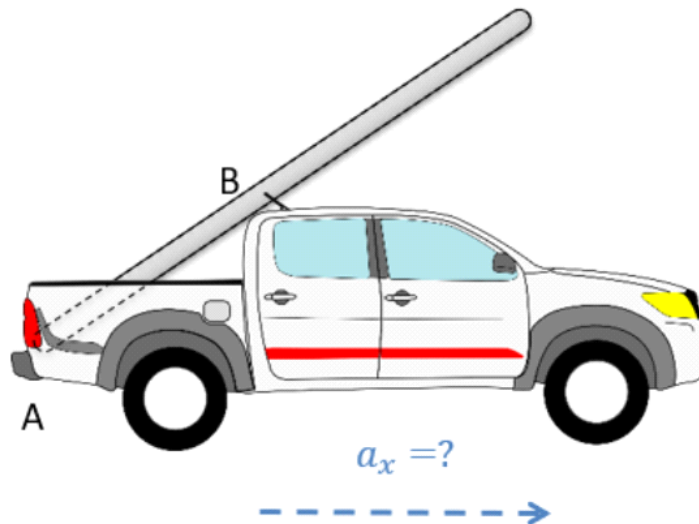


Problem 4

A pickup truck is carrying a 30 kg, 6 meter long ladder at a 35 degree angle as shown to the right. The ladder is wedged against the tailgate at A and makes contact with the roof of the truck at B. The distance from A to B is 2 meters. At what rate of acceleration would we expect the ladder to start to rotate upwards?



Free body diagram of the ladder:

- Weight force $F_s = (30)(9.81)$ acting downwards from the center of the ladder.
- Force F_{AY} acting upwards at point A.
- Force F_{AX} acting to the right at point A.
- Force F_B acting upwards at point B, labeled "lifting".
- Distance from A to the center of the ladder is 3m.
- Distance from A to B is 2m.
- The ladder is at a 35-degree angle.

Equations of motion:

$$\sum F_x = F_{AX} = (30 \text{ kg}) a_x$$

$$\sum F_y = F_{AY} - (30)(9.81) = 0$$

$$\sum M_c = (F_{AX})(3 \sin(35)) - (F_{AY})(3 \cos(35)) = 0$$

Solving for F_{AY} :

$$F_{AY} = 294.3 \text{ N}$$

Solving for F_{AX} :

$$F_{AX} = \frac{(294.3)(3 \cos(35))}{3 \sin(35)} = 420.3 \text{ N}$$

Solving for a_x :

$$a_x = \frac{F_{AX}}{m} = \boxed{14.0 \text{ m/s}^2}$$