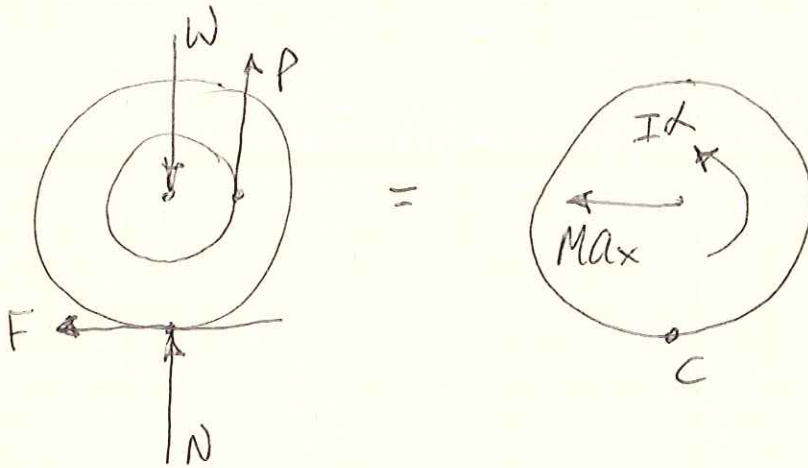


PROB. 16-101

$$r_1 = \frac{1}{3} \text{ ft}, \quad r_2 = \frac{2}{3} \text{ ft}, \quad W = 10^{\text{LB}}, \quad k = \frac{1}{2} \text{ ft}, \quad P = 5^{\text{LB}},$$

$$\mu_s = 0.25, \quad \mu_k = 0.2$$

DETERMINE IF DISK SLIDES, α , a_x



FOR NO SLIPPING,

$$\sum F_x = ma_x: -F = -ma_x, \quad F = \left(\frac{W}{g}\right) r_2 \alpha$$

$$\sum F_y = ma_y: N - W + P = 0, \quad N = W - P$$

$$\sum M_c = \sum (M_c)_{\text{eff}} \uparrow: r_1 P = r_2 \cdot ma_x + I \alpha$$

$$r_1 P = r_2 \left(\frac{W}{g}\right) \cdot r_2 \alpha + \left(\frac{W}{g}\right) k^2 \alpha$$

$$\alpha = \frac{g r_1 P}{W(r_2^2 + k^2)} = \frac{(32.2 \frac{\text{ft}}{\text{s}^2}) \left(\frac{1}{3} \text{ ft}\right) (5^{\text{LB}})}{(10^{\text{LB}}) \left[\left(\frac{2}{3} \text{ ft}\right)^2 + \left(\frac{1}{2} \text{ ft}\right)^2 \right]}$$

$$\alpha = 7.728 \frac{\text{RAD}}{\text{s}^2} \curvearrowright$$

$$F = \left(\frac{10^{\text{LB}}}{32.2 \frac{\text{ft}}{\text{s}^2}}\right) \cdot \left(\frac{2}{3} \text{ ft}\right) \left(7.728 \frac{\text{RAD}}{\text{s}^2}\right) = 1.6^{\text{LB}}$$

PROB. 16-101 CONT.

FOR NO SLIPPING, THE MAXIMUM FRICTION IS

$$F_{\max} = \mu_s N = \mu_s (W - P) = (0.25)(10 - 5 \text{ LB}) = 1.25 \text{ LB}$$

SINCE $F > F_{\max}$, DISK SLIDES

$$F = \mu_k N = \mu_k (W - P) = (0.2)(10 - 5 \text{ LB}) = 1.0 \text{ LB}$$

$$\sum F_x = ma_x: -F = -ma_x: a_x = \frac{F}{m} = \frac{Fg}{W}$$

$$a_x = \frac{(1.0 \text{ LB}) \left(32.2 \frac{\text{ft}}{\text{s}^2} \right)}{(10 \text{ LB})} = 3.22 \frac{\text{ft}}{\text{s}^2} \leftarrow$$

$$\sum M_c = \sum (M_c)_{\text{EFF}} \uparrow: r_1 P = r_2 ma_x + I \alpha$$

$$\alpha = \frac{1}{I} (r_1 P - r_2 ma_x) = \frac{1}{mk^2} \left[r_1 P - r_2 \left(\frac{W}{g} \right) a_x \right]$$

$$\alpha = \left(\frac{g}{Wk^2} \right) \left[r_1 P - r_2 \left(\frac{W}{g} \right) a_x \right]$$

$$\alpha = \left[\frac{\left(32.2 \frac{\text{ft}}{\text{s}^2} \right)}{\left(10 \text{ LB} \right) \left(\frac{1}{2} \text{ ft} \right)^2} \right] \left\{ \left(\frac{1}{3} \text{ ft} \right) \left(5 \text{ LB} \right) - \left(\frac{2}{3} \text{ ft} \right) \cdot \left[\frac{10 \text{ LB}}{32.2 \frac{\text{ft}}{\text{s}^2}} \right] \cdot \left(3.22 \frac{\text{ft}}{\text{s}^2} \right) \right\}$$

$$\alpha = 12.88 \frac{\text{RAD}}{\text{s}^2} \curvearrowright$$