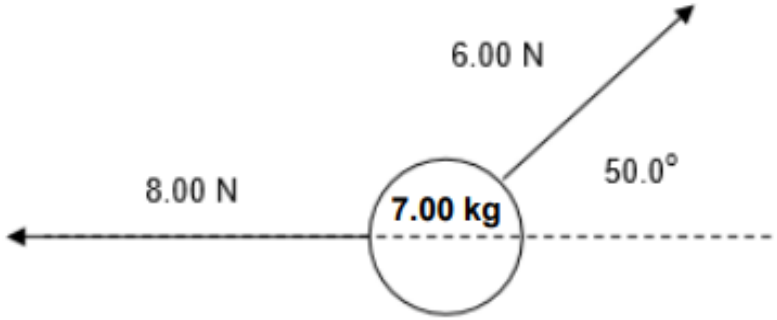
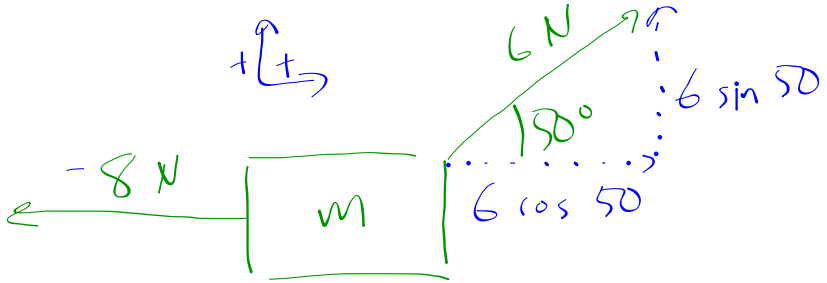
2. For this particle in space (there is no gravity), find the accelerations and directions (an angle) of the mass shown.




$$\Sigma F_x = ma_x$$

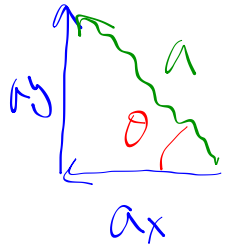
$$-8 + 6\cos 50 = ma_x$$

$$a_x = \frac{-8 + 6\cos 50}{m}$$

$$\Sigma F_y = ma_y$$

$$6\sin 50 = ma_y$$

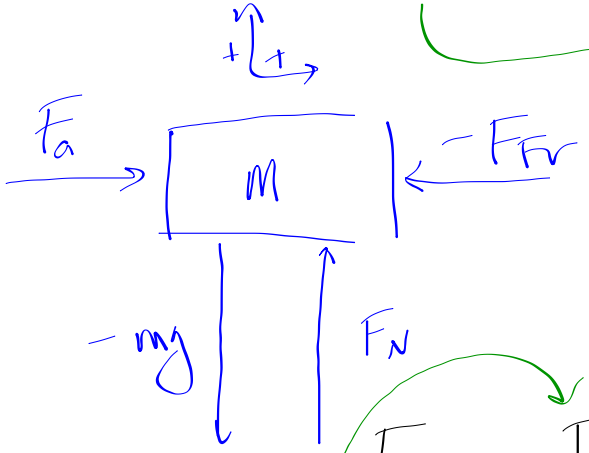
$$a_y = \frac{6\sin 50}{m}$$




$$a = \sqrt{a_x^2 + a_y^2}$$

$$\theta = \tan^{-1}\frac{a_y}{a_x}$$

3. (p. 67 #23) If the coefficient of kinetic friction between a 25-kg crate and the floor is 0.45, how much force is required to move the crate at a steady speed across the floor? How much force is required if $\mu_k$ is zero?




