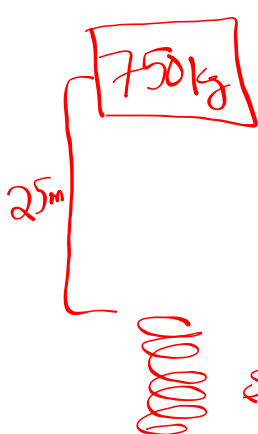23. An elevator cable breaks when a 750-kg elevator is 25 m above a huge spring (k=4.0x10⁴ N/m) at the bottom of the shaft. Calculate
   a) the work done by gravity on the elevator before it hits the spring.
   b) the speed of the elevator just before striking the spring.
   c) the amount the spring compresses (Hint: remember that work is done by both the spring and gravity in this part).

$$\text{(start)} \quad \frac{1}{2}mv_0^2 + mgh_0 + \frac{1}{2}kx_0^2 + W_{NC}$$

$$\text{(end)} \quad \frac{1}{2}mv^2 + mgh + \frac{1}{2}kx^2$$

750 kg

25 m

$k = 4.0 \times 10^4 \, \text{N/m}$

$$\frac{1}{2}(750)(0)^2 + (750)(9.8)(25)^{+x} + \frac{1}{2}(40000)(0)^2 + 0 =$$

$$\frac{1}{2}(750)(0)^2 + (750)(9.8)(0 \text{ or } x) + \frac{1}{2}(40000)(x)^2$$

$$183750 = \frac{1}{2}(40000)x^2$$

$$x^2 = \frac{183750 \cdot 2}{40000}$$

$$\boxed{x = 3.03 \, m}$$