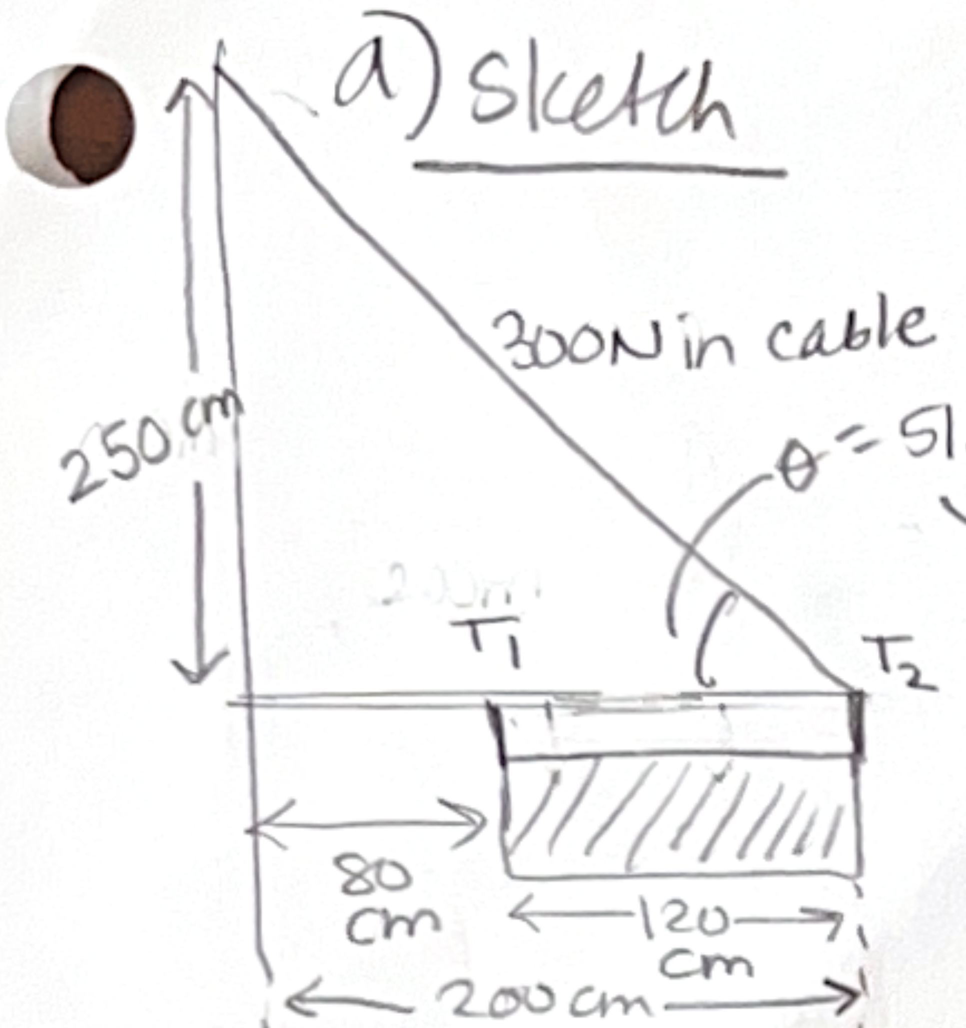
P. 333 #62 Assume the ropes holding the sign are at its edges.