$\Sigma F_x = ma_x = 0$

$F_a + -F_{Fr} = ma_x = 0$

$\Sigma F_y = ma_y = 0$

$-mg + F_N = 0$

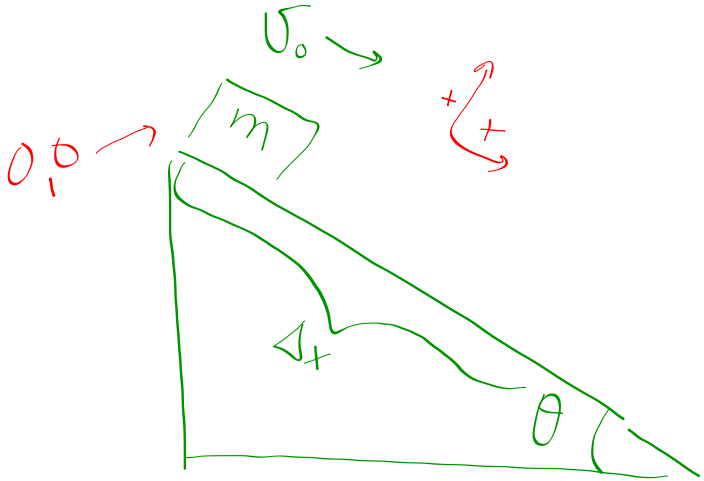
$F_N = mg$

$F_{Fr} = \mu F_N$

$F_{Fr} = F_a$

$F_a = \mu mg$

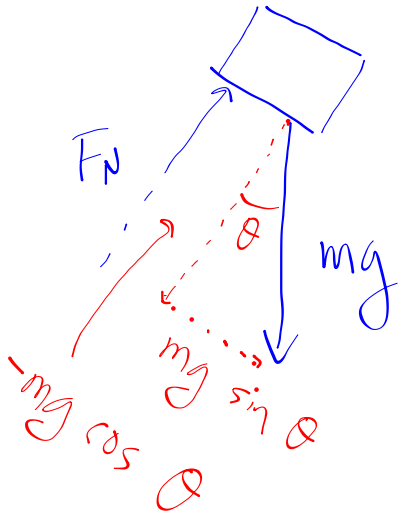
4. (p. 67 #28) A roller coaster reaches the top of the steepest hill with a speed of 5.0 km/h. It then descends the hill which is at an average angle of 45° and is 50-m long. What will its speed be when it reaches the bottom? Neglect friction. (Hint: what did you just learn about the component of gravity's acceleration down an incline?)




$$\Sigma F_x = ma_x$$

$$mg \sin\theta = ma_x$$

$$a_x = \boxed{g \sin\theta}$$




$x_0 = 0$

$x = x$ ✓

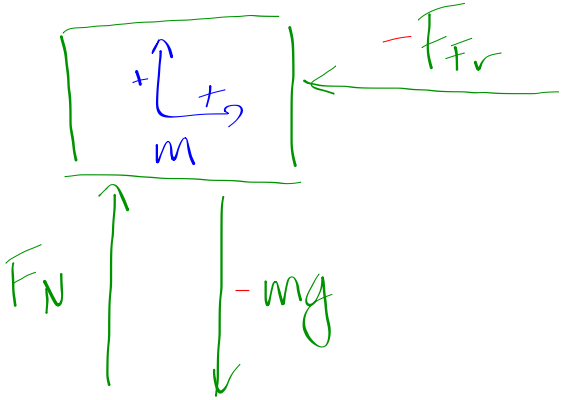
$v_0 = v_0$ ✓

$v = \square$

$a = g\sin\theta$

$t =$

6. (p. 67 #31) A box is given a push so that it slides across the floor. How far will it go, given that the coefficient of kinetic friction is 0.30 and the push imparts an initial speed of 3.0 m/s? $\Delta x$




