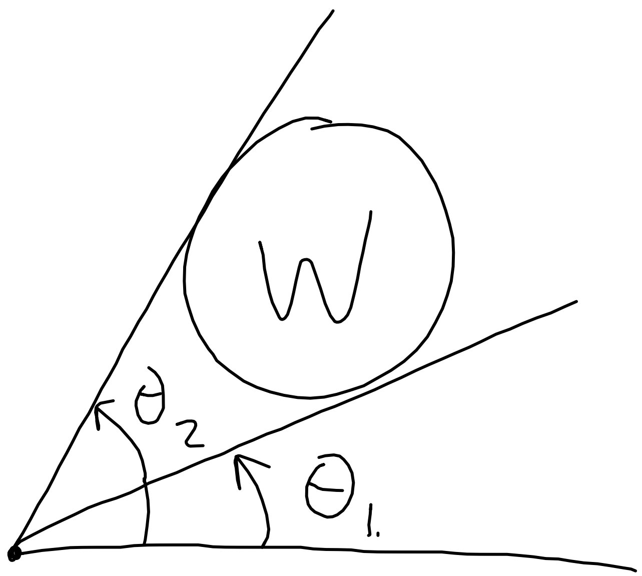
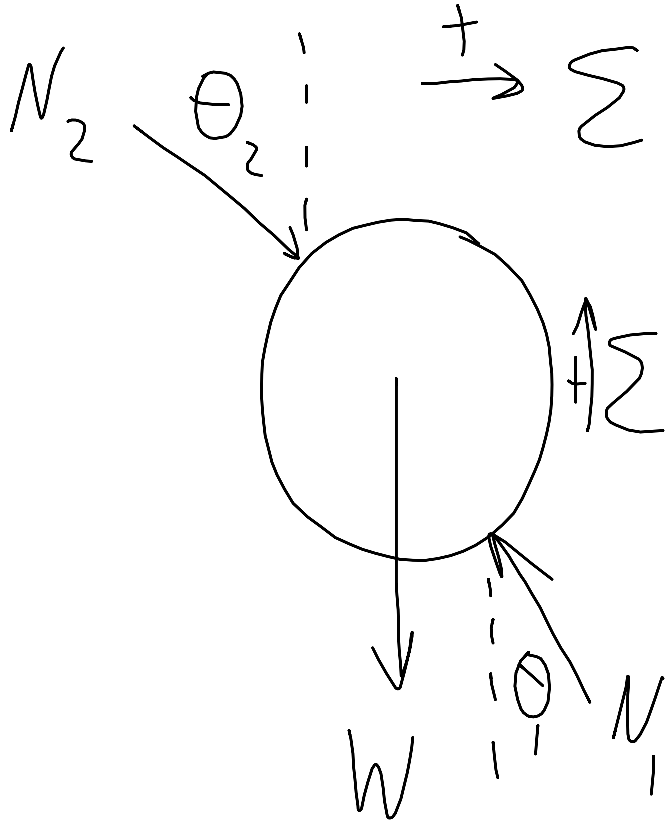


