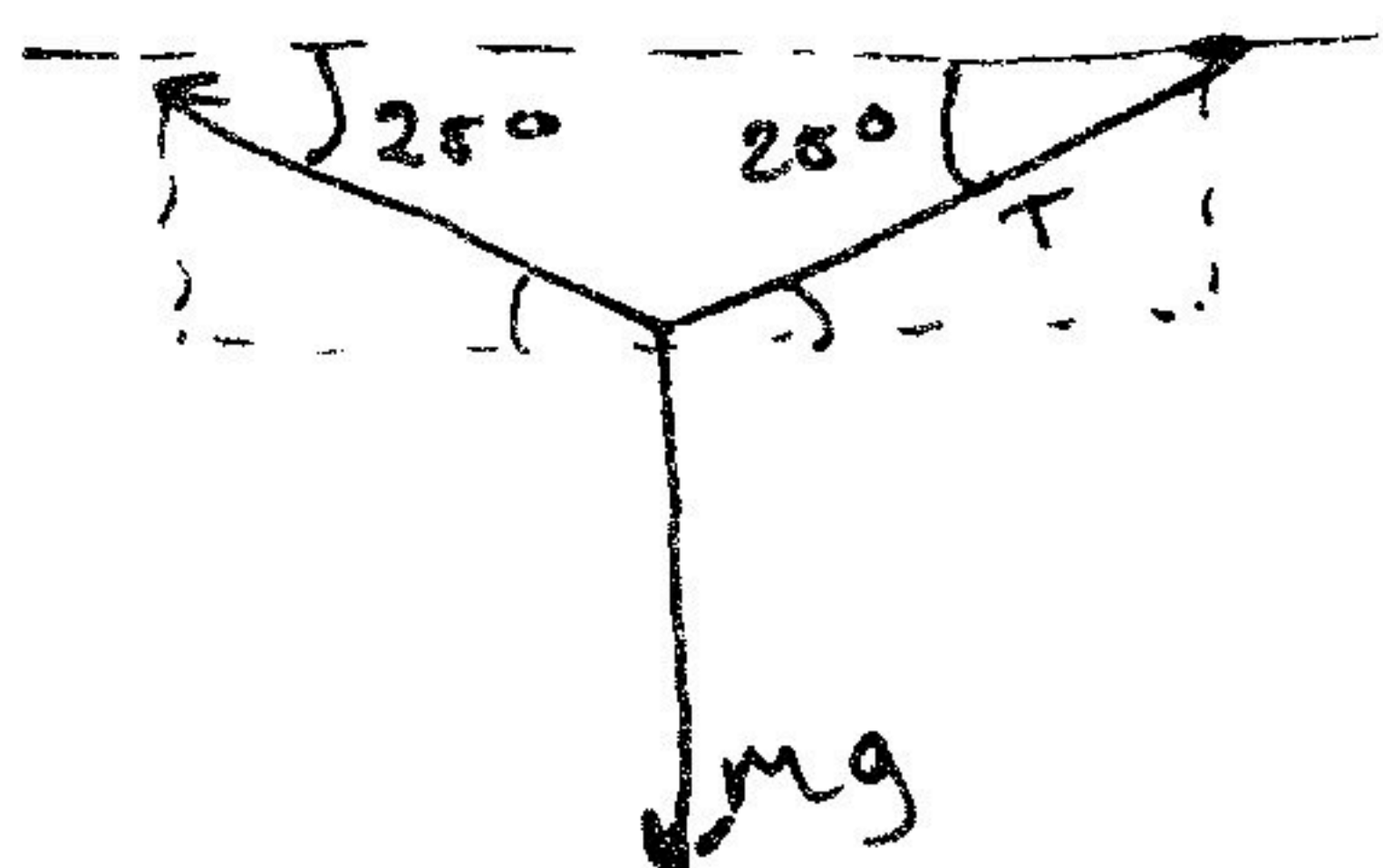


3a - 12 pts) Spark introduces you to her friend Dave, who (to your surprise) appears to be hanging upside down from the middle of a power line attached to two power poles. If the power line makes an angle of 25 degrees from horizontal and Dave has a mass of 70 kg, how much tension is in the power line?



$$y: \quad m a_y = 0 = 2T \sin \theta - mg$$

$$2T \sin \theta = mg$$

$$T = \frac{mg}{2 \sin \theta}$$

$$= \frac{70 \text{ kg} \cdot 9.8 \text{ m/s}^2}{2 \sin 25^\circ}$$

$$= 811 \text{ N}$$

3b-13 pts) Dave suddenly drops from the wire and lands at a velocity of 2 m/s on some cardboard boxes that contract to absorb the force of his fall. If the cardboard boxes exerts a force of 350 N on Dave who weighs 70 kg, how much do the cardboard boxes contract?

$$v^2 = v_0^2 + 2a\Delta y$$

$$F = ma \quad \text{so} \quad a = \frac{F}{m}$$

$$\text{Combining...} \quad 2a\Delta x = \frac{2F\Delta x}{m} = v_0^2$$

$$\Delta x = \frac{v_0^2 m}{2F} = \frac{(2 \text{ m/s})^2 \cdot 70 \text{ kg}}{2 \cdot 350 \text{ N}} = 0.4 \text{ m}$$

Note: Full credit for stating that box completely collapses due to the force of Dave's weight exceeding the force applied by boxes.