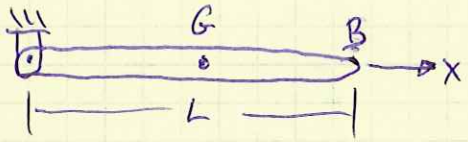
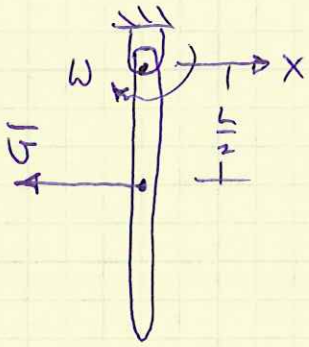
PROB. 17-18

POSITION 1



POSITION 2



$\omega_0 = 0$

a) FIND ω AT $\theta = 90°$,

REACTIONS AT A

CONSERVATION OF ENERGY: $T_1 + V_1 = T_2 + V_2$

$T_1 = 0, \quad V_1 = V_g = 0$

$T_2 = \frac{1}{2} m \bar{v}_2^2 + \frac{1}{2} \bar{I} \omega^2$

$\bar{v}_2 = r\omega = \frac{1}{2} L \omega, \quad \bar{I} = \frac{1}{12} m L^2$

$T_2 = \frac{1}{2} m \left(\frac{1}{2} L \omega\right)^2 + \frac{1}{2} \left(\frac{1}{12} m L^2\right) \omega^2$

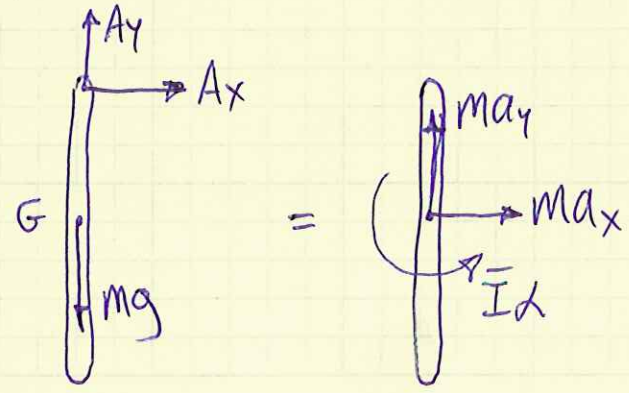
$T_2 = \frac{1}{2} m L^2 \omega^2 \left(\frac{1}{4} + \frac{1}{12}\right) = \frac{1}{6} m L^2 \omega^2$

$V_2 = V_g = -mgh_2 = -\frac{1}{2} mgL$

$0 = \frac{1}{6} m L^2 \omega^2 - \frac{1}{2} mgL$

$$\boxed{\omega = \sqrt{\frac{3g}{L}}}$$

FBD:



$\Sigma F_x = ma_x : \quad A_x = ma_x$

$a_x = a_t = r\alpha$

$A_x = mr\alpha$

$\Sigma F_y = ma_y$: $A_y - mg = ma_y$

$a_y = a_n = r\omega^2$

$\boxed{A_y = mg + mr\omega^2 = m(g + r\omega^2) = W\left(1 + \frac{L\omega^2}{2g}\right)}$

$\Sigma M_A = \Sigma (M_A)_{EFF}$ $\circlearrowleft^+$: $0 = \left(\frac{1}{2}L\right)ma_x + \bar{I}\alpha$

$\frac{1}{2}Lm \cdot r\alpha + \bar{I}\alpha = 0$

$\alpha\left(\frac{1}{2}Lmr + \bar{I}\right) = 0$ TRUE ONLY FOR $\alpha = 0$

$\boxed{A_x = 0}$

~~$A_y = m(g + r\omega^2)$~~

b) SOLVE PART A FOR $W = 1.8^{LB}$ AND $L = 3^{ft}$

$\omega = \sqrt{\frac{3(32.2\ \frac{ft}{s^2})}{(3^{ft})}} = 5.674\ \frac{RAD}{s}$

~~$A_y = (1.8^{LB})$~~

$A_y = (1.8^{LB})\left[1 + \frac{(3^{ft})(5.674\ \frac{RAD}{s})^2}{2(32.2\ \frac{ft}{s^2})}\right] = 4.5^{LB}\uparrow$