

3a – 7 pts) You get to the entrance of the caves and it looks like a long way down. One of the Fog brothers pulls out a spring scale from his pocket to measure the weight of a rock he just picked up. If the spring has a spring constant of 100 N/m and it stretches 5 cm, what is the mass of the rock?

$$F_{\text{net}} = 0 = F_{\text{sp}} - F_g$$

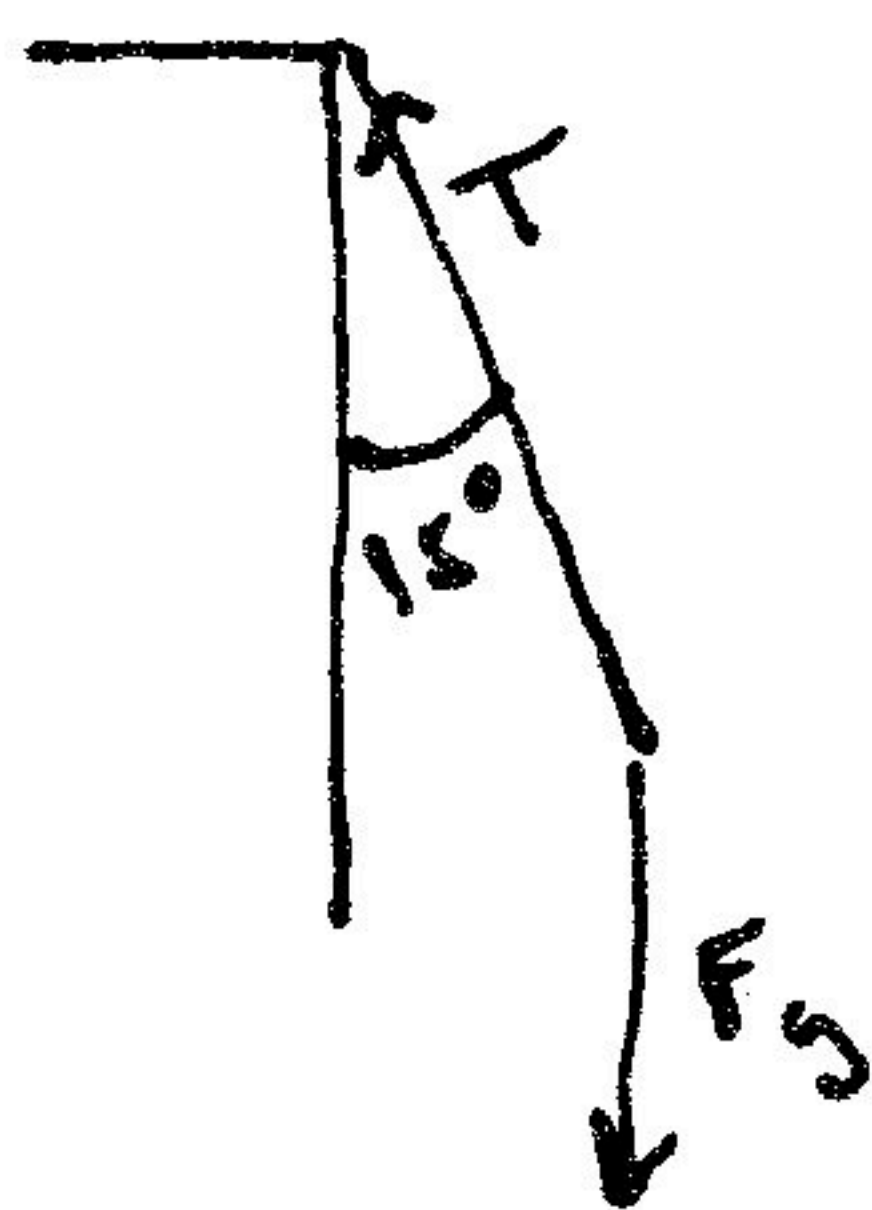
$$F_{\text{sp}} = -kx = mg$$

$$m = \frac{-kx}{g} = \frac{-100 \text{ N/m} \cdot (-0.05 \text{ m})}{9.8 \text{ m/s}^2} = 0.51 \text{ kg}$$

3b – 8 pts) The Fog brother drops the rock he just weighed down the cave and you hear a sound 4 seconds later. How far down is the bottom of the cave (ignore the speed of sound)?

$$\begin{aligned} \Delta x &= \frac{1}{2}gt^2 \\ &= \frac{1}{2} \cdot 9.8 \text{ m/s}^2 \cdot (4 \text{ s})^2 = 78 \text{ m} \end{aligned}$$

3c – 10 pts) Knowing the rope is long enough, the Fog brother lowers you down into the cave using his rope. The rope makes an angle of 15 degrees from vertical as you climb down. What is the tension on the rope if you weigh 60 kg and he lowers you at 1 m/s?



$$ma = 0 = T \cos \theta - mg$$

$$T \cos \theta = mg$$

$$T = \frac{mg}{\cos \theta} = \frac{60 \text{ kg} \cdot 9.8 \text{ m/s}^2}{\cos 15^\circ}$$

$$= 608 \text{ N}$$