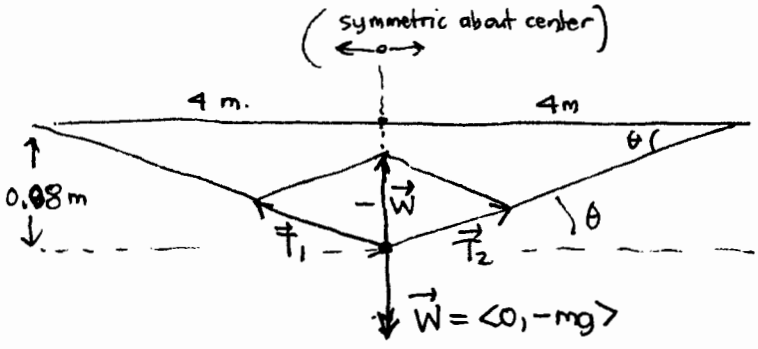
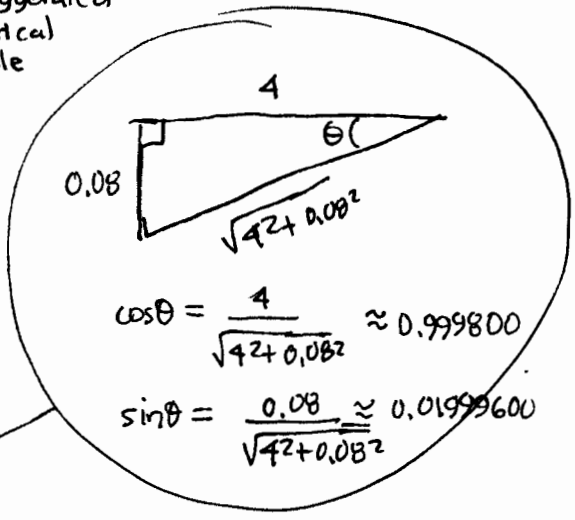
Stewart 12.2.33 Force balance using ordinary trig

A clothesline is tied between two poles, 8 m apart.
The line is quite taut and has negligible sag.
When a wet shirt with a mass of 0.8 kg is hung at the middle of the line, the midpoint is pulled down 8cm.
Find the tension in each half of the clothesline. ← [tension is a force vector – final result should be two vectors]



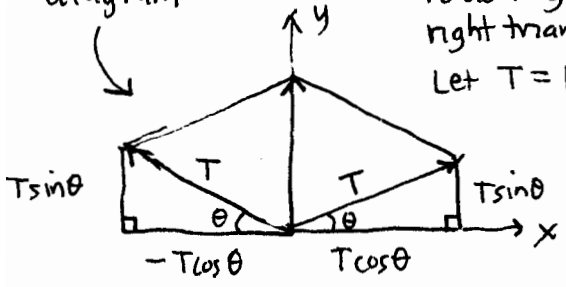
exaggerated vertical scale



$$\cos\theta = \frac{4}{\sqrt{4^2+0.08^2}} \approx 0.999800$$

$$\sin\theta = \frac{0.08}{\sqrt{4^2+0.08^2}} \approx 0.01999600$$

Expand force diagram



To do trig, draw in right triangles, label sides.
Let $T = |\vec{T}_1| = |\vec{T}_2|$ (by symmetry)

$\vec{T}_1 = \langle -T\cos\theta, T\sin\theta \rangle \approx \langle 196.000, 3.9207 \rangle$ N

$\vec{T}_2 = \langle T\cos\theta, T\sin\theta \rangle \approx \langle -196.000, 3.920 \rangle$ N

↑ MKS-force unit

$\vec{T}_1 + \vec{T}_2 = \langle -T\cos\theta + T\cos\theta, 2T\sin\theta \rangle$

$= \langle 0, 2T\sin\theta \rangle = -\vec{W} = \langle 0, mg \rangle$

so $2T\sin\theta = mg$

$$T = \frac{mg}{2\sin\theta} \approx \frac{(0.8)(9.8)}{2\,(0.01999600)} \approx 196.0391961$$

always keep lots of digits during calculation