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$$1. \int 3e^{2x} dx = \frac{3e^{2x}}{2} + C$$

$$\int 3e^{-x} dx = -3e^{-x} + C$$

$$A_{x=0, x=1} = \left[ \frac{3e^{2x}}{2} \right]_1^2 - \left[ -3e^{-x} \right]_1^2$$

$$= \frac{3e^4}{2} - \frac{3e^2}{2} - (-3e^{-2} - 3e^{-1})$$

$$= \frac{3(e^4 - e^2)}{2} + 3(e^{-2} + e^{-1})$$

$$= 72.323 \text{ Unit}^2$$

$$2. \int y \cos x = \int 2 \sin\left(\frac{\pi}{10}t\right) dx$$

$$= \int \left( 2 \sin\left(\frac{\pi}{10}t\right) \right) \left( 2 + \frac{\pi}{5} \sin\left(\frac{\pi t}{10}\right) \right) dt$$

$$= \int 4 \sin\left(\frac{\pi t}{10}\right) + \frac{2\pi}{5} \sin^2\left(\frac{\pi t}{10}\right) dt$$

$$= \frac{40}{\pi} \cos\left(\frac{\pi}{10}t\right) + \int \frac{2\pi}{5} \left( 1 - \cos 2\left(\frac{\pi}{10}t\right) \right) dt$$

$$= \frac{40}{\pi} \cos\left(\frac{\pi t}{10}\right) + \frac{2\pi}{5} \left( \frac{1}{2}t - \frac{10}{4\pi} \sin\left(\frac{2\pi}{10}t\right) \right)$$

$$= \frac{40}{\pi} \cos\left(\frac{\pi t}{10}\right) + \frac{\pi t}{5} - \frac{10}{4\pi} \sin\left(\frac{2\pi t}{10}\right)$$

$$\left[ \frac{40}{\pi} \cos\left(\frac{\pi t}{10}\right) + \frac{\pi t}{5} - \frac{10}{4\pi} \sin\left(\frac{\pi t}{5}\right) \right]_0^{10}$$

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

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

$$dx = 2 + \frac{\pi}{5} \sin\left(\frac{\pi t}{10}\right) dt$$

$$= \left( \frac{40}{\pi} \cos(\pi) + \frac{10\pi}{5} - \frac{10}{4\pi} \sin(2\pi) \right) - \left( \frac{40}{\pi} \cos 0 + 0 - \frac{10}{4\pi} \sin(0) \right)$$

$$= \left( \frac{40}{\pi} (-1) + 2\pi - \frac{5}{2\pi} (0) \right) - \left( \frac{40}{\pi} \right)$$

$$= \frac{40}{\pi} + 2\pi + \frac{40}{\pi} = \frac{80}{\pi} + 2\pi$$

$$= 31.748 \text{ Unit}^2$$