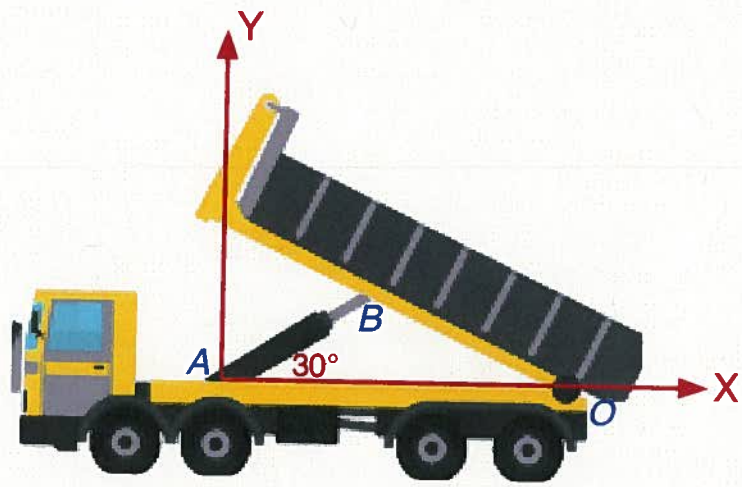
Problem 1: A truck's bed weighs 8,000 lbs and its moment of inertia about the pivot point at O is 33,000 lb-ft-s^2. At the instant shown and using the coordinate system indicated, the center of mass of the truck-bed is located at x = 12 ft and y = 14 ft. The coordinates of point B are x = 14 ft and y = 12 ft. The coordinates of point O are x = 25ft and y = 0ft. If the truck bed has a counterclockwise angular acceleration of 0.2 rad/s^2, what is the magnitude of the force exerted on the bed at *B* by the hydraulic cylinder *AB*?

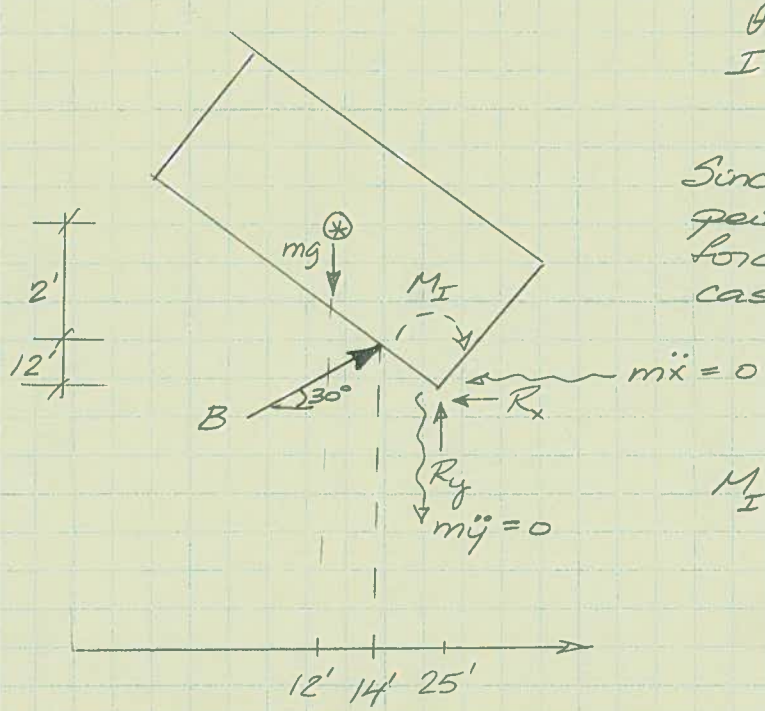


Solution

$\alpha = 0.2\ \text{RAD/s}^2$ ↻

$\ddot{\theta} = +0.2\ \text{RAD/s}^2$

$I = 33{,}000\ \text{lb-ft-s}^2$



Since have I about pivot point @ O, apply inertial forces @ point O. In this case, accel @ that pt = 0

$M_I = I\ddot{\theta}$

Taking moments about pivot:

$$M_I + B_x(12') + B_y(25'-14') - (mg)(25-12) = 0$$

$$I\ddot{\theta} + (B\cos 30^\circ)(12) + (B\sin 30^\circ)(11') - (8000\text{ lbs})(13') = 0$$

$$B(12\cos 30 + 11\sin 30) = (8000)(13) - (33{,}000)(0.2)$$

$$\underline{\underline{B = 6128.75\text{ lbs}}}$$

TOPS. 35500