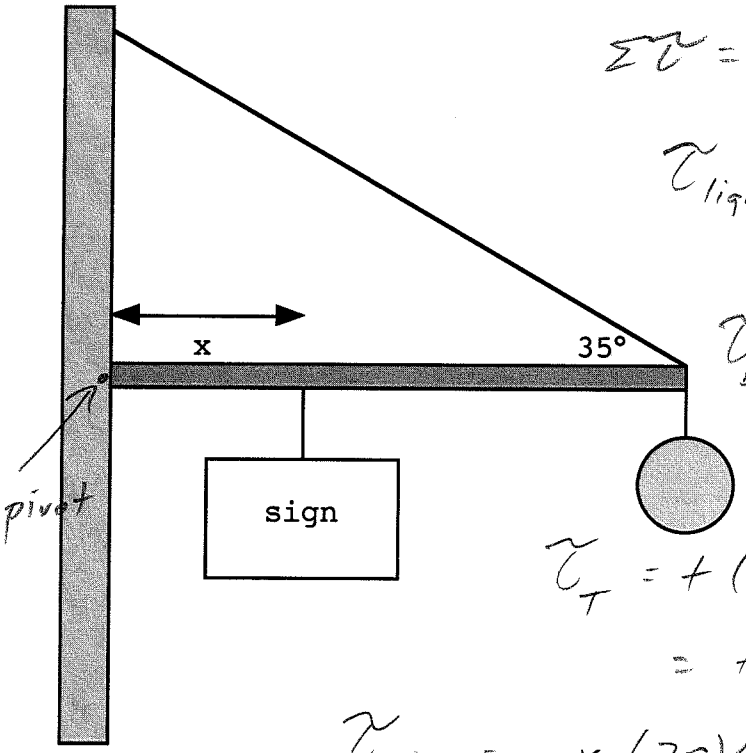
**Quiz #8A**

**Clearly indicate (with a box) your answers to the following questions. SHOW ALL WORK.**

**1.** A 25.0 kg street light is supported at the end of a uniform 3.50 meter horizontal beam of mass 45.0 kg. The beam is supported by the tension in a cable attached to the end of the beam. A worker wants to hang a 75.0 kg sign from the beam at some distance "x" from the light pole supporting the horizontal beam.

If the maximum tension the cable can withstand is 1750 Newtons, what is the largest value of x possible for the hanging sign?




$$\Sigma\tau = \tau_{light} + \tau_{beam} + \tau_T + \tau_{sign}$$

$$\tau_{light} = -(3.50)(25)(9.8)\sin 90^\circ$$
$$= -857.5$$

$$\tau_{beam} = -(1.75)(45)(9.8)\sin 90^\circ$$
$$= -771.75$$

$$\tau_T = +(3.5)(1750)\sin 145^\circ$$
$$= +3513.2$$

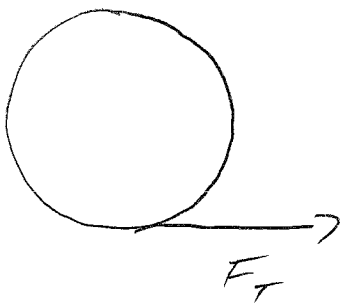
$$\tau_{sign} = -x(75)(9.8)\sin 90$$
$$= -735x$$

$$-857.5 - 771.75 + 3513.2 - 735x = 0$$

$$1884 = 735x$$

$$\boxed{x = 2.56\ m}$$

**2.** A 350-kg stone wheel is shaped like a solid cylinder and has a radius of 1.4 meters. It rests on a pivot that provides a frictional torque of 250 N-m opposing any motion. A rope is wrapped around the circular perimeter of the cylinder, causing the cylinder to go from rest to an angular speed of 0.25 rev/sec over the time interval of 5.0 seconds. What is the tension in the rope?




$\Delta\theta = ?$

$\omega_0 = 0$

$\omega = 0.25 \frac{rev}{s} = 1.57 \frac{rad}{s}$

$\alpha = ?$

$t = 5.0\ s$

$\omega = \omega_0 + \alpha t$

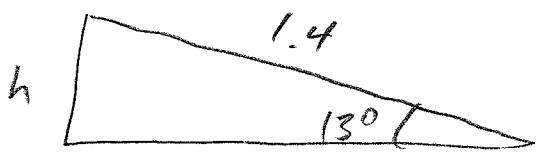
$\alpha = \frac{1.57}{5.0} = .314 \frac{rad}{s^2}$

$\Sigma\tau = +(1.4)F_T \sin 90 - 250 = \frac{1}{2}MR^2\alpha$

$1.4F_T - 250 = 686$

$F_T = 260\ N$

**3.** A sphere rolls down a 1.4-meter ramp inclined 13° with respect to the horizontal. If it starts from rest, how long does it take (in seconds) to reach the bottom of the ramp?




$h = 1.4 \sin 13^\circ$

$= 0.315\ m$

$\Sigma W_F = W_{grav} = \Delta K$

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2}\left(\frac{2}{5}MR^2\right)\omega^2$$

$$= \frac{1}{2}mv^2 + \frac{2}{10}mv^2$$

$$gh = \frac{7}{10}v^2$$

$$v = \sqrt{\frac{10}{7}gh} = 2.1\ m/s$$

$\Delta s = 1.4$

$v_0 = 0$

$v = 2.1\ m/s$

$a = ?$

$t = ?$

$1.4 = \frac{1}{2}(0 + 2.1)t$

$\boxed{t = 1.3\ s}$