$\Sigma F_x = ma_x$

$-F_{Fr} = ma_x$; $F_{Fr} = -ma_x$

$F_{Fr} = \mu F_N$

$\Sigma F_y = ma_y = 0$

$F_N + -mg = 0$

$F_N = mg$

$-ma_x = \mu mg$

$a_x = -\mu g$

$x_0 = 0$

$x = \square$

$v_0 = v_0$

$v = 0$

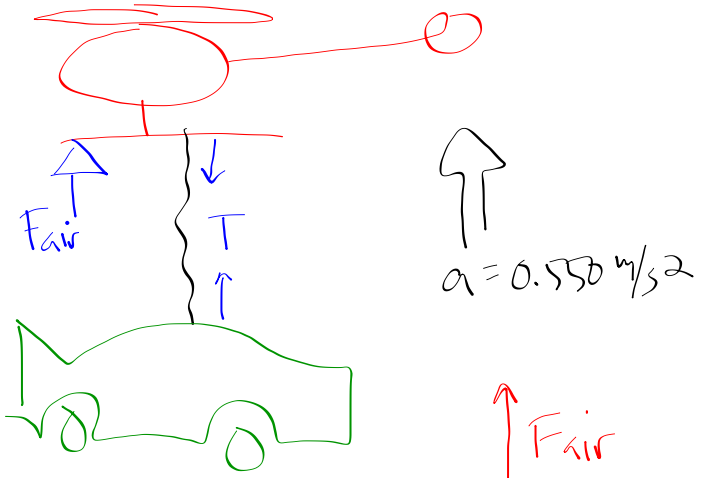
$a = -\mu g$

$t =$

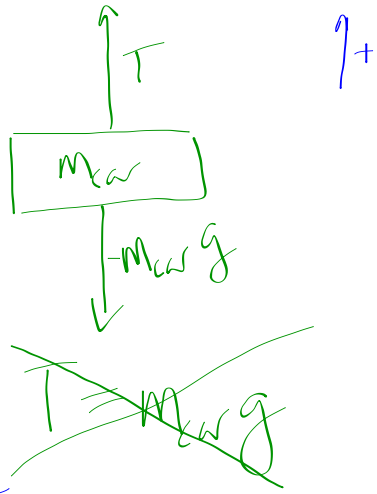
7. (p. 68 #36) A 5000-kg helicopter accelerates upward at 0.550 m/s$^2$ while lifting a 1500-kg car.

a) What is the lift force exerted by the air on the blades of the helicopter?

b) What is the tension in the cable (ignore its mass) that connects car to helicopter?








$\Sigma F_h = m_h a$

$F_{air} - m_h g - T = m_h a$

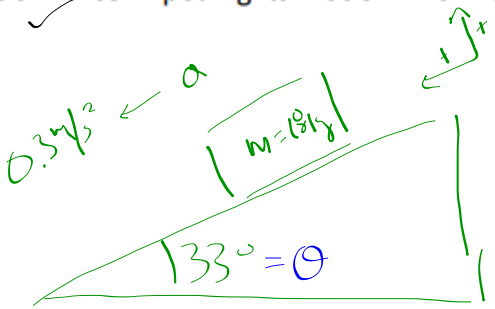
$F_{air} = m_h g + T + m_h a$ ✓

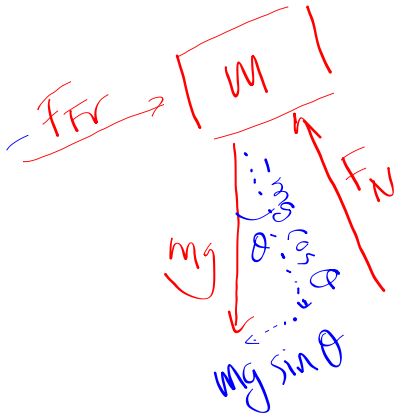
$\Sigma F_{car} = m_{car} a$

$T + -m_{car} g = m_{car} a$

$T = m_{car} g + m_{car} a$ ✓

8. (p. 68 #37) An 18.0-kg box is released on a 33.0° incline and accelerates down the incline at 0.300 m/s$^2$. Find the friction force impeding its motion. How large is the coefficient of friction?




