}{10}t + \frac{4\pi}{10}\int\frac{1-\cos 2\frac{\pi}{10}t}{2}\right]_0^{10} dt$

$A = \left[\frac{-40}{\pi}\cos\frac{\pi}{10}t + \frac{4\pi}{10}\cdot\frac{1}{2}\left\{t - \frac{10}{2\pi}\sin 2\frac{\pi}{10}t\right\}\right]_0^{10} dt$

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

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

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

$$A = \left[\frac{-40}{\pi} \cos\pi + 2\pi - \sin 2\pi + \frac{40}{\pi} \right]$$

$$A = 31.75$$