

42. Repeating the steps of Eq. 17-34  $\longrightarrow$  Eq. 17-40, but applying

$$\cos \alpha + \cos \beta = 2 \cos \left( \frac{\alpha + \beta}{2} \right) \cos \left( \frac{\alpha - \beta}{2} \right)$$

(see Appendix E) instead of Eq. 17-37, we obtain

$$y' = [0.10 \cos \pi x] \cos 4\pi t$$

with SI units understood.

(a) For non-negative  $x$ , the smallest value to produce  $\cos \pi x = 0$  is  $x = 1/2$ , so the answer is  $x = 0.50$  m.

(b) Taking the derivative,

$$u' = \frac{dy'}{dt} = [0.10 \cos \pi x] (-4\pi \sin 4\pi t)$$

We observe that the last factor is zero when  $t = 0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, \dots$  which leads to the answers  $t = 0$ ,  $t = 0.25$  s, and  $t = 0.50$  s.