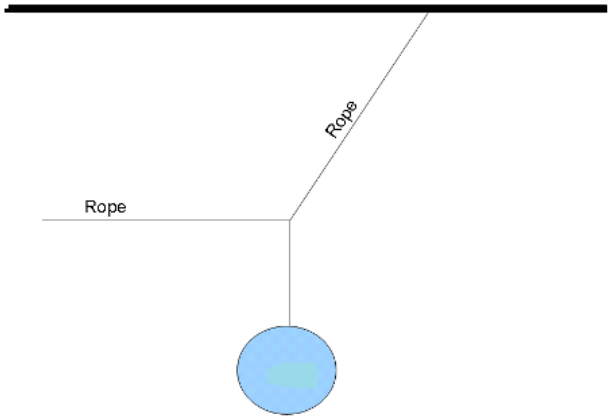
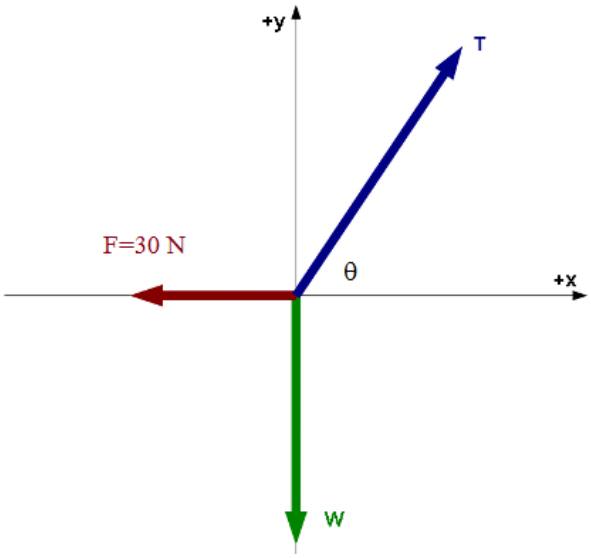
## Answer on Question #41192, Physics, Other

A rope suspended from a ceiling supports an object of weight W at its opposite end. Another rope tied to the first at the middle is pulled horizontally with a force of 30N. The junction P of the ropes is in equilibrium. Calculate the weight W and the tension

**Solution:**




The object of our focus here is the knot where all the ropes converge. Draw a free-body diagram for the knot.




Make our equations of motion. Here, since nothing is moving, our acceleration is zero; we are in equilibrium.

$$\sum F_x = -F + T\cos\theta = 0$$
$$\sum F_y = T\sin\theta - W = 0$$

Solve for our unknown tensions.

$$T = \frac{F}{\cos\theta} = \frac{30}{\cos\theta}$$
$$W = F\tan\theta = 30\tan\theta$$

We also have that

$$T^2 = F^2 + W^2$$
$$T^2 - W^2 = 900$$