Find N_1 & N_2 as functions of θ_1 & θ_2 for equil

No friction



$$\xrightarrow{+} \sum F_x = N_2 \sin\theta_2 - N_1 \sin\theta_1 = 0$$

$$+\uparrow \sum F_y = N_1 \cos\theta_1 - N_2 \cos\theta_2 - W = 0$$

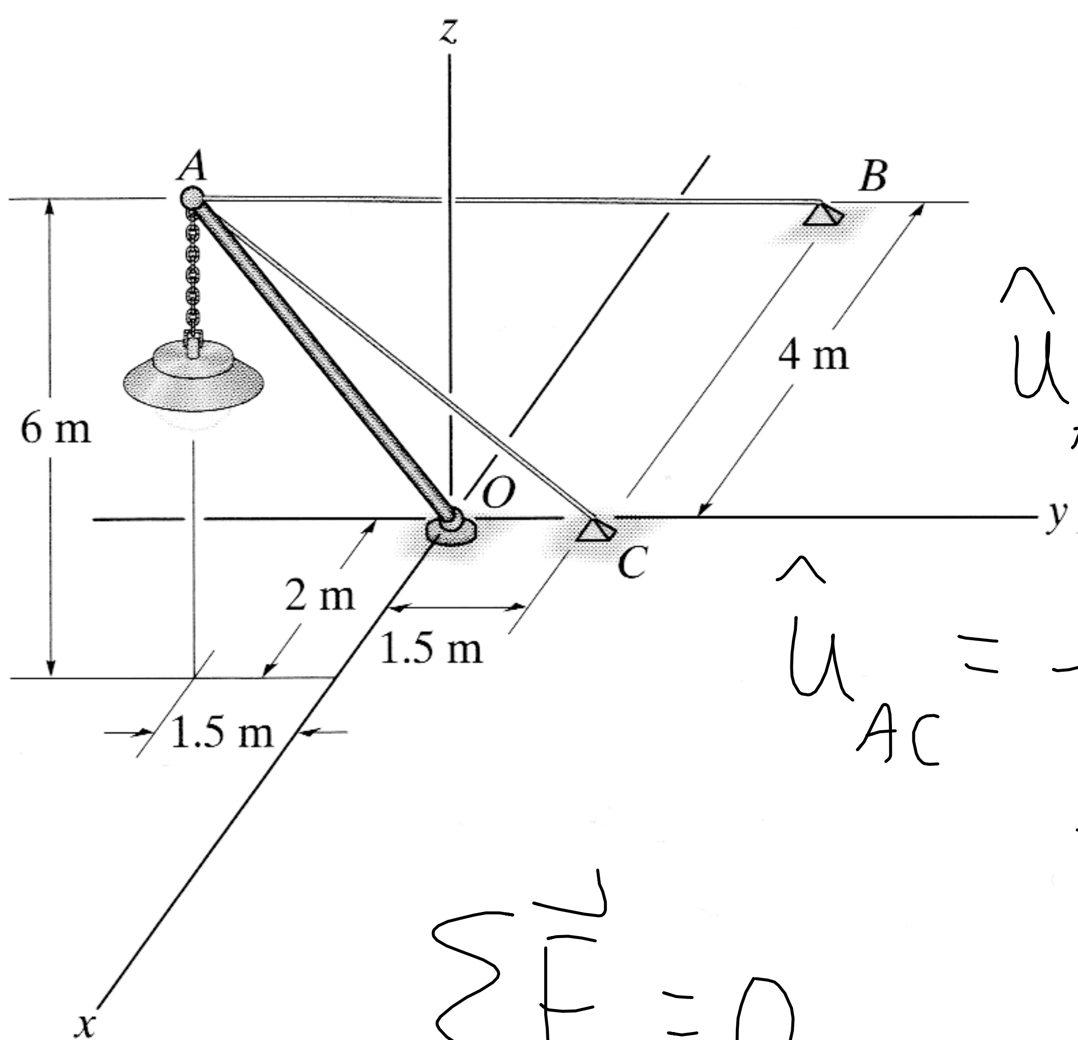
$$N_2 = \frac{N_1 \sin\theta_1}{\sin\theta_2}$$

$$N_1 \cos\theta_1 - \frac{N_1 \sin\theta_1}{\sin\theta_2} \cos\theta_2 = W$$

$$N_1 \left[\underbrace{\cos\theta_1 \sin\theta_2 - \sin\theta_1 \cos\theta_2}_{\sin(\theta_2 - \theta_1)} \right] = W \sin\theta_2$$

$$N_1 = \frac{W \sin\theta_2}{\sin(\theta_2 - \theta_1)} , \quad N_2 = \frac{W \sin\theta_1}{\sin(\theta_2 - \theta_1)}$$

3–74. The lamp has a mass of 15 kg and is supported by a pole AO and cables AB and AC. If the force in the pole acts along its axis, determine the forces in AO, AB, and AC for equilibrium.



$$\hat{u}_{OA} = \frac{2\hat{i} - 1.5\hat{j} + 6\hat{k}}{6.5}$$

$$\hat{u}_{AB} = \frac{-6\hat{i} + 3\hat{j} - 6\hat{k}}{9}$$

$$\hat{u}_{AC} = \frac{-2\hat{i} + 3\hat{j} - 6\hat{k}}{7}$$

$$\sum \vec{F}_A = 0$$

$$\hat{i}: \quad F_A\left(\frac{2}{6.5}\right) + F_B\left(\frac{-6}{9}\right) + F_C\left(\frac{-2}{7}\right) = 0$$