$$\Sigma F_x = ma_x$$

$$-F_{Fr} + mg\sin\theta = ma_x$$

$$F_{Fr} = mg\sin\theta - ma_x$$

$$F_{Fr} = \mu F_N$$

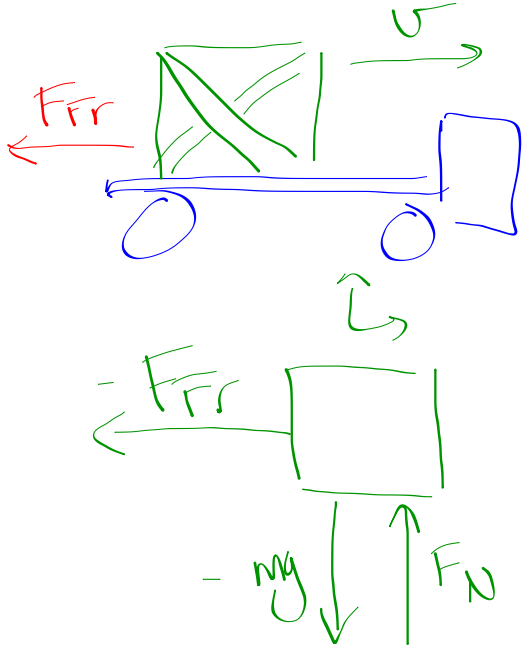
$$\Sigma F_y = ma_y = 0$$

$$-mg\cos\theta + F_N = 0$$

$$F_N = mg\cos\theta$$

$$\mu = \frac{mg\sin\theta - ma_x}{mg\cos\theta}$$

9. (p. 68 #46) A flatbed truck is carrying a 2800-kg crate of bananas. If the coefficient of static friction between the crate and the bed of the truck is 0.55, what is the maximum rate the driver can decelerate when coming to a stop in order to avoid burying himself in squished bananas if the crate were to hit the cab?




Objects will travel with a constant velocity unless there's an overall force.

$\Sigma F_x = ma_x$

$-F_{Fr} = ma_x$

$F_{Fr} = -ma_x$

$\Sigma F_y = ma_y = 0$

$-mg + F_N = 0$

$F_N = mg$

$F_{Fr} = \mu_s F_N$

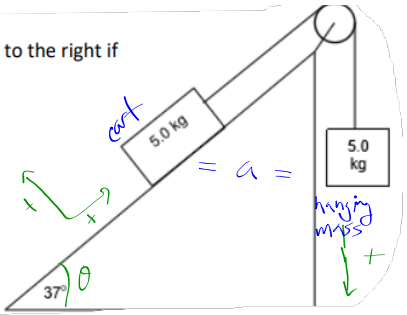
$-ma_x = \mu mg$

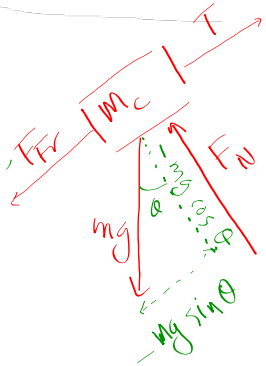
$a_x = -\mu g$

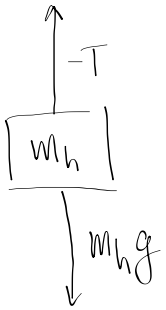
10. (p. 68 #49) What is the acceleration of the system shown in the diagram to the right if the kinetic coefficient of friction is 0.15?

ANSWERS:

1. 3.95 slugs
2. a = .884 m/sec$^2$; θ = 48.0° above the direction of the 8N force
3. 110.25 N; if μ is zero and the crate is already moving, no force is required
4. 26.4 m/s
5. 1.86 sec
6. 1.53 m
7. a) 6.73x10$^4$ N; b) 1.55x10$^4$ N
8. 90.7 N; .613
9. 5.39 m/s$^2$
10. 1.37 m/s$^2$




$\Sigma F_x = m_c a_{cx}$

$-F_{Fr} - m_c g\sin\theta + T = m_c a$

$\Sigma F = m_h a_h$

$-T + m_h g = m_h a$

$T = m_h g - m_h a$

$\Sigma F_y = m_c a_{cy} = 0$

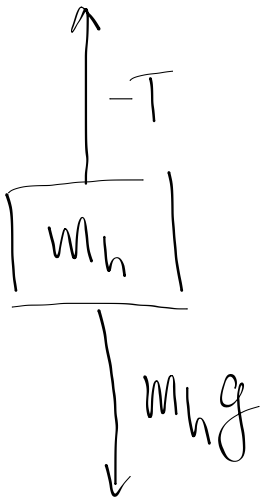
$-m_c g\cos\theta + F_N = 0$

$F_N = m_c g\cos\theta$

$F_{Fr} = \mu F_N$

$F_{Fr} = \mu m_c g\cos\theta$

$-\mu m_c g\cos\theta - m_c g\sin\theta + m_h g - m_h a = m_c a$




$T = m_h g$

$\Sigma F = ma$

$-T + mg = ma$

$T = mg - ma$

when $a = 0$ then