Homework problem 4.7

4.7 A person with a black belt in karate has a fist that has a mass of 0.70 kg. Starting from rest, this fist attains a velocity of 8.0 m/s in 0.15 s.

What is the magnitude of the average force applied to the fist to achieve this level of performance?

$$v = \cancel{v_0}^{\,0} + at = at$$

$$a = \frac{v}{t}$$

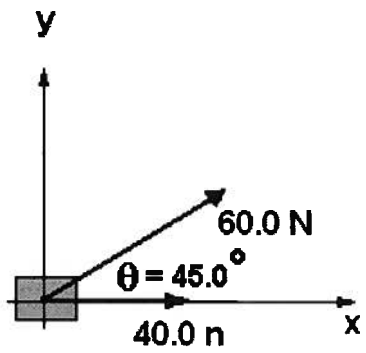
$$F = ma = \frac{m v}{t} = \frac{0.70\,kg * 8.0\,m/s}{0.15\,s}$$

$$F = \frac{0.70 * 8.0}{0.15} = \boxed{37 \text{ Newtons}}$$

Homework problem 4.13

4.13 Only two forces act on an object (mass = 3.00 kg), as in the drawing.

Find the magnitude and direction (relative to the x axis) of the acceleration of the object.



Problem 13

Add Forces then use $\vec{F} = m\vec{a}$

$\vec{F}_1 = 40\hat{x}$

$\vec{F}_2 = 60\cos 45^\circ \hat{x} + 60\sin 45^\circ \hat{y}$

$\vec{F} = \vec{F}_1 + \vec{F}_2 = (40 + 60\cos 45^\circ)\hat{x} + (60\sin 45^\circ)\hat{y}$

$\vec{F} = m\vec{a}$

$\vec{a} = \frac{\vec{F}}{m} = \left(\frac{40 + 60\cos 45^\circ}{3}\right)\hat{x} + \left(\frac{60\sin 45^\circ}{3}\right)\hat{y}$

$\vec{a} = 27.47\,\hat{x} + 14.14\,\hat{y}$

$\vec{a} = \sqrt{(27.47)^2 + (14.14)^2}\ \angle \tan^{-1}\left(\frac{14.14}{27.47}\right)$

$\vec{a} = 30.9\ \angle 27.2^\circ\ m/s^2$

Homework problem 4.21

4.21 A space travler whose mass is 115 kg leaves earth.

What are his weight and mass

a. on earth and
b. in interplanetary space where there are no nearby planetary objects?

$F = mg = \text{weight}$ Weight is a Force

a) on earth $g = 9.80$

$F = 9.80 * 115 = 1{,}127$ Newtons

Weight = 1,127 N

MASS = 115 kg

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b) IN SPACE (No gravity)

Weight = 0

mass = 115 kg

$1{,}127\ N = 1{,}127\ N * \frac{1\ Lb}{4.448\ N} = 253\ Lb$

Homework problem 4.43

4.43 A skater with an initial speed of 7.60 m/s is gliding across the ice. Air resistance is negligible.

a. The coefficient of kinetic friction between the ice and the skate blades is 0.100. Find the deceleration caused by kinetic friction.
b. How far will the skater travel before coming to rest?

Assume the skater is moving in the positive x direction.

The friction force opposes the motion

$$\vec{F} = -\mu_K F_N \hat{x}$$

F_N is the weight of the skater $F_N = mg$

$$\vec{F} = m\vec{a} =$$

$$-\mu_K mg\hat{x} = m\vec{a}$$

$$\vec{a} = -\mu_K g = -0.1 \times 9.8 = -0.980 \text{ m/s}^2$$

a) deceleration $= \boxed{|a| = 0.980 \text{ m/s}^2}$

b) What is x when $v = 0$

$$v^2 = v_0^2 + 2ax = 0$$

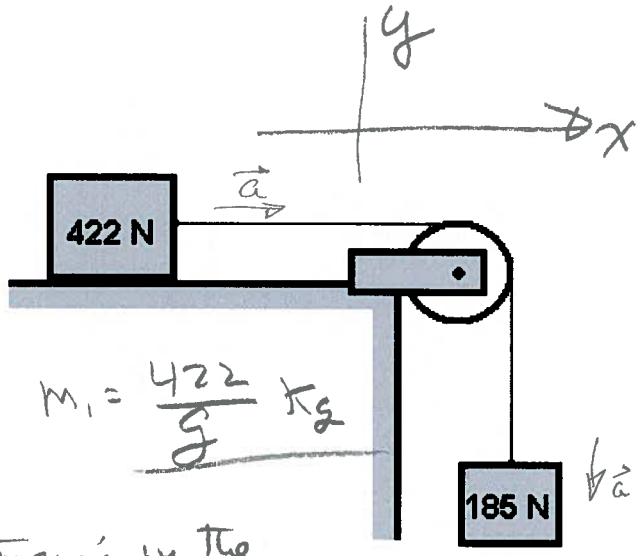
$$x = -\frac{v_0^2}{2a} = \frac{(7.60)^2}{2 \times 0.980} = 29.469$$

$$\boxed{x = 29.5 \text{ m}}$$

Homework problem 4.67

4.67 In the drawing, the weight of the block on the table is 422 N and that of the hanging block is 185 N. Ignoring all frictional effects and assuming the pulley to be massless, find

a. the acceleration of the two blocks and
b. the tension in the cord.



Problem 67

Block 1 (422 N) $m_1 g = 422\,N$ $m_1 = \frac{422}{g}\,kg$

$F = m_1 a_x = T$ = Tension in the Cord

Block 2. 185 N

Sum of the Forces $= T - m_2 g = m_2 a_y$

Since the cord connects the Blocks their accelerations have the same magnitude.

$a_x = -a_y = a$

$\therefore \quad m_1 a_x = T = m_1 a$

$T - m_2 g = m_2 a_y = -m_2 a$

$T - m_2 g = -m_2 a$

$T = m_2 g - m_2 a$

also $T = m_1 a$

Equating T $\quad m_1 a = m_2 g - m_2 a$

$$(m_1 + m_2) a = m_2 g$$

$$a = \frac{m_2 g}{m_1 + m_2}$$

$$= \frac{185}{185 + 422} g$$

$$= 2.9868$$

a) $a = 2.99\ m/s^2$

b) $T = m_1 a = \frac{422 \times 2.9}{g}$

$T = 129\,N$