

Problem 1 $v_x = 500 \cos 60^\circ = 250 \text{ m/s}$ $v_{yi} = 500 \sin 60^\circ = 433 \text{ m/s}$

(A) Solve for v_y at the ground: $v_{yf}^2 = v_{yi}^2 - 19.6\Delta y = (433)^2 - 19.6(-380) \rightarrow v_{yf} = -441.5 \text{ m/s}$

Now use to find t : $v_{yf} = v_{yi} - 9.8t \rightarrow -441.5 = 433 - 9.8t \rightarrow t = \underline{\underline{89 \text{ sec}}}$

(B) $\Delta x = v_x t = 250(89) = \underline{\underline{2.23 \times 10^4 \text{ m}}}$

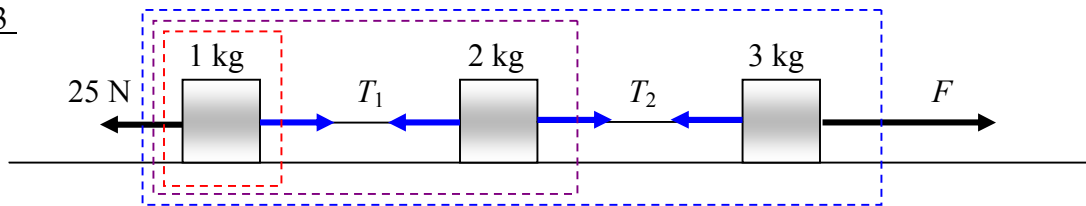
Problem 2

	<u>x components</u>	<u>y components</u>
170 SE	$170 \cos 315^\circ = 120.2$	$170 \sin 315^\circ = -120.2$
60 E	$60 \cos 0^\circ = 60$	$60 \sin 0^\circ = 0$
40 at 20° N of E	$40 \cos 20^\circ = 37.6$	$40 \sin 20^\circ = 13.7$
TOTAL	217.8 miles	-106.5 miles

Magnitude $R^2 = 217.8^2 + (-106.5)^2 \rightarrow R = \underline{\underline{242.4 \text{ miles}}}$

Direction $\theta = \tan^{-1}(-106.5/217.8) = \underline{\underline{-26^\circ}}$ or **26° south of east**

Problem 3



(A) $F_{net} = F - 25 \text{ N} = (1 \text{ kg} + 2 \text{ kg} + 3 \text{ kg})(8.0 \text{ m/s}^2) \rightarrow F = \underline{\underline{73 \text{ N}}}$

(B) $F_{net} = T_1 - 25 \text{ N} = (1 \text{ kg})(8.0 \text{ m/s}^2) \rightarrow T_1 = \underline{\underline{33 \text{ N}}}$

(C) $F_{net} = T_2 - 25 \text{ N} = (1 \text{ kg} + 2 \text{ kg})(8.0 \text{ m/s}^2) \rightarrow T_2 = \underline{\underline{49 \text{ N}}}$

Problem 4

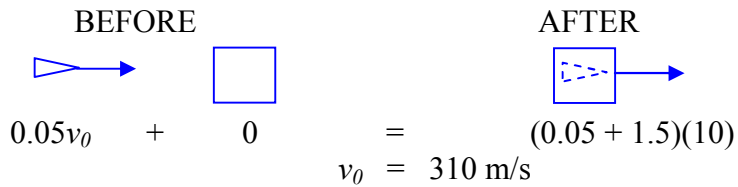
(A) $E_O = \frac{1}{2}kx^2 = \frac{1}{2}(600)(0.4) = \underline{\underline{48 \text{ J}}}$

(B) Energy loss $\Delta E = W_f = -\mu mg\Delta x = -(0.33)(2.5)(9.8)(2.0) = -16.17 \text{ J}$

