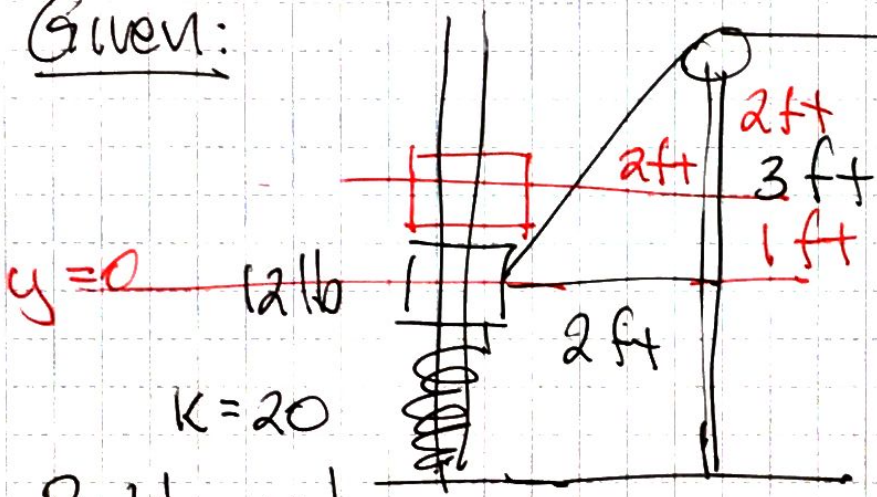
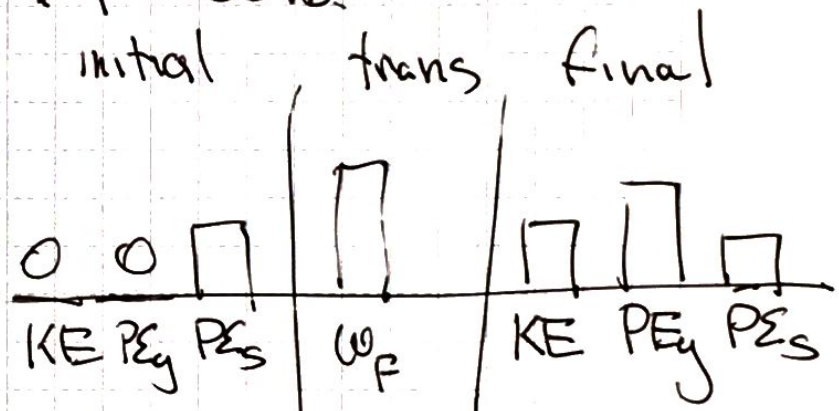
Given:





Reqd $v|_{y=1ft}$

Assump $\mu = 0$, ideal string, spring is attached

Strategy: Bar chart, conservation of energy

Estimate Give $k = 20\,lb/ft \Rightarrow$ spring is compressed about $1/2$ ft $\Rightarrow$ as it moves up a foot it ends up w/ same energy stored. Because at angle string doesn't move 1 ft but take $\Delta x = 1$ ft $\Rightarrow W_F = 30lb \cdot 1ft = 30\,ft\,lb$. gravity take $(mg)y = 12(1ft) = 12\,ft\,lb$ away $\Rightarrow$ net energy added $\cong$ 18 ft lb $m = \frac{12}{30} = .3 \Rightarrow v^2 \cong 60 \Rightarrow v \cong 8\,ft/s$

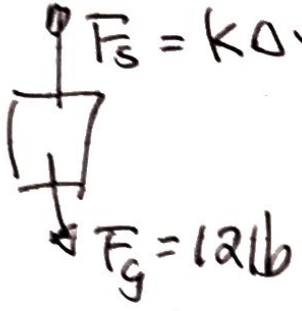
1 SQUARE =

Soln: $\frac{1}{2}k\Delta y_o^2 + \underbrace{F_c \cdot \Delta x}_{F=\text{const}} = \frac{1}{2}mv^2 + \frac{1}{2}k\Delta y_f^2 + (mg)y_f$

resting compression $\Rightarrow$ no integration

mg: 12lb, y_f: 1ft

Δy_o:



$\Delta x = L_o - L_f$

$L_o = \sqrt{2^2+3^2} = 3.61ft$

$L_f = \sqrt{2^2+2^2} = 2.83ft$

$\Delta x = 3.61 - 2.83 = .78ft$

$12lb = 20lb/ft\,\Delta y \Rightarrow \Delta y_o = .6ft$

Because moves up 1ft $\Rightarrow \Delta y_f = .4ft$

$\frac{1}{2}k\Delta y_o^2 = \frac{1}{2}20lb/ft \cdot (.6ft)^2 = 3.6\,ft\,lb$

$\frac{1}{2}k\Delta y_f^2 = \frac{1}{2}20lb/ft(.4ft)^2 = 1.6\,ft\cdot lb$

$\vec{F_c}\cdot\Delta\vec{x} = 30lb \cdot .78ft = 23.4\,ft\cdot lb$

$mgy_f = (12)1ft = 12\,ft\,lb$

Soln: (cont)

$$3.6\,ft\cdot lb + 23.4\,ft\cdot lb = \frac{1}{2}mv^2 + 1.6\,ft\cdot lb + 12\,ft\cdot lb$$

$$13.4\,ft\cdot lb = \frac{1}{2}mv^2$$

$$\frac{2(13.4\,ft\cdot lb)}{m = .373\,slug} = v^2 = 71.85\,ft^2/s^2$$

$$\boxed{v = 8.47\,ft/s}$$

Discussion: matches remarkably well.

The bar chart provides clear process and directio