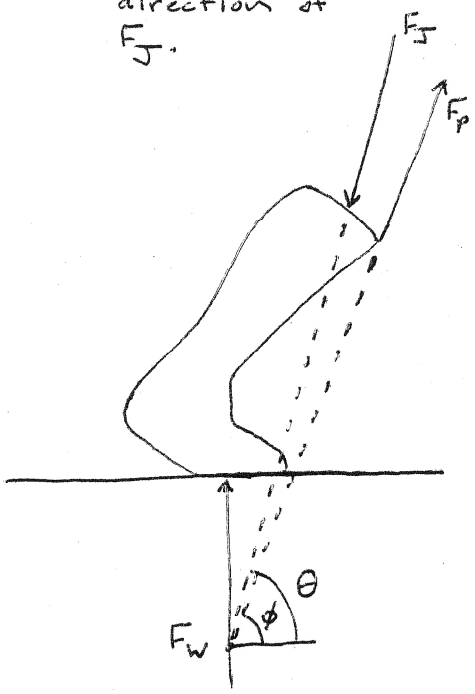
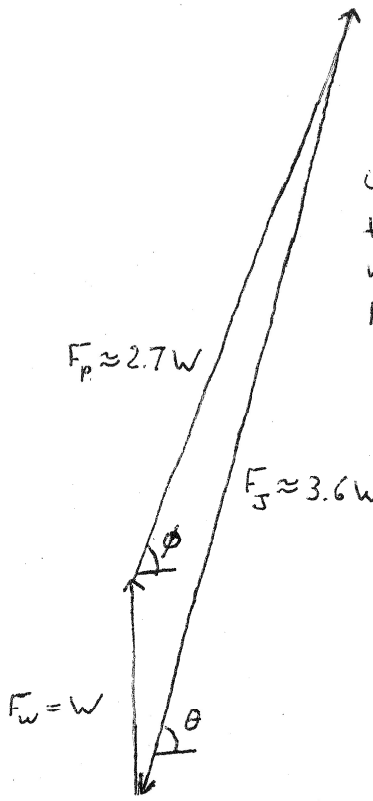
2.1

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

$$\sum M_H = I_H \alpha$$

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

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

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

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

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

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

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

2-3

About the hip

$$\sum M_H = I_H \alpha$$

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

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

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

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

$$T_H = 48\ N \cdot m$$

For the lower leg

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

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

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

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

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

About the mass center of the lower leg

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

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

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

$$T_K = 11\ N \cdot m$$