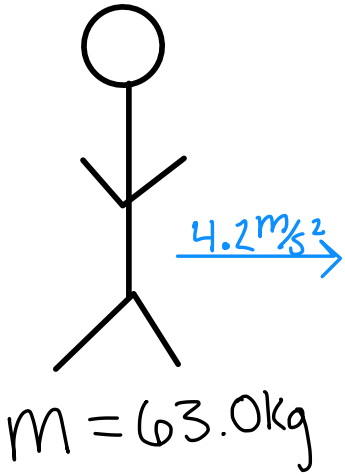
Forces Pt 2

Practice

A 63.0-kg sprinter starts a race with an acceleration of 4.20 m/s^2. What is the net external force on him?

$m = 63.0\,kg \quad a = 4.20\,m/s^2 \quad F_{net} = ?$

$F = m \cdot a = 63\,kg \cdot 4.2\,m/s^2 = 265\,N$



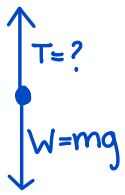
Suppose a 60.0-kg gymnast climbs a rope. (a) What is the tension in the rope if they climb at a constant speed? (b) What is the tension in the rope it they accelerate upward at a rate of 1.50 m/s?

$m = 60.0\,kg$

ⓐ $\Sigma F_y = ma_y \quad a = 0$

$T - mg = \cancel{ma_y}^{\,0}$

$T = mg = 60 \cdot 9.8 = 588\,N$



ⓑ $T - mg = ma_y \quad a_y = 1.50$

$T = ma_y + mg = 60kg \cdot 9.8\,m/s^2 + 60kg \cdot 1.5\,m/s^2$

$T = 678\,N$

30. (a) Find the magnitudes of the forces Fy and F2 that add to give the total force F tot shown in Figure 4.34. This may be done either graphically or by using trigonometry. (b) Show graphically that the same total force is obtained independent of the order of addition of Fj and F2. (c) Find the direction and magnitude of some other pair of vectors that add to give Ftot. Draw these to scale on the same drawing used in part (b) or a similar picture.

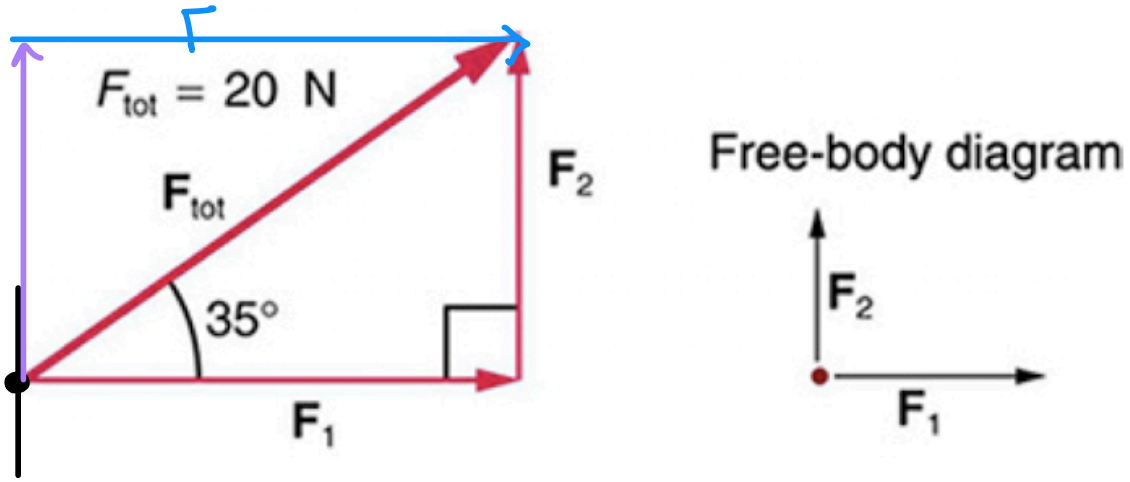


FIGURE 4.34

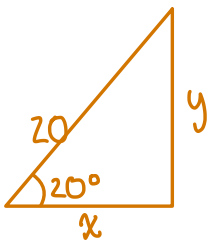
(a) $\cos\theta = \frac{F_1}{F_{tot}}$

$F_1 = F_{tot}\cos\theta = 20\,N \cdot \cos 35^\circ = 16.38\,N \approx 16\,N$

(c) $\cos\theta = \frac{a}{h}$ ←

$x = h \cdot \cos\theta = 20\,N \cdot \cos 20^\circ = 19$

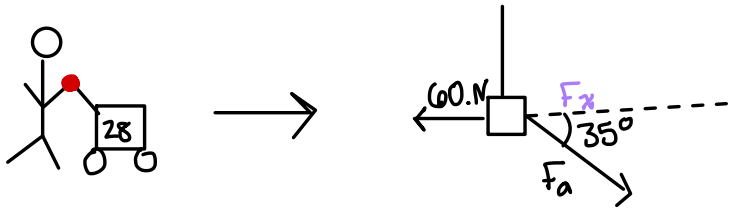
$y = h \cdot \sin\theta = 20\,N \cdot \sin 20^\circ = 6.8$



A nurse pushes a cart by exerting a force on the handle at a downward angle 35.0° below the horizontal. The loaded cart has a mass of 28.0 kg, and the force of friction is 60.0 N. (a) Draw a free-body diagram for the system of interest. (b) What force must the nurse exert to move at a constant velocity?

$\theta = 35°$ $m = 28.0\,kg$ $f = 60.0N$

(a)



(b) $a = 0$ $F_a = ?$

$\cos\theta = \frac{a}{h}$

$F_a = \frac{60.0}{\cos 35} = F_a = 73.2N$

$\Sigma F_x = ma = 0$

$F_{ax} - 60.0 = 0$

$[f_{ax}] = 60.0N$