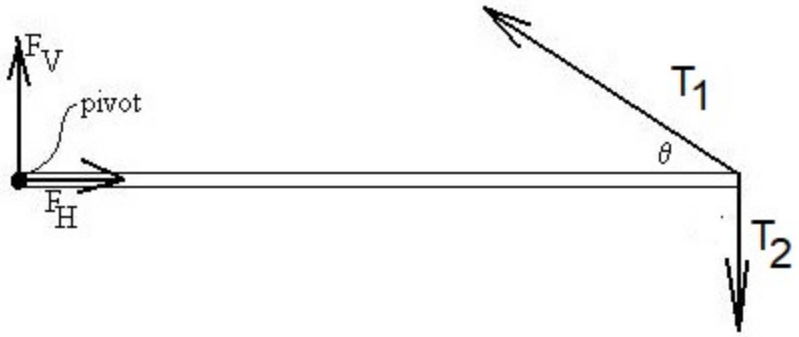
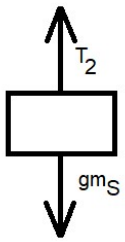
HW 10-1 Soln)

To be in equilibrium, we require that the sums of the torques, x-component forces, and y-component forces be zero. Let x be horizontal and y be vertical.



The beam seems to be the central object on which most of the forces of interest act, so to keep track of the forces, draw a free-body diagram.



We'll need to do an analysis for the forces acting on the sign as well:

$$+T_2 - gm_S = 0$$
$$T_2 = gm_S$$

The force from the hinge at the left is decomposed into its vertical and horizontal components. Let L be the length of the beam. Define the torques to be positive out of the page (CCW). Since the beam is in static equilibrium, we can *choose* our pivot about which to calculate the torques; we should get zero regardless of our choice. I choose the hinge. So,

$$0(F_V)\sin(?) + 0(F_H)\sin(?) + L(T_1)\sin\theta - L(T_2)\sin 90 = 0$$

$$T_1 \sin\theta = T_2$$

$$T_1 = \frac{T_2}{\sin\theta} = \frac{gm_S}{\sin 30} = \frac{300}{0.5} = 600\ \text{N} \quad .$$