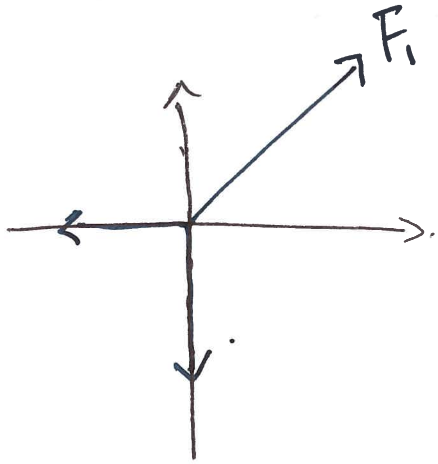
Homework (Week-6) Solutions.

Ch: 5.

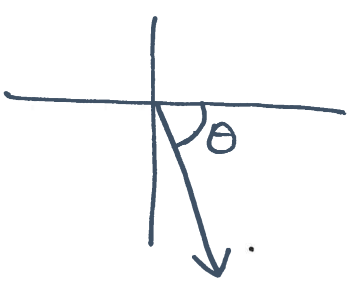
Problem 20:



$$\vec{F}_{net} = \vec{F_1} + \vec{F_2} + \vec{F_3} \quad \text{(Add respective components)}$$

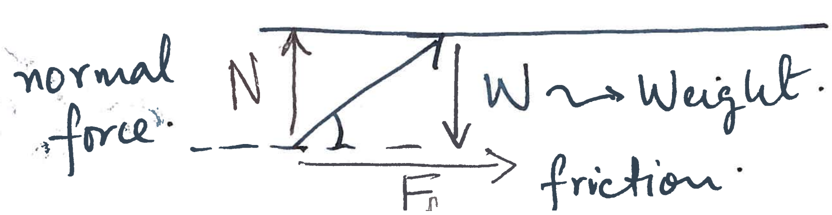
$$= 100\hat{i} - 300\hat{j}$$

$$|\vec{F}_{net}| = \sqrt{(100^2) + (-300)^2}$$



$$\theta = \tan^{-1}\left(\frac{300}{100}\right) = \tan^{-1}(3).$$

Problem 70:



Problem 80:

$$\vec{F}_{net} = \vec{F}_1 + \vec{F}_2 + \vec{F}_3.$$

$$= (50 \cos 37^\circ)\,\hat{i} + 50 \sin(37^\circ)\,\hat{j} + (-30 \cos 30^\circ)\,\hat{j}$$

$$- 30 \sin 30^\circ\,\hat{i} - 80\,\hat{i}.$$

$$\vec{F}_{net} = 39.93\hat{i} + 30.09\hat{j} - 25.98\hat{j} - 15\hat{i} - 80\hat{i}.$$

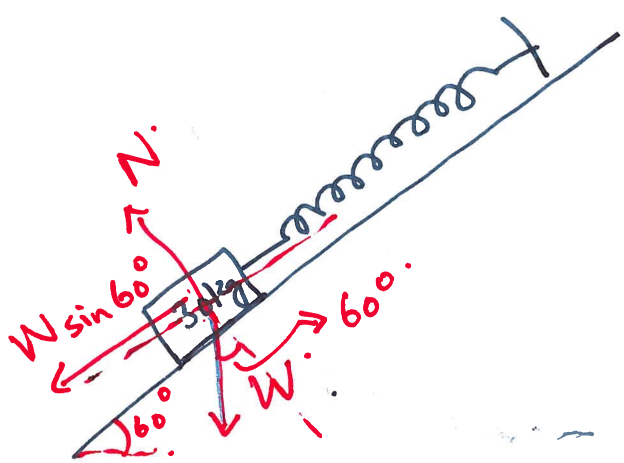
$$\vec{a} = \frac{\vec{F}_{net}}{m} = \frac{1}{2}(\vec{F}_{net}) = -27.53\hat{i} + 4.11\hat{j}.$$

$$\vec{V}(t) = 3\hat{i} + \frac{1}{2}(\vec{F}_{net})(10).$$

at $t = 10$.

$$\vec{x}(t) = 3t\,\hat{i} + \frac{1}{4}\vec{F}_{net}(10)^2.$$

Problem 88:



W has a component along the ramp which.

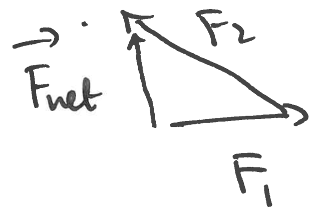
$$W \sin 60^\circ = kx.$$

$$k = \frac{W \sin 60^\circ}{x}$$

$$= \frac{30 \times 10 \times \sin 60^\circ}{0.05} = 5196.15 \text{ N/m}$$

Problem 100:

$$\vec{F}_{net} = 10\hat{j}.$$



$$\vec{F}_1 = 12\hat{i}.$$

$$\vec{F}_2 = \vec{F}_{net} - \vec{F}_1.$$
$$= 10\hat{j} - 12\hat{i}$$
$$\vec{F}_2 = -12\hat{i} + 10\hat{j}.$$

$$|\vec{F}_2| = \sqrt{(12)^2 + (10)^2}.$$
$$= 15.62\,N.$$

Problem 106:

Direction of the retarding force is to the left.

