

Chapter 16

Problem 56

$$y(x,t) = (0.30 \text{ m}) \sin(2.00 \text{ m}^{-1}x - 628.00 \text{ s}^{-1}t)$$

a) How many crests pass an observer in 2.00 minutes?

From the equation $\omega = 628.00 \text{ s}^{-1}$

$$\therefore \text{The time period is } T = \frac{2\pi}{\omega} = \frac{2\pi}{628 \text{ s}^{-1}}$$

$$T = 0.0100 \text{ s}$$

in 2.00 minutes or 120s there will be

$$\frac{t}{T} = \frac{120 \text{ s}}{0.0100 \text{ s/cycle}} = \boxed{12,000 \text{ cycles}}$$

b) How far does the wave travel in 2 minutes?

from part a) the frequency is

$$f = \frac{1}{T} = \frac{1}{0.01 \text{ s/cycle}} = 100 \text{ Hz}$$

Wavelength is

$$\lambda = \frac{2\pi}{k} = \frac{2\pi}{2.00 \text{ m}^{-1}} = 3.14 \text{ m}$$

velocity is then

$$v = f \cdot \lambda = (100 \text{ Hz})(3.14 \text{ m}) = 314 \frac{\text{m}}{\text{s}}$$

distance traveled in 120s is

$$\Delta x = v \cdot t = (314 \text{ m/s})(120 \text{ s}) = \boxed{37,680 \text{ m}}$$