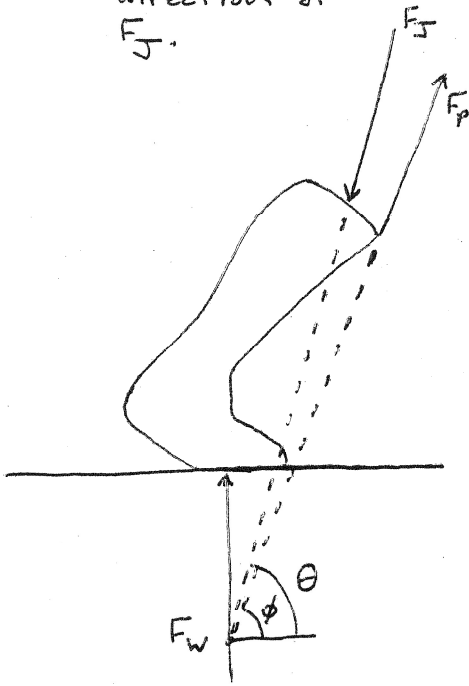
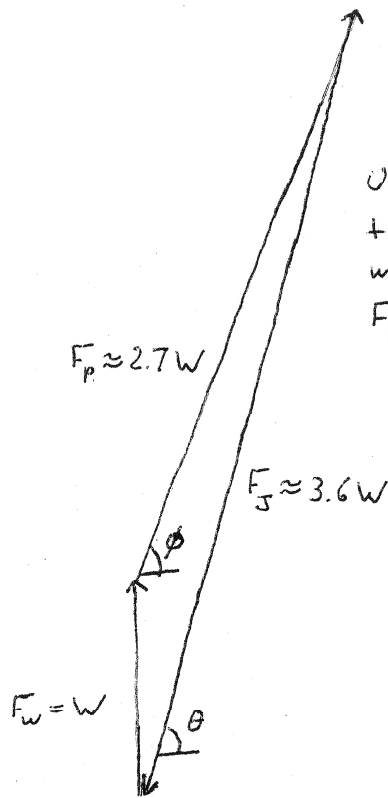


2.1

Find point of concurrency to determine the direction of F_J .



Use a vector diagram to estimate the magnitude of F_J and F_P .



2.2

$$\sum M_H = I_H \alpha$$

$$(I_{HAT})_{Hip} \alpha = T_H - d_{HAT} m_{HAT} g$$

$$T_H = (I_{HAT})_{Hip} \alpha + d_{HAT} m_{HAT} g$$

$$(I_{HAT})_{Hip} = (k_{HAT})_{Hip}^2 m_{HAT}$$

$$(k_{HAT})_{Hip} = .621 \times .52 \times 1.8 = 0.581 \text{ m}, \quad m_{HAT} = .678 \times 70 = 47.46 \text{ kg}$$

$$d_{HAT} = .374 \times .52 \times 1.8 = .350 \text{ m}$$

$$(I_{HAT})_{Hip} = .581^2 \times 47.46 = 16.02 \text{ kg} \cdot \text{m}^2$$

$$T_H = 16.02 \times 3 + .350 \times 47.46 \times 9.81 = 48.1 + 162.9 = 211.0 \text{ N} \cdot \text{m}$$

2-3

About the hip

$$\sum M_H = I_H \alpha$$

$$T_H - m_T g d_T - m_{LL} g (d_{LL} + l_T) = (I_T + I_{LL})_H \alpha$$

$$(I_{LL})_H = (I_{LL})_{cm} + (l_T + d_{LL})^2 m_{LL}$$

$$T_H = ((I_T)_H + (I_{LL})_{cm} + (l_T + d_{LL})^2 m_{LL}) \alpha + m_T g d_T + m_{LL} g (d_{LL} + l_T)$$

$$T_H = (.4 + .05 + 5(.40 + .20)^2)(2) + (8)(9.81)(.18) + (5)(9.81)(.20 + .40)$$

$$T_H = 48 \text{ N} \cdot \text{m}$$

For the lower leg

$$\sum F_y = m_{LL} (a_{LL})_y$$

$$F_{Ky} - m_{LL} a_G = m_{LL} (l_T + d_{LL}) \alpha$$

$$F_{Ky} = m_{LL} (l_T + d_{LL}) \alpha + m_{LL} a_G$$

$$F_{Ky} = 5(.4 + .2)(2) + 5(9.81)$$

$$F_{Ky} = 55 \text{ N}$$

About the mass center of the lower leg

$$\sum M_{GL} = I_{GL} \alpha = T_K - d_{LL} F_{Ky}$$

$$T_K = I_{GL} \alpha + d_{LL} F_{Ky}$$

$$T_K = 5(2) + .2(55)$$

$$T_K = 11 \text{ N} \cdot \text{m}$$

2-4

About the hip

$$\sum M_H = I_H \alpha$$

$$T_H + m_T d_T (a_T - a_G) + m_{LL} (l_T + d_{LL}) (a_{LL} - a_G) = (I_T + I_{LL})_H \alpha$$

$$a_T = \alpha d_T \quad a_{LL} = a_K = \alpha l_T$$

$$(I_{LL})_H = (I_{LL})_{cm} + m_{LL} (l_T + d_{LL})^2$$

$$T_H = [I_T + (I_{LL})_{cm} + m_{LL} (l_T + d_{LL})^2] \alpha - m_T d_T (\alpha d_T - a_G) - m_{LL} (l_T + d_{LL}) (\alpha l_T - a_G)$$

$$T_H = [.4 + .05 + 5(.4 + .2)^2](3) - (8)(.18)[(3)(.18) - 9.81] - 5(.4 + .2)[(3)(.4) - 9.81]$$

$$T_H = 46 \text{ N} \cdot \text{m}$$

For the lower leg

$$\sum F_y = m_{LL} (a_{LL})_y \quad a_K = \alpha l_T$$

$$F_{Ky} = m_{LL} \alpha l_T + m_{LL} a_G = m_{LL} (\alpha l_T + a_G)$$

$$F_{Ky} = 5[3(.4) + 9.81]$$

$$F_{Ky} = 55 \text{ N}$$

About the mass center of the lower leg

$$\sum M_{GL} = I_{GL} \alpha = T_K - d_{LL} F_{Ky}$$

$$T_K = I_{GL} \alpha + d_{LL} F_{Ky}$$

$$T_K = .05(3) + .2(55)$$

$$T_K = 11 \text{ N} \cdot \text{m}$$