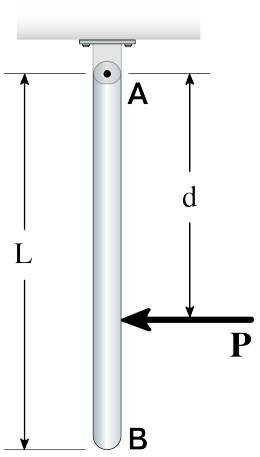
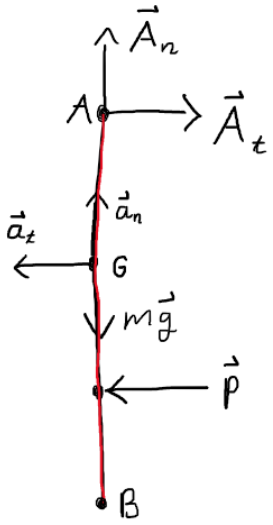
22-R-KIN-TW-12



A force of, $P = 375$ N is applied at a distance $d = 2.4$ m to a uniform rod of mass $m = 3$ kg and length $L = 4$ m connected to a pin at point A. If, at the instant shown, the rod has an angular velocity of $\omega = 1$ rad/s clockwise, find the horizontal and vertical components of the pin at point A. (Use $g = 9.81$ m/s^2)

Solution:



$$F_n : A_n - mg = m\omega^2 r_G$$
$$F_t : P - A_t = m\alpha r_G$$
$$M_A : Pd = I_A \alpha$$

$$I_A = \frac{1}{3}mL^2 = 16 \text{ kg} \cdot \text{m}^2$$
$$\alpha = \frac{Pd}{I_A} = \frac{(375)(2.4)}{16} = 56.25 \text{ rad/s}^2$$
$$\vec{A}_t = P - m\alpha r_G = 375 - (3)(56.25)(2) = 37.5\hat{i} \text{ N}$$
$$\vec{A}_n = m\omega^2 r_G + mg = (3)(1)^2(2) + (3)(9.81) = 35.43\hat{j} \text{ N}$$