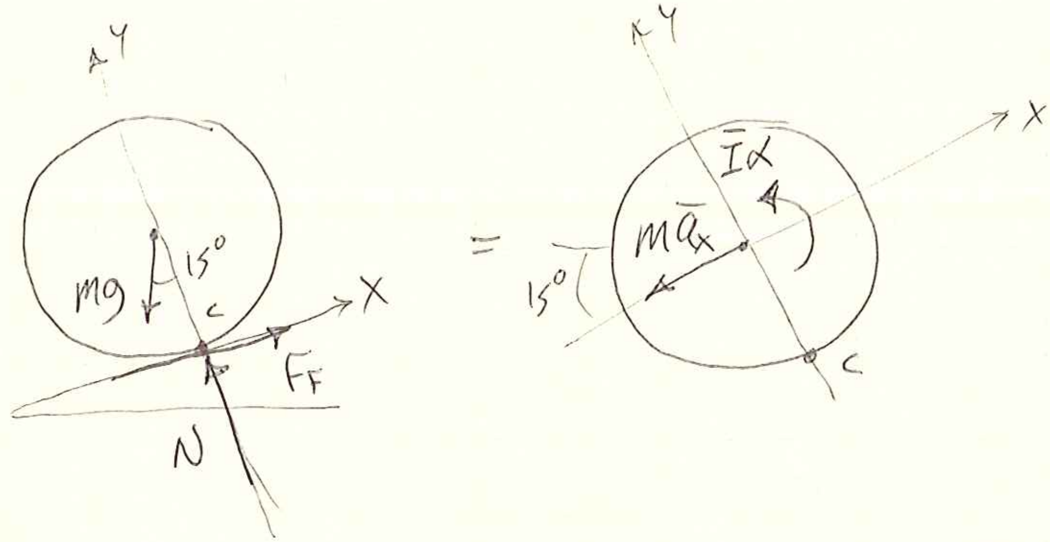
PROB. 16-95

$r_s = (1.5^{\text{IN}})\left(\frac{\text{ft}}{12^{\text{IN}}}\right) = 0.125^{\text{ft}}, \ \Delta X = 16^{\text{ft}}, \ t = 40^{s}, \ \omega_0 = 0$

FIND k_0



$$\Sigma M_c = \Sigma (M_c)_{EFF} \circlearrowleft : \ r \cdot mg\sin\theta = r m\bar{a}_x + \bar{I}\alpha$$

$$\bar{I} = mk_0^2, \quad \bar{a}_x = r\alpha$$

$$rmg\sin\theta = rm \cdot r\alpha + mk_0^2\alpha$$

$$k_0 = \sqrt{\frac{rg\sin\theta - r^2\alpha}{\alpha}} = \sqrt{\frac{rg\sin\theta}{\alpha} - r^2}$$

FOR UNIFORMLY ACCELERATED ROTATION,

$$\theta = \theta_0 + \omega_0 t + \tfrac{1}{2}\alpha t^2$$

$$s = r\theta, \quad \theta = \frac{s}{r} = \frac{\Delta X}{r}, \quad \theta_0 = 0, \ \omega_0 = 0$$

$$\frac{\Delta X}{r} = \tfrac{1}{2}\alpha t^2, \quad \alpha = \frac{2\Delta X}{r t^2}$$

PROB. 16-95 CONT.

$$\alpha = \frac{2(16\,ft)}{(0.125\,ft)(40\,s)^2} = 0.16\ \frac{RAD}{s^2} \circlearrowright$$

$$K_0 = \sqrt{\frac{(0.125\,ft)(32.2\,\frac{ft}{s^2})\sin 15^\circ}{(0.16\,\frac{RAD}{s^2})} - (0.125\,ft)^2}$$

$$\boxed{K_0 = 2.548\ ft}$$