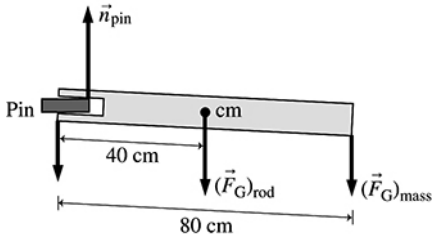
12.31. Model: The rod is in rotational equilibrium, which means that $\tau_{net} = 0$.

Visualize:



As the gravitational force on the rod and the hanging mass pull down (the rotation of the rod is exaggerated in the figure), the rod touches the pin at two points. The piece of the pin at the very end pushes down on the rod; the right end of the pin pushes up on the rod. To understand this, hold a pen or pencil between your thumb and forefinger, with your thumb on top (pushing down) and your forefinger underneath (pushing up).

Solve: Calculate the torque about the left end of the rod. The downward force exerted by the pin acts through this point, so it exerts no torque. To prevent rotation, the pin's normal force $\vec{n}_{pin}$ exerts a positive torque (ccw about the left end) to balance the negative torques (cw) of the gravitational force on the mass and rod. The gravitational force on the rod acts at the center of mass, so

$$\tau_{net} = 0 \text{ N m} = \tau_{pin} - (0.40 \text{ m})(2.0 \text{ kg})(9.8 \text{ m/s}^2) - (0.80 \text{ m})(0.50 \text{ kg})(9.8 \text{ m/s}^2)$$

$$\Rightarrow \tau_{pin} = 11.8 \text{ N m}$$