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Assignment

1 $A = \int_a^b y\,dx$

Between two sides

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

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

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

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

$= 70.814 - 3(-e^{-2} + e^{-1})$

$= 70.814 - 3(0.233$

$A = 70.115 \text{ units}^2$

2 $y = 2\sin \pi/10 t$

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

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

$\frac{dx}{dt} = 2 - \frac{20}{\pi}\sin\left(\pi t/10\right)$

$dx = 2 - \frac{20}{\pi}\sin\left(\frac{\pi t}{10}\right)dt$

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

$= \int_0^{10} 2\sin\left(\frac{\pi t}{10}\right)\left[2 - 20/\pi \sin\frac{\pi t}{10}\right)\right]$

$= \int_0^{10} 4\sin\left(\frac{\pi t}{10}\right) - \frac{40}{\pi}\sin^2\left(\frac{\pi t}{10}\right)dt$

Let $\pi t/10 = y$

Using, $\cos 2y = \cos^2 y - \sin^2 y$

$\cos 2y = (1 - \sin^2 y) - \sin^2 y$

$\cos 2y = 1 - 2\sin^2 y$

$2\sin^2 y = 1 - \cos 2y$

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

$$\sin^2\left(\frac{\pi}{10}t\right) = \frac{1}{2} - \frac{\cos}{2}\left(\frac{2\pi}{10}t\right)$$

$$A = \int_0^{10} 4\sin\left(\frac{\pi}{10}t\right)dt - \int_0^{10} \frac{40}{\pi}\sin^2\left(\frac{\pi}{10}t\right)$$

$t_2 = 10$ and $t_1 = 0$

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

$$= -\int_0^{10} \frac{40}{\pi}\left[\frac{1}{2} - \frac{\cos}{2}\left(\frac{2\pi t}{10}\right)\right]$$

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

$$= \int_0^{10} \frac{40}{\pi} \cdot \frac{1}{2}\left(1 - \cos\frac{\pi}{5}t\right)$$

$$A = \left[-\frac{40}{\pi}(-1) + \frac{40}{\pi}(1)\right]$$

$$= -\int_0^{10} \frac{20}{\pi}\left[1 - \cos\left(\frac{\pi t}{5}\right)\right]$$

$$A = \left[\frac{80}{\pi}\right] - \int_0^{10} \frac{20}{\pi} - \frac{20}{\pi}\cos\left(\frac{\pi}{5}t\right)dt$$

$$= \frac{80}{\pi} - \left[\frac{20t}{\pi} - \frac{100}{\pi^2}\sin\left(\frac{\pi}{5}t\right)\right]_0^{10}$$

$$A = \frac{80}{\pi} - \left[\frac{20(10)}{\pi} - \frac{100}{\pi^2}\sin\left(\frac{10\pi}{5}\right)\right] - \left[0 - \frac{20(0)}{\pi} - \frac{100}{\pi^2}\sin\left(\frac{0\pi}{5}\right)\right]$$

$$A = \frac{80}{\pi} - \left[\frac{200}{\pi} - \frac{100}{\pi^2}\sin(2\pi) + \frac{100}{\pi^2} \times 1\right]$$

$$= \frac{80}{\pi} - \left[\frac{200}{\pi} - \frac{100}{\pi^2}\sin 2\pi + \frac{100}{\pi^2}\right]$$

$$= \frac{80}{\pi} - \frac{200}{\pi} + \frac{100}{\pi^2}\sin 2\pi - \frac{100}{\pi^2}$$

$$= \frac{-120}{\pi} + \frac{100}{\pi^2}(0) - \frac{100}{\pi^2}$$

$$= \frac{-120}{\pi} - \frac{100}{\pi^2} = \frac{-120\pi - 100}{\pi^2}$$

$$A = -48.33 \text{ unit}^2$$