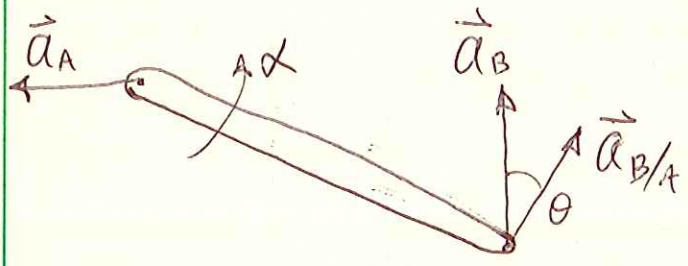
PROB. 16-118

$m = 10^{kg}$, $\theta = 25°$, $a_B = 12 \frac{m}{s^2} \uparrow$, FIND P, a_A

KINEMATICS



$$\vec{a}_B = \vec{a}_A + \vec{a}_{B/A}$$

$$\vec{a}_B = (a_B)\hat{j}$$

$$\vec{a}_A = (-a_A)\hat{i}$$

$$\vec{a}_{B/A} = L\alpha[(\sin\theta)\hat{i} + (\cos\theta)\hat{j}]$$

$$(a_B)\hat{j} = (-a_A)\hat{i} + L\alpha[(\sin\theta)\hat{i} + (\cos\theta)\hat{j}]$$

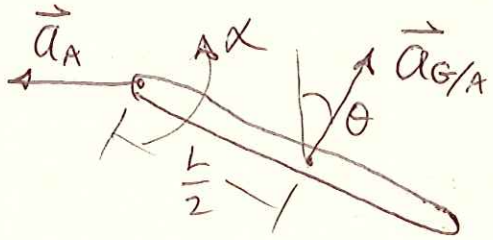
X-DIRECTION: $0 = -a_A + L\alpha\sin\theta \Rightarrow a_A = L\alpha\sin\theta$

Y-DIRECTION: $a_B = L\alpha\cos\theta \Rightarrow \alpha = \frac{a_B}{L\cos\theta}$

$$\alpha = \frac{\left(12 \frac{m}{s^2}\right)}{(1.2^m)\cos 25°} = 11.03 \frac{RAD}{s^2} \curvearrowright$$

$$a_A = (1.2^m)\left(11.03 \frac{RAD}{s^2}\right)\sin 25° = 5.596 \frac{m}{s^2} \leftarrow$$

ACCELERATION OF POINT G:



$$\vec{a}_G = \vec{a}_A + \vec{a}_{G/A}$$

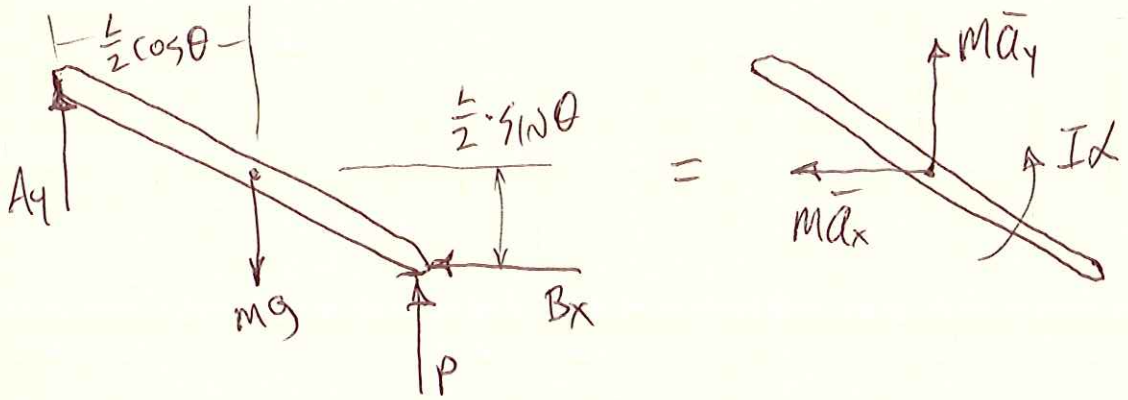
$$\vec{a}_{G/A} = \left(\frac{L}{2}\right)\alpha[(\sin\theta)\hat{i} + (\cos\theta)\hat{j}]$$

$$\vec{a}_G = (-L\alpha\sin\theta)\hat{i} + \left(\frac{L}{2}\right)\alpha[(\sin\theta)\hat{i} + (\cos\theta)\hat{j}]$$

$$\vec{a}_G = \left(-\frac{L}{2}\alpha\sin\theta\right)\hat{i} + \left(\frac{L}{2}\alpha\cos\theta\right)\hat{j}$$

PROB. 16-118 CONT.

KINETICS



$\Sigma F_x = ma_x : \; -B_x = -ma_x , \quad \boxed{B_x = m\left(\frac{L}{2}\right)\alpha \sin\theta}$

$\Sigma F_y = ma_y : \; A_y - mg + P = ma_y$

$\boxed{P = mg - A_y + m\left(\frac{L}{2}\right)\alpha\cos\theta}$

$\Sigma M_G = \Sigma (M_G)_{EFF} \; \circlearrowleft^{+} :$

$-A_y\left(\frac{L}{2}\right)\cos\theta + P\left(\frac{L}{2}\right)\cos\theta - B_x\left(\frac{L}{2}\right)\sin\theta = I\alpha$

$-A_y = -P + B_x \tan\theta + \left(\frac{1}{12}ML^2\alpha\right)/\left(\frac{L}{2}\cos\theta\right)$

$$-A_y = -P + B_x \tan\theta + \frac{ML\alpha}{6\cos\theta}$$

$$-A_y = -P + \left[m\left(\frac{L}{2}\right)\alpha\sin\theta\right]\cdot\tan\theta + \frac{ML\alpha}{6\cos\theta}$$

$$P = mg - P + \frac{1}{2}ML\alpha\sin\theta\cdot\tan\theta + \frac{ML\alpha}{6\cos\theta} + \frac{1}{2}ML\alpha\cos\theta$$

PROB. 16-118 CONT.

$$P = \frac{M}{2}\left[g + \frac{L\alpha}{2}(\sin\theta \cdot \tan\theta + \cos\theta) + \frac{L\alpha}{6\cos\theta}\right]$$

$$P = \frac{(10^{kg})}{2}\left\{\left(9.81\,\frac{m}{s^2}\right) + \frac{(1.2^{m})(11.03\,\frac{RAD}{s^2})}{2}\cdot(\sin 25^\circ \cdot \tan 25^\circ + \cos 25^\circ)\right.$$

$$\left. + \frac{(1.2^{m})(11.03\,\frac{RAD}{s^2})}{6\cdot\cos 25^\circ}\right\}$$

$$\boxed{P = 97.73^{N}\ \uparrow}$$

$$A_y = (97.73^{N}) - (10^{kg})\cdot\frac{1}{2}(1.2^{m})(11.03\,\frac{RAD}{s^2})\cdot\sin 25^\circ\cdot\tan 25^\circ$$

$$- \frac{(10^{kg})(1.2^{m})(11.03\,\frac{RAD}{s^2})}{6\cdot\cos 25^\circ}$$

$$\boxed{A_y = 60.35^{N}\ \uparrow}$$