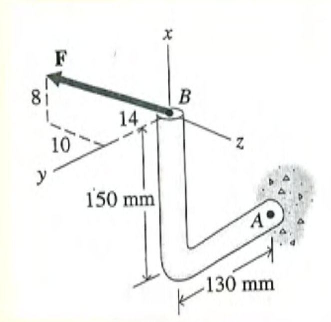
GIVEN:

2-46 A 2000-N force **F** acts on a machine component as shown in Fig. P2-46.

(a) Determine the *x*, *y*, and *z* scalar components of the force.

(b) Express the force in Cartesian vector form.

(c) Determine the angle α between the force and the line *AB*.



FIND: a) F_x, F_y, F_z

b) F

c) α between $\vec{F}$ and $\overline{AB}$

KNOWN: $|F| = 2000\,N$, geometry shown.

SOLUTION:

$$e_n = \frac{8\hat{i} + 14\hat{j} - 10\hat{k}}{\sqrt{8^2 + 14^2 + 10^2}} = 0.422\hat{i} + 0.738\hat{j} - 0.527\hat{k}$$

$$\vec{F} = 2000\left[0.422\hat{i} + 0.738\hat{j} - 0.527\hat{k}\right]$$

$$\boxed{\vec{F} = 843\hat{i} + 1476\hat{j} - 1054\hat{k}\ N} \quad (b)$$

$$\boxed{\begin{aligned} F_x &= 843\ N \\ F_y &= 1476\ N \\ F_z &= -1054\ N \end{aligned}} \quad (a)$$

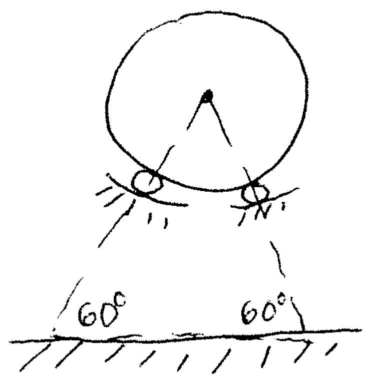
$\overrightarrow{AB}$: $150\hat{i} + 130\hat{j}$ $\quad \vec{F} = 8\hat{i} + 14\hat{j} - 10\hat{k}$

$$\overrightarrow{AB} \cdot \vec{F} = AB\cos\theta$$

$$\cos\theta = \frac{(150)(8) + (130)(14) + (-10)(0)}{\left(\sqrt{150^2 + 130^2}\right)\left(\sqrt{8^2 + 14^2 + 10^2}\right)}$$

$$\cos\theta = 0.802$$

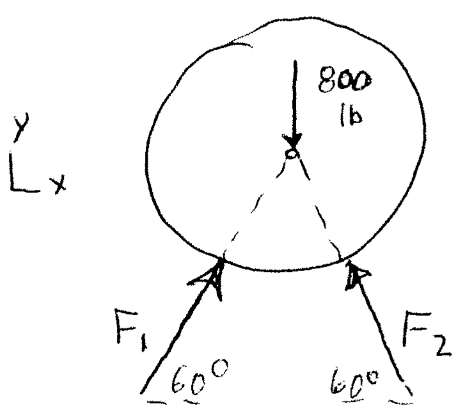
$$\boxed{\theta = 36.7^\circ} \quad (c)$$



Given: cyl. weight is 800 lb. c.g. at center.
No friction in rollers

To find: contact forces

FBD



EQN

$$\Sigma F_x = 0$$

$$+F_1 \cos 60° - F_2 \cos 60° = 0$$

$$\therefore \; F_1 = F_2$$

$$\Sigma F_y = 0$$

$$F_1 \sin 60° + F_2 \sin 60° - 800 = 0$$

since $F_1 = F_2$

$$F_1 = F_2 = \frac{800}{2 \sin 60°} = \underline{462 \text{ lb}}$$