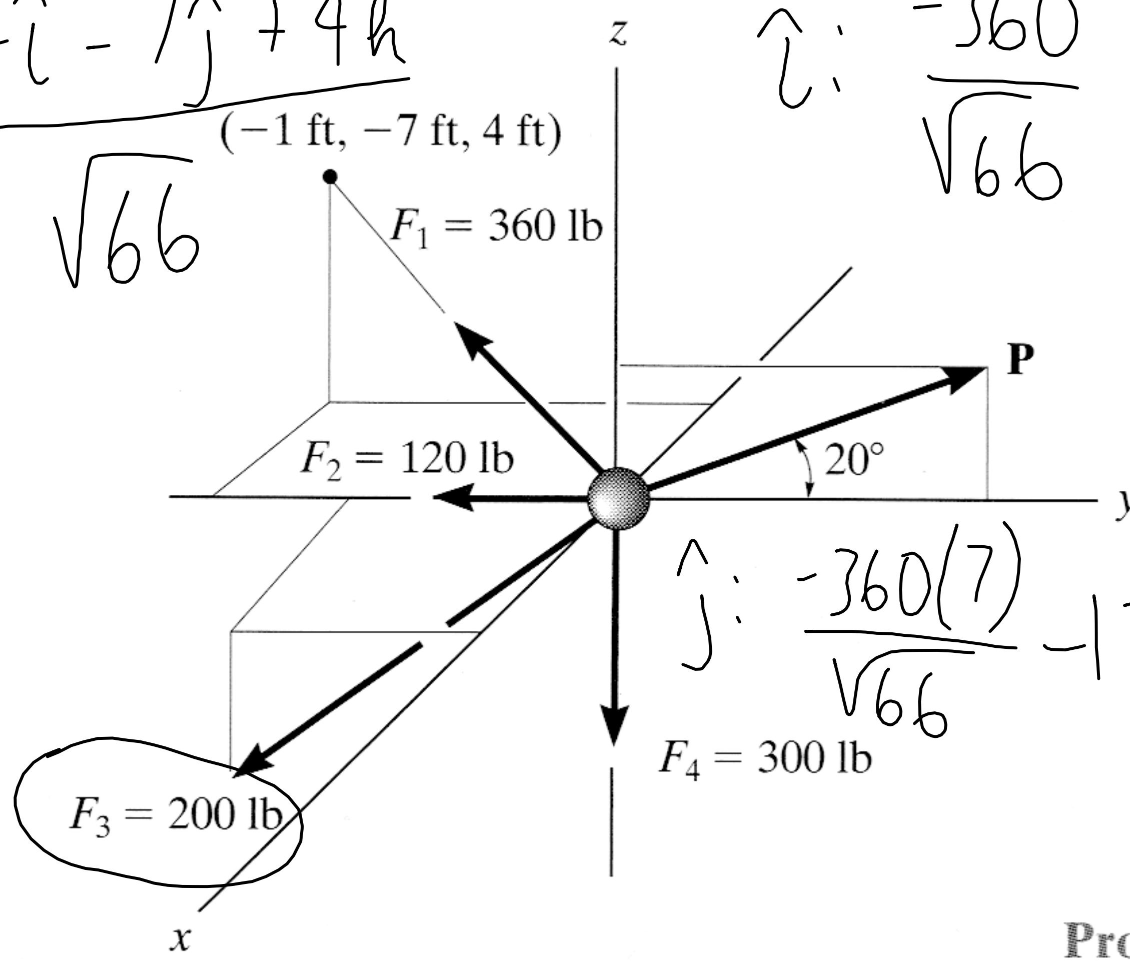
$$\hat{j}: \quad F_A\left(\frac{-1.5}{6.5}\right) + F_B\left(\frac{3}{9}\right) + F_C\left(\frac{3}{7}\right) = 0$$

$$\hat{k}: \quad F_A\left(\frac{6}{6.5}\right) + F_B\left(\frac{-6}{9}\right) + F_C\left(\frac{-6}{7}\right) = 15(9.81)$$

$F_A = 318.8 \quad F_B = 110.4 \quad F_C = 85.8\ N$

3–75. Determine the magnitude of **P** and the coordinate direction angles of $\mathbf{F}_3$ required for equilibrium of the particle. Note that $\mathbf{F}_3$ acts in the octant shown.

$$\frac{-\hat{i} - 7\hat{j} + 4\hat{k}}{\sqrt{66}}$$



Prob. 3–75

$$\hat{i}: \frac{-360}{\sqrt{66}} + F_{3x} = 0$$

$$F_{3x} = \frac{360}{\sqrt{66}}$$

$$\hat{j}: \frac{-360(7)}{\sqrt{66}} - 120 - F_{3y} + P\cos 20 = 0$$

$$\hat{k}: \frac{360(4)}{\sqrt{66}} - F_{3z} + P\sin 20 = 0$$

$$F_{3x}^2 + F_{3y}^2 + F_{3z}^2 = 200^2$$

Use Mathematica:

$F_{3y} = 169.9 \quad F_{3z} = 95.68 \quad P = 638.6 \text{ lbs}$

$$\hat{u}_3 = \frac{F_{3x}}{F_3}\hat{i} - \frac{F_{3y}}{F_3}\hat{j} - \frac{F_{3z}}{F_3}\hat{k}$$

$\cos\alpha \qquad \cos\beta \qquad \cos\gamma$