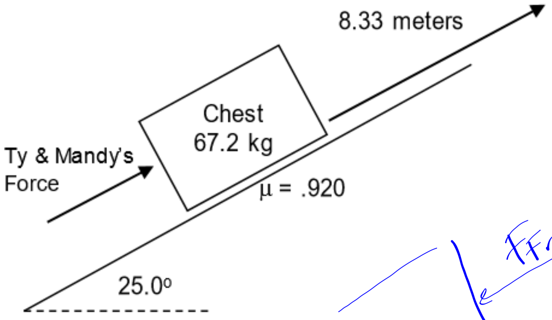
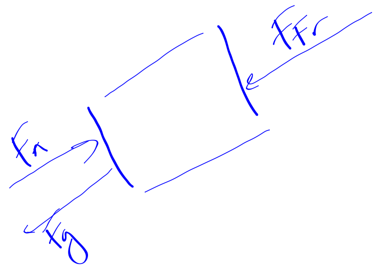
1. Mandy Lifeboats and Ty Dalwaive are walking on a beach when they see a treasure chest. They push the 67.2-kg chest up the beach (which makes an angle of 25.0° with the horizontal). The coefficient of kinetic friction between the beach sand and the chest is .920. If they push the treasure chest at a constant velocity for 8.33 meters,



a) What work do Mandy and Ty do on the chest? 6892.3 J

b) Why is it important that they push *parallel* to the surface of the beach (the incline)?



To minimize friction & maximize the force that is doing work...

$$F_A + F_g + F_{Fr} = 0$$

$$F_g = (67.2)(9.8)(\sin 25)$$

$$F_{Fr} = (67.2)(9.8)(\cos 25)(0.920)$$

$$F_A = 827.4\ \text{N} \qquad W_A = (827.4)(8.33)$$

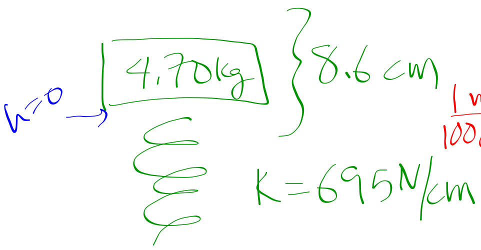
$$\boxed{= 6892.3\text{J}}$$

2. Suddenly the chest pops open. Inside is a spring (k= 695 N/cm) that is compressed by 8.60 cm with a 4.70-kg book resting on it. Mandy accidentally triggers the spring's release mechanism.

   a) How high (above the book's original position) will the text go after the spring is released? $v=0$; $h=55.8\,m$

   b) What will the book's maximum upward speed be? $h=8.6\,cm=0.086\,m$

$$\frac{1}{2}kx_0^2=\frac{1}{2}mv^2+mgh$$



$$\frac{1\,m}{100\,cm}\cdot\ \frac{1}{2}(695)(8.6)^2=(4.7)(9.8)h$$

$$2570\,J=(4.7)(9.8)h$$

$$h=55.8\,m$$

$$2570\,J=\frac{1}{2}(4.7)v^2+(4.7)(9.8)(0.086)$$

$$v=33.05\,m/s$$

EPE of Spring

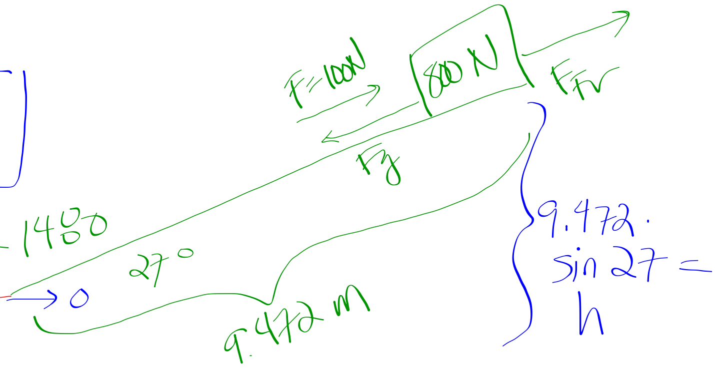
$$695\,N/cm\cdot\frac{100\,cm}{m}=695000\,N/m$$

$$8.6\,cm\cdot\frac{1\,m}{100\,cm}=0.086\,m$$

$$\frac{1}{2}kx^2=\frac{1}{2}(695000)(0.086)^2=2570\,J$$

3. You are sitting upon a 27° incline that is 9.472 meters long and you weigh 800 N. Because it is a very slippery surface, the coefficient of kinetic friction is a mere 0.15. There is a flat surface at the bottom of the incline that also has a coefficient of kinetic friction of 0.15. Your friend is pushing you with a constant 100 N force that is parallel to both surfaces the entire way. How far do you travel along the flat surface?

$$mgh + \underbrace{W_F + W_{Fr}}_{\text{on ramp}} = \boxed{\tfrac{1}{2}mv^2}$$



-947.2 − 1012.8 = 1480 → 0

$$\tfrac{1}{2}mv_0^2 + \underbrace{W_F + W_{Fr}}_{\text{on flat}} = 0$$

So...

$$mgh + \underbrace{W_F + W_{Fr}}_{\text{on ramp}} + \underbrace{W_F + W_{Fr}}_{\text{on flat}} = 0$$

$(800)(9.472)(\sin 27)$ + GPE (initial)

$-(100)(9.472)$ + Work done by friend (on ramp)

$-(800)(9.472)(\cos 27)(0.15)$ + Work done by friction (on ramp)

$-(100)d$ + Work done by friend (on flat)

$-(800)(d)(0.15)$ Work done by friction (on flat)

$$3440 + {-947.2} + {-1012.8} + {-100d} + {-120d} = 0$$

$$-220d = -1480; \quad d = 6.73\text{m}$$