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DEPT : COMPUTER ENG.

(1) $f(x) = y = 3e^{2x}$ $\quad x = 1$
$g(x) = y = 3e^{-x}$ $\quad x = 2$

$A = \int_a^b [f(x) - g(x)]\,dx$
$A = \int_1^2 (3e^{2x} - 3e^{-x})\,dx$
$= \int_1^2 3(e^{2x} - e^{-x})\,dx$
$= 3\int_1^2 (e^{2x} - e^{-x})\,dx$
$= 3\left[\frac{e^{2x}}{2} + e^{-x}\right]_1^2$
$= 3\left[\left(\frac{e^{2(2)}}{2} + e^{-2}\right) - \left(\frac{e^2}{2} + e^{-1}\right)\right]$
$= 3[(27.43 - 4.06)]$
$= 3 \times 23.37$
$= 70.11$ square units
$\simeq 70$ square units

(2) $y = 2\sin \pi/10\, t$ $\quad t = 0$
$x = 2 + 2t - 2\cos \pi/10\, t$ $\quad t = 10$

$A = \int_a^b y\,dx$
$A = \int_0^{10} (2\sin \pi/10\, t)\,dx$
$\frac{dx}{dt} = 2 + \pi/5 \sin \pi/10\, t$
$dx = 2 + \pi/5 \sin \pi/10\, t \cdot dt$
substituted dx
$A = \int_0^{10} (2\sin \pi/10\, t)(2 + \pi/5 \sin \pi/10\, t)(dt)$
$= \int_0^{10} (4\sin \pi/10\, t + \frac{2\pi}{5}\sin^2 \pi/10\, t)\,dt$

Recall:
$\cos 2\theta = 1 - 2\sin^2\theta$
$\sin^2\theta = \frac{1 - \cos 2\theta}{2}$

$A = \int_0^{10} (4\sin \pi/10\, t + \frac{2\pi}{5}\left(1 - \cos \frac{2\pi}{10} t\right)\cdot \tfrac{1}{2})\,dt$
$A = \int_0^{10} (4\sin \pi/10\, t + \frac{2\pi}{10}(1 - \cos \pi/5\, t))\,dt$
$A = \left[\frac{-4\cos \pi/10\, t}{\pi/10} + \frac{2\pi}{10}\left(t - \frac{\sin \pi/5\, t}{\pi/5}\right)\right]_0^{10}$

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

$$= 19.016 - (-12.732)$$

$$= 19.016 + 12.732$$

$$= 31.748 \text{ square units}$$

$$\simeq \cancel{31.75}\ 31.75 \text{ square units.}$$