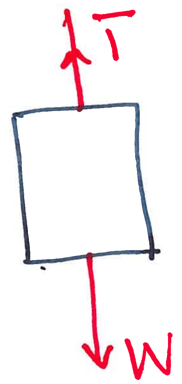
$$F_{retarding} = ma.$$

$$a = \frac{v_f^2 - v_i^2}{2(\Delta x)} = \frac{0^2 - (350)^2}{2(0.34)} = -180147.05\,N/kg$$

$$F_{retarding} = -1801.47\,N.$$

Ch 6: (Chapter 6)

Problem 37:



(a) $T - W = ma$

$T = W + ma = (1700)(10) + (1700)(1.20) = 19040\,N.$

(b) $T = W$ if $a = 0.$

(c) $W - T = ma$

$T = -ma + W$

$= 17000 - \frac{2040}{2} = 15{,}800\,N.$

$+ 180 = 15{,}980\,N.$

(d) Distance covered while accelerating

is $\Delta y_1 = \frac{1}{2}(1.20)(1.5)^2$

$v_f = 0 + (1.20)(1.5)$ velocity at end of acceleration.

Distance covered moving at constant velocity

$\Delta y_2 = (1.20)(1.5)(8.50)$

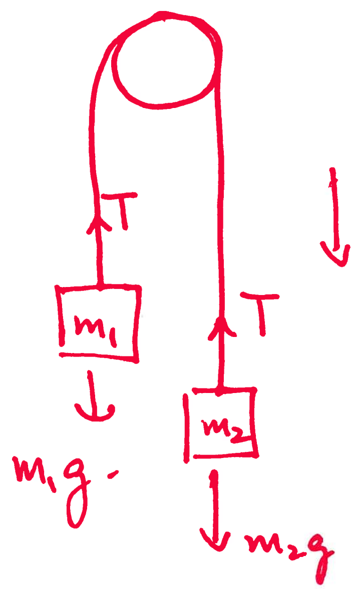
$$\Delta y_3 = (1.20)(1.5) - \frac{1}{2}(0.6)(3)^2$$

Total height above starting point is:

$$h = \Delta y_1 + \Delta y_2 + \Delta y_3$$

Problem 42:

Important point: Tension in the string is the same for both masses.



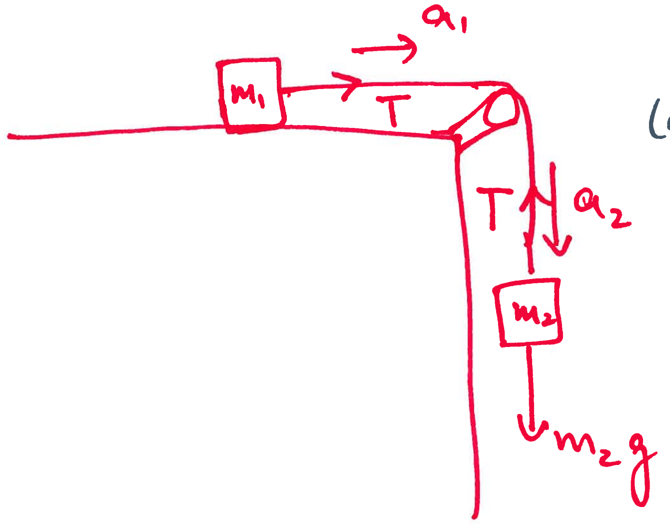
assume system is moving down.

$$\Rightarrow \left.\begin{aligned} m_2 g - T &= m_2 a \\ T - m_1 g &= m_1 a \end{aligned}\right\}$$

$$\Rightarrow a = \frac{(m_2 - m_1)g}{(m_1 + m_2)}.$$

Rest is just plugging in values.

Problem 43:



(a) For m_1: $T = m_1 a$.

For m_2: $m_2 g - T = m_2 a$.

$$\Rightarrow a = \frac{m_2 g}{(m_1 + m_2)}$$

$$a = \frac{10}{5} = 2$$

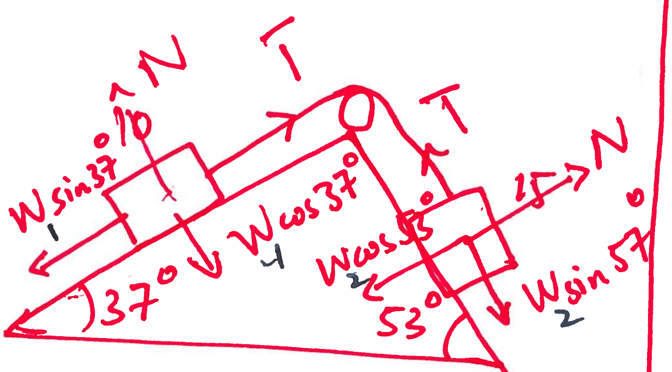
(b) $T = \dfrac{m_1 m_2 g}{(m_1 + m_2)} = 8N$.

(c) $V_f = \sqrt{2a\Delta y}$.

$$V_f = \sqrt{2a(1.0)}$$

$$= \sqrt{2(2)(1.0)} = 2 m/s$$

Problem 44:



$\cancel{T} - W_1 \sin 37° = m_1 a$ $m_1 = 10 kg$

$W_2 \sin 53° - \cancel{T} = m_2 a$. $m_2 = 15 kg$.

$$\frac{W_2 \sin 53° - W_1 \sin 37°}{m_1 + m_2} = a$$

$$\frac{-10g \sin 37° + 15g \sin 53°}{25} = a$$

$T = m_1 a + m_1 g \sin 37°$

To calculate tension | Use acceleration from previous part