

ave. = 5.5
 $\sigma = 3.0$

Quiz #5: Applying Newton's Laws

Problem 1 (2 points)

A fireman is sliding down a fire pole. As he speeds up, he tightens his grip on the pole, thus increasing the frictional force the pole exerts on the fireman. When the frictional force equals the weight of the fireman, what happens?

B

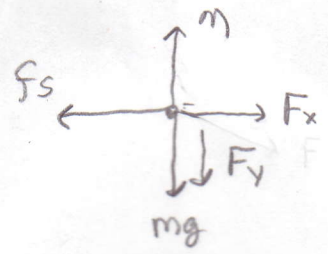
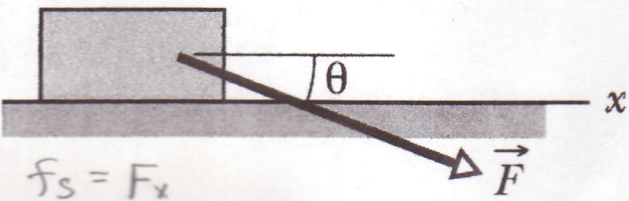
- a) The fireman comes to a stop.
- b) The fireman continues to descend, but with constant speed.
- c) The fireman descends with slower and slower speed.

once $\sum \vec{F} = 0$, then $\vec{a} = 0$
and velocity does not change

Problem 2 (3 points)

In the figure below, if the box is stationary and the angle θ of force \vec{F} is increased while the magnitude is kept constant, do the following quantities increase, decrease, or remain the same:

- (a) f_s ; (b) N ; (c) $f_{s,max}$?

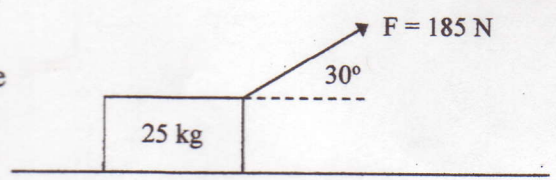


as θ increases,
 F_x decreases +
 F_y increases

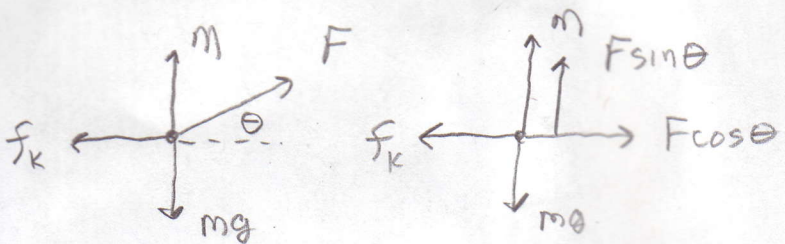
- (a) decrease (b) increase (c) increase

Problem 3 (5 points)

A 25 kg crate is being pulled to the right along a rough surface by a 185 N force acting at a 30° angle as shown in the figure. Friction is present and the coefficient of kinetic friction is $\mu_k = 0.40$.



- a) What is the normal force on the crate?



$$\sum F_y = m a_y = 0$$

$$n + F \sin \theta - mg = 0$$

$$n = mg - F \sin \theta$$

$$n = (25 \text{ kg})(9.80 \text{ m/s}^2) - (185 \text{ N}) \sin 30^\circ$$

- b) What is the magnitude of the acceleration of the crate?

$n = 152.5 \text{ N} = 1.5 \times 10^2 \text{ N}$

$$\sum F_x = m a_x$$

$$a_x = \frac{F \cos \theta - \mu_k n}{m}$$

$$F \cos \theta - f_k = m a_x$$

$$a_x = \frac{(185 \text{ N}) \cos 30^\circ - (0.40)(152.5 \text{ N})}{25 \text{ kg}}$$

$$F \cos \theta - \mu_k n = m a_x$$

$a_x = 4.0 \text{ m/s}^2$