

6-18)

$$f_5(x) = \sqrt{\frac{2}{L}} \sin\left(\frac{5\pi x}{L}\right)$$

$$a) \quad P = \int_{0.2L}^{0.4L} \left(\frac{2}{L}\right) \sin^2\left(\frac{5\pi x}{L}\right) dx$$

CHANGE VARIABLES $u = \frac{5\pi x}{L}$ $dx = \frac{L}{5\pi} du$

$$\begin{aligned} P &= \left(\frac{2}{L}\right) \left(\frac{L}{5\pi}\right) \int_{\pi}^{2\pi} \sin^2(u) du \\ &= \frac{2}{5\pi} \left\{ \frac{u}{2} - \frac{1}{4} \sin(2u) \right\}_{\pi}^{2\pi} \\ &= \frac{2}{5\pi} \cdot \frac{\pi}{2} = \underline{\underline{\frac{1}{5}}} \end{aligned}$$

$$b) \quad P = \int_{\frac{L-\Delta x}{2}}^{\frac{L+\Delta x}{2}} \left(\frac{2}{L}\right) \sin^2\left(\frac{5\pi x}{L}\right) dx$$

$$\approx (\Delta x) \cdot \left(\frac{2}{L}\right) \sin^2\left(\frac{5\pi}{2}\right)$$

$$= (0.01L) \cdot \left(\frac{2}{L}\right) \sin^2\left(\frac{5\pi}{2}\right) = \underline{\underline{0.02}}$$