a) Sketch



$\theta = \tan^{-1}\left(\frac{250m}{200m}\right)$

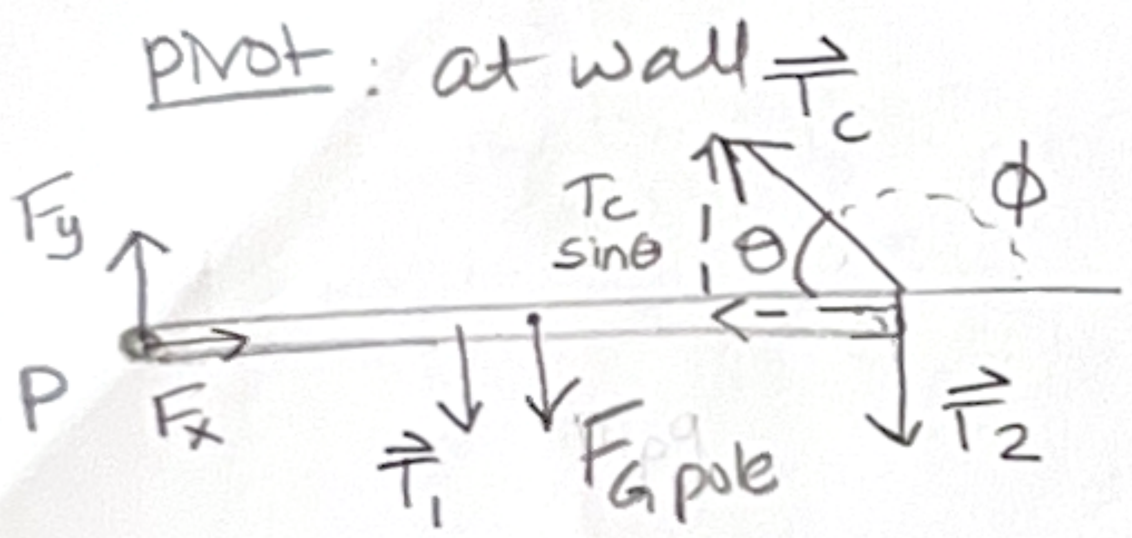
$\theta = 51.3°$

$m_{pole} = 5kg$

b) Diagram + Simplify

System: pole

pivot: at wall



Each end of the sign supports half its weight, so

$T_1 = T_2 = \frac{1}{2} m_s g$

m_s = mass of sign
m_p = mass of pole

$\Sigma \vec{\tau} = 0$

$-(.80m)(T_1) - m_p g(1m) - T_2(2m) + (2m)(T_c \sin\theta) = 0$

This is the component of $\vec{T}_c$ that is $\perp$ to the distance from the pivot point.

$-(.8)(\frac{1}{2} m_s g) - (5kg)(9.8\frac{N}{kg}) - \frac{1}{2} m_s g(2) + 2(300N)\sin 51.3° = 0$

$-3.92 m_s - 49 - 9.8 m_s + 468 = 0$

$-13.72 m_s = -468 + 49$

$-13.72 m_s = -419$

$m_s = 30.5 kg$

$\approx \boxed{31 kg}$

A mass of 31 kg is reasonable for a sign

Ch12 p. 333 #62, continued

Also find the force of the wall exerted on the beam.

I think the wall must be exerting a force that is up and to the right. I will find those components separately and then combine them to find $\vec{F}_{wall}$.

$\Sigma F_y = 0$

$F_y + T_c \sin\theta - T_1 - T_2 - F_{G\,pole} = 0$

together these equal the weight of the sign

$F_y = -T_c \sin\theta + T_1 + T_2 + F_{G\,pole}$

$F_y = -(300)\sin 51.3 + m_s g + m_p g$

$F_y = -234 + (31\,kg)(9.8\,N/kg) + (5\,kg)(9.8\,N/kg)$

$F_y = -234 + 303.8 + 49$

$F_y = 119\,N$

$\Sigma F_x = 0$

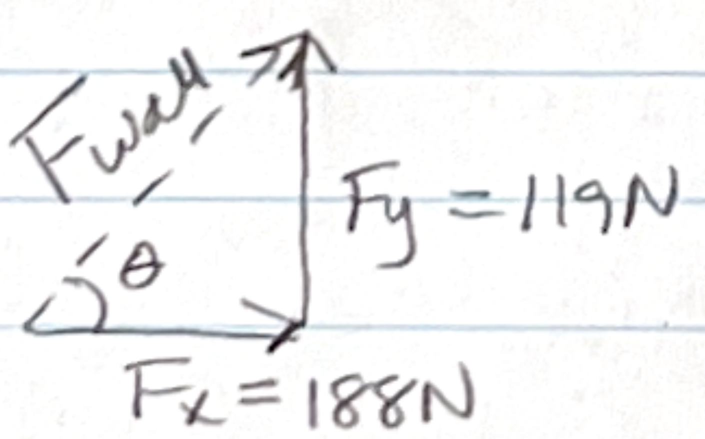
$F_x - T_c \cos\theta = 0$

$F_x = T_c \cos\theta$

$F_x = (300)\cos 51.3$

$F_x = 188\,N$

Now, combine F_x and F_y to find the complete $\vec{F}_{wall}$!



$F_w^2 = F_x^2 + F_y^2$

$F_w^2 = (188N)^2 + (119N)^2$

$F_w = 222N$

$\tan\theta = \frac{F_y}{F_x}$

$\tan\theta = \frac{119N}{188N}$

$\theta = 32°$

The wall exerts a force of 222N at an angle of 32° above the horizontal.