$E_Q = E_O + \Delta E = 48 - 16.17 = \underline{\underline{31.83 \text{ J}}}$

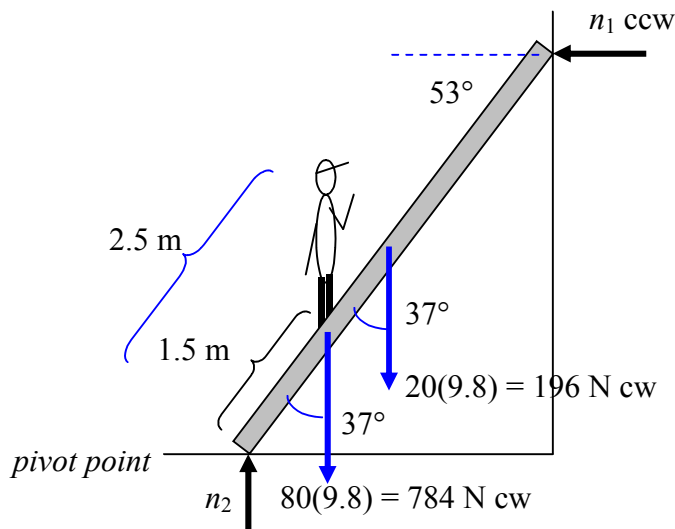
(C) $E_Q = mgh \rightarrow 31.83 = (2.5)(9.8)h \rightarrow h = \underline{\underline{1.3 \text{ m}}}$

Problem 5



- (A) $\Delta p_{target} = m_{target}\Delta v_{target} = 1.5(10 - 0) = \underline{\underline{+15 \text{ kg}\cdot\text{m/s}}}$
- (B) $\Delta p_{bullet} = m_{bullet}\Delta v_{bullet} = 0.05(10 - 310) = \underline{\underline{-15 \text{ kg}\cdot\text{m/s}}}$
- (C) $v_0 = \underline{\underline{310 \text{ m/s}}}$

Problem 6



- (A) CW = CCW $\rightarrow 1.5(784)\sin 37^\circ + 2.5(196)\sin 37^\circ = 5n_1 \sin 53^\circ \rightarrow n_1 = \underline{\underline{251 \text{ N}}}$
- (B) UP = DOWN $\rightarrow n_2 = 784 + 196 = \underline{\underline{980 \text{ N}}}$

Problem 7 $\omega_i = 400 \text{ rpm} = 400(2\pi)/60 = 41.89 \text{ rad/s}$, $\omega_f = 0$, $t = 60 \text{ sec}$

- (A) $\omega_f = \omega_i + at \rightarrow \alpha = \underline{\underline{-0.698 \text{ rad/s}^2}}$
- (B) $\Delta\theta = \frac{1}{2}(\omega_i + \omega_f)t = \frac{1}{2}(400 \text{ rpm} + 0)(1 \text{ min}) = \underline{\underline{200 \text{ rev}}}$
- (C) $\tau_{net} = I\alpha = (0.0648)(-0.698) = \underline{\underline{-0.0452 \text{ N}\cdot\text{m}}}$

Problem 8

(A) $v_{max} = \omega A \rightarrow \omega = \underline{\underline{16 \text{ rad/s}}}$

(B) $\omega = \sqrt{k/m} \rightarrow k = m\omega^2 = 0.5(16)^2 = \underline{\underline{128 \text{ N/m}}}$

(C) $T = 2\pi/\omega = \underline{\underline{\pi/8 \text{ sec}}}$ or $\underline{\underline{0.39 \text{ sec}}}$

(D) $F_{max} = kA = 128(0.40) = \underline{\underline{51.2 \text{ N}}}$

Problem 9 $f_o = f_s(v - v_o)/(v - v_s) = 780(331 + 32)/(331 - 30) = \underline{\underline{941 \text{ Hz}}}$

Problem 10

(A) $T = 57^\circ + 273 = 330 \text{ K}$

$$W_{isothermal} = nRT \ln(V_i/V_f) = 2.0(8.31)(330) \ln(1/2) = \underline{\underline{-3.80 \times 10^3 \text{ J}}}$$

(B) *Isothermal process* $\rightarrow \Delta U = 0 = Q + W$, so $Q = -W$

$$\Delta S = Q/T = -W/T = \underline{\underline{+11.5 \text{ J/K}}}$$

