P55

(a) What is the resultant force exerted by the two cables?

\[ T_1 = 60.0 \text{ N} \]
\[ T_2 = 60.0 \text{ N} \]

\[ \overrightarrow{R} = \overrightarrow{T_1} + \overrightarrow{T_2} \quad \text{resultant force} \]

\[ \begin{align*}
R_x &= T_1 \cos(135^\circ) + T_2 \cos 45^\circ \\
&= -T_1 \cos 45^\circ + T_2 \cos 45^\circ \\
&= 0 \quad \text{because} \ T_1 = T_2
\end{align*} \]

\[ R_y = T_1 \sin(135^\circ) + T_2 \sin 45^\circ \\
&= T_1 \sin 45^\circ + T_2 \sin 45^\circ \\
&= 2 \times 60.0 \text{ N} \times \sin 45^\circ \\
&= 84.85 \text{ N} \]

\[ R = \sqrt{R_x^2 + R_y^2} = R_y = 84.85 \text{ N} \]

\( R \) is in the \( y \) direction (in direction of \( R_y \)).

(b) What is the weight of the light?

Equilibrium \( \Rightarrow \Sigma F_y = 0 \)

\[ R_y - mg = 0 \]

\( \Rightarrow \quad mg = R_y = 84.85 \text{ N} \)

mg acts downward.
Ch 4

P 57

$v_0 = 7.0 \text{ m/s}$

$\mu_k = 0.050$

$m g = 600 \text{ N}$

How far to come to rest?

Newton's second law:

1. $\Sigma F_y = m a_y = 0 \quad (a_y = 0)$
2. $\Sigma F_x = m a_x \quad (a_x \text{ due to friction, slowing down})$

1. \[ n - m g = 0 \]
2. \[ -\mu_k n = m a_x \quad \text{using the fact} \quad F = \mu_k n \]

1 & 2 \Rightarrow \quad -\mu_k m g = m a_x

\[ a_x = -\mu_k g = -0.050 \times 9.8 \text{ m/s}^2 \]

\[ a_x = -0.49 \text{ m/s}^2 \]

Now solve for distance $\Delta x$

\[ v^2 = v_0^2 + 2a \Delta x \]

\[ 0 = v_0^2 + 2a \Delta x \]

\[ \Delta x = -\frac{v_0^2}{2a} \]

\[ \Delta x = -\frac{(7.0)^2}{2 \times 0.49} = \frac{50.0 \text{ m}}{} \]
Two boxes:

\[ m_1 = 10 \text{ kg} \quad m_2 = 20 \text{ kg} \]

on frictionless surface, light string, no applied force:

\[ F = 50 \text{ N} \]

(a) acceleration? tension?

\[ F = m_1 a = (m_1 + m_2) a \]

\[ a = \frac{F}{m_1 + m_2} = \frac{50 \text{ N}}{30 \text{ kg}} = 1.67 \text{ m/s}^2 \]

\[ \text{to find } T \text{ consider } m_1:\]

\[ T = m_1 a \]

\[ T = 10 \times 1.67 = 16.7 \text{ N} \]

(b) Repeat with friction \( \mu_k = 0.10 \)

\[ \Sigma F = m_1 a = (m_1 + m_2) a \]

\[ F - f_1 - f_2 = (m_1 + m_2) a \]

\[ F - \mu_k (m_1 + m_2) g = (m_1 + m_2) a \]

\[ \therefore a = \frac{F}{m_1 + m_2} - \mu_k g \]

\[ = 1.67 - 0.98 = 0.69 \text{ m/s}^2 \]

Find \( T \):

\[ T - f_1 = m_1 a \]

\[ T = f_1 + m_1 a \]

\[ = \mu_k m_1 g + m_1 a \]

\[ = 10 \text{ kg} \times (0.1 \times 9.8 + 0.69) = 16.7 \text{ N} \]
Ch 4
P67

2 people pull on a boat

\[ m = 200 \text{ kg} \]

\[ a_s = 1.52 \text{ m/s}^2 \text{ to the right} \]

\[ a_o = 0.518 \text{ m/s}^2 \text{ to the left} \]

what are the forces exerted by each person?

Newton 2nd law \( \Sigma F = ma \)

\[ F_1 + F_2 = ma_s = 304 \text{ N} \]  \( \text{(1)} \)

\[ F_1 - F_2 = ma_o = -103.6 \text{ N} \]  \( \text{(2)} \)

Add \( \text{(2)} \) to \( \text{(1)} \):

\[ 2F_1 = 304 - 103.6 \]

\[ F_1 = 160.2 \text{ N} \]

Subtract \( \text{(2)} \) from \( \text{(1)} \):

\[ 2F_2 = 304 + 103.6 \]

\[ F_2 = 203.8 \text{ N} \]