

# Chapter 16

## Problem 68

Tension  $F_T = 7.00\text{ N} = F_0$

velocity  $v_0 = 20.00\text{ m/s}$

What tension is needed for  $v_f = 25.00\text{ m/s}$

The original speed is related to tension by

$$v_0 = \sqrt{\frac{F_0}{\mu}} \rightarrow v_0^2 \cdot \mu = F_0 \quad \text{\#1}$$

The new speed or final speed is

$$v_f = \sqrt{\frac{F_f}{\mu}} \rightarrow v_f^2 \cdot \mu = F_f \quad \text{\#2}$$

The mass per length of the string is constant

$$\text{\#2} \div \text{\#1} \quad \frac{F_f}{F_0} = \frac{v_f^2 \cdot \mu}{v_0^2 \cdot \mu} = \frac{v_f^2}{v_0^2}$$

$$\therefore F_f = \left(\frac{v_f}{v_0}\right)^2 \cdot F_0$$

$$= \left(\frac{25.00\text{ m/s}}{20.00\text{ m/s}}\right)^2 \cdot (7.00\text{ N})$$

$$F_f = 10.94\text{ N}$$