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Question ①

Find the area bounded by the curves $y = 3e^{2x}$ and $y = 3e^{-x}$ and the ordinates at $x=1$ and $x=2$.

$y_1 = 3e^{2x}; y_2 = 3e^{-x}$

$dy = \int 3e^{2x} \cdot dx$

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

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

$= 81.897 - 11.084 = c$

$A_1 = \underline{\underline{70.813}}$

$y_3 = 3e^{-x}$
 $dy = \int 3e^{-x} dx$

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

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

$= -0.406 + c + 1.104 - c$

$A_2 = \underline{\underline{0.698}}$

QUESTION ②

The Parametric equations of a curve are $x = 2 + 2t - 2\cos \frac{\pi}{10} t$ and $y = 2t \sin \frac{\pi}{10} t$. Find the area under the curve between $t=0$ and $t=10$.

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

$y = 2t \sin \frac{\pi}{10} t$

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

$dy = -2\cos \frac{\pi}{10} t \times \frac{\pi}{10}$

$dA = \int_0^{10} (-2\cos \frac{\pi}{10} t) \times \frac{\pi}{10} dt$

$dA = \left[-\frac{2\pi}{10} \cos \frac{\pi}{10} t \right]_0^{10} - \left[-\frac{2\pi}{10} \cos \frac{\pi}{10} t \right]_0^{10}$

$dA = -6.857 + c + 6.366 - c$

$dA = 9 \times 10^{-3} \approx 0.009 = A_1$

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

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

$= \left[2t + t^2 - \frac{2\pi}{10} \sin \frac{\pi}{10} t + c \right]_0^{10}$

$= \left(2(10) + (10)^2 - \frac{2\pi}{10} \sin \frac{\pi}{10} (10) + c \right) -$

$\left(2(0) + (0)^2 - \frac{2\pi}{10} \sin \frac{\pi}{10} (0) + c \right)$

$= (20 + 100 - 0.34 + c) - (0 - 0 - 0 + c)$

$= 20 + 100 - 0.34 + c - 0 + 0 + 0 - c$

$A_2 = 119.66$

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$$y = \int_0^{10} 2 \sin \frac{\pi}{10} t \, dt$$

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

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

$$\int_0^{10} 2 \sin \frac{\pi}{10} t \times \left(2 + 2 \frac{\pi}{10} \sin \frac{\pi}{10} t \right) dt$$

$$dy = \left[-\frac{20}{\pi} \cos \frac{\pi}{10} t \times \left(2t - 2 \cos \frac{\pi}{10} t \right) \right]_0^{10}$$

$$= \left[-\frac{20}{\pi} \cos \frac{\pi}{10} (0) \times 2(0) - 2 \cos \frac{\pi}{10} (0) \right] -$$

$$\left[-\frac{20}{\pi} \cos \frac{\pi}{10} (1) \times 2(1) - 2 \cos \frac{\pi}{10} (1) \right]$$

$$= -114.438 - 12.732$$

$$K = \underline{\underline{-127.17}}$$