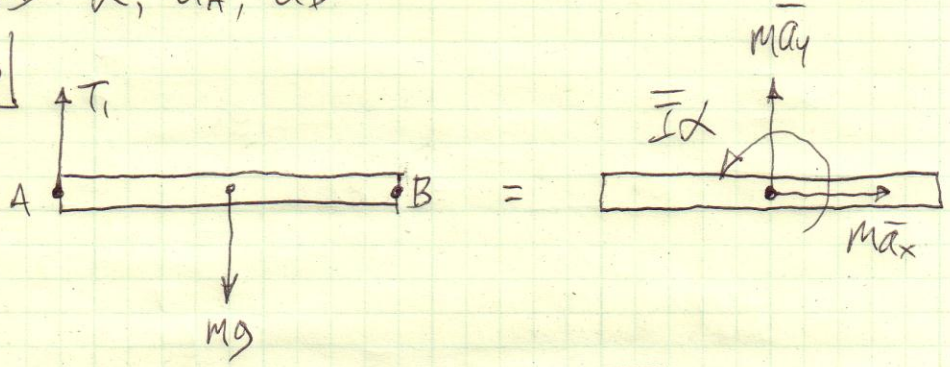
PROB. 16-63

FIND α, a_A, a_B

FBD



$\Sigma F_x = ma_x$: $0 = m\bar{a}_x \Rightarrow \boxed{\bar{a}_x = 0}$ (1)

$\Sigma F_y = ma_y$: $T_1 - mg = m\bar{a}_y \Rightarrow \boxed{\bar{a}_y = \frac{T_1}{m} - g}$ (2)

$\Sigma \vec{M}_G = \Sigma (\vec{M}_G)_{EFF}$ $+\circlearrowleft$: $-\left(\frac{L}{2}\right) T_1 = \bar{I}\alpha$

$-\left(\frac{L}{2}\right) T_1 = \frac{1}{12} m L^2 \alpha$

$\boxed{\alpha = -\left(\frac{6}{mL}\right) T_1}$ (3)

FROM POINT A, $\bar{a}_y = r\alpha = \left(\frac{L}{2}\right)\alpha$

(2): $\left(\frac{L}{2}\right)\alpha = \frac{T_1}{m} - g$

$\alpha = \frac{2}{L}\left(\frac{T_1}{m} - g\right)$ (2)

SET (2) = (3):

$\frac{2}{L}\left(\frac{T_1}{m} - g\right) = -\left(\frac{6}{mL}\right) T_1$

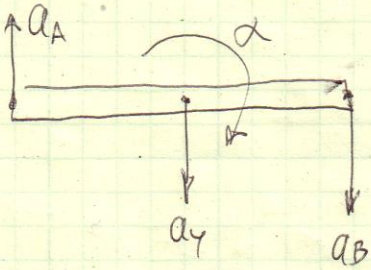
$$\frac{T_1}{m} - g = -\left(\frac{L}{2}\right)\left(\frac{6}{mL}\right)T_1$$

$$\frac{T_1}{m}(1+3) = g$$

$$\boxed{T_1 = \tfrac{1}{4}mg}$$

$$\boxed{\bar{a}_y = \left(\tfrac{1}{4}mg\right)\left(\tfrac{1}{m}\right) - g = -\tfrac{3}{4}g \downarrow}$$

$$\boxed{\alpha = -\left(\frac{6}{mL}\right)\left(\tfrac{1}{4}mg\right) = -\tfrac{3}{2}\left(\frac{g}{L}\right) \curvearrowright}$$



$$\boxed{a_A = \bar{a}_y - r\alpha = \left(-\tfrac{3}{4}g\right) - \left(\tfrac{L}{2}\right)\left(-\tfrac{3}{2}\tfrac{g}{L}\right) = 0}$$

$$\boxed{a_B = \bar{a}_y + r\alpha = \left(-\tfrac{3}{4}g\right) + \left(\tfrac{L}{2}\right)\left(-\tfrac{3}{2}\cdot\tfrac{g}{L}\right) = -\tfrac{3}{2}g \downarrow}$$