PROB. 17-1

$\theta = (1500\ \text{REV})\left(\frac{2\pi}{\text{REV}}\right) = 3000\pi\ \text{RAD}$

$W = 6000\ \text{LB}, \quad \omega_0 = (300\ \frac{\text{REV}}{\text{MIN}})(\frac{\text{MIN}}{60\ \text{S}})(\frac{2\pi}{\text{REV}}) = 10\pi\ \frac{\text{RAD}}{\text{S}}$

$\omega_F = 0, \quad K = 36^{\text{IN}} = 3\ \text{ft}, \quad \text{FIND } M_{KF}$

$I = K^2 m, \quad W = mg, \quad m = \frac{W}{g}, \quad I = K^2\left(\frac{W}{g}\right)$

$$I = \frac{(3\ \text{ft})^2(6000\ \text{LB})}{(32.2\ \frac{\text{ft}}{\text{s}^2})} = 1677\ \text{ft}\cdot\text{LB}\cdot\text{s}^2$$

WORK AND ENERGY: $T_1 + U_{1-2} = T_2$

$U_{1-2} = \int_{\theta_1}^{\theta_2} M\,d\theta = M(\theta_2 - \theta_1)$ ASSUMING M = CONSTANT

KINETIC ENERGY: $T = \frac{1}{2}m\bar{v}^2 + \frac{1}{2}\bar{I}\omega^2$

FLYWHEEL IS UNDER CENTROIDAL ROTATION, NO TRANSLATION

$T_1 = \frac{1}{2}I\omega_0^2, \quad T_2 = 0$ SINCE $\omega_F = 0$

$$\frac{1}{2}I\omega_0^2 - M(\theta_2 - \theta_1) = 0$$

$$M = \frac{I\omega_0^2}{2(\theta_2 - \theta_1)} = \frac{(1677\ \text{ft}\cdot\text{LB}\cdot\text{s}^2)(10\pi\ \frac{\text{RAD}}{\text{s}})^2}{2(3000\pi\ \text{RAD})}$$

$$\boxed{M = 87.81\ \text{ft}\cdot\text{LB}}$$