

$$\begin{aligned}
 1) \quad y &= 3e^{2x} \quad y_2 = 3e^{-x} \\
 x &= 1 \quad x = 2 \\
 A &= \int_1^2 (3e^{2x}) dx = \frac{3}{2} (e^{2x}) \Big|_1^2 \\
 A &= \int_1^2 (3e^{2x}) dx = \frac{3}{2} (e^{2x}) \Big|_1^2 \\
 &= \left(\frac{3e^{2(2)}}{2} - \frac{3e^{2(1)}}{2} \right) - \left(\frac{3e^{-2}}{2} - \frac{3e^{-1}}{2} \right) \\
 &= \left[\frac{3 \cdot 8}{2} - \frac{3 \cdot 3}{2} \right] - \left[\frac{3 \cdot 0.135}{2} - \frac{3 \cdot 0.368}{2} \right] \\
 &= \left[12 - 4.5 \right] - \left[0.2025 - 0.552 \right] \\
 &= 7.5 - (-0.3495) \\
 &= 7.8495 \approx 7.85
 \end{aligned}$$

$$\begin{aligned}
 2) \quad y &= 2 \sin \pi / 10t \quad x = 2 + 2t - 2 \cos \pi / 10t \\
 t &= 0 \quad t = 10 \\
 A &= \int_0^{10} (y) dx \\
 \frac{dx}{dt} &= 2 + \frac{\pi}{5} \sin \pi / 10t \\
 dx &= \left(2 + \frac{\pi}{5} \sin \pi / 10t \right) dt \\
 A &= \int_0^{10} \left[2 \sin \pi / 10t \right] \left[\left(2 + \frac{\pi}{5} \sin \pi / 10t \right) dt \right] \\
 &= \int_0^{10} \left[4 \sin \pi / 10t + \frac{2\pi}{5} \sin^2 \pi / 10t \right] dt \\
 &= \int_0^{10} \left[4 \sin \pi / 10t \right] dt + \frac{2\pi}{5} \int_0^{10} \left[\sin^2 \pi / 10t \right] dt
 \end{aligned}$$

Recall, $\sin^2 a = \frac{1 - \cos 2a}{2}$, $\cos 2a = \cos^2 a - \sin^2 a$

$$\sin^2 \pi / 10t = \frac{1 - \cos 2\pi / 10t}{2}$$

$$\cos 2\pi / 10t = \cos^2 \pi / 10t - \sin^2 \pi / 10t$$

$$\cos^2 \pi / 10t = 1 - \sin^2 \pi / 10t$$

Substituting eqn (c) into eqn (d)

$$\cos^2 \pi / 10t = 1 - \sin^2 \pi / 10t$$

$$\cos^2 \pi / 10t = 1 - 2 \sin^2 \pi / 10t$$

$$\sin^2 \pi / 10t = \frac{1 - \cos 2\pi / 10t}{2}$$

$$\therefore \int_0^{10} \left[4 \sin \pi / 10t \right] dt + \frac{2\pi}{5} \int_0^{10} \left[\frac{1 - \cos 2\pi / 10t}{2} \right] dt$$

$$\int_0^{10} [4 \sin \pi/10 t] dt + 2\pi/10 \int_0^{10} [1 - \cos \pi/5 t] dt$$

$$[40/\pi (\cos \pi/10 t)]_0^{10} - \left(\frac{2\pi}{10} \left[t - \frac{5 \sin \pi/5 t}{\pi} \right] \right)_0^{10}$$

$$[-40/\pi \cos \pi/10(10) - (-40/\pi \cos \pi/10(0))] + \left[\frac{2\pi}{10} (10) - \frac{5 \sin \pi/5}{\pi} \right]_0^{10}$$

$$[-40/\pi (\cos \pi) + 40/\pi] + [2\pi - \sin 2\pi]$$

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

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

$$\left[\frac{40}{\pi} + \frac{40}{\pi} \right] + 2\pi$$

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

$$+64.8 + 6.28319$$

$$31.743$$

$$31.7599 \text{ units}$$