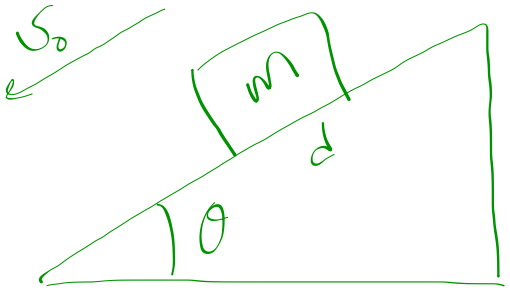
$W_{net} = ?$ $W_{net} = F_{net} \cdot d$

① What is F_{net}? → W_{net}?

② What's another way to solve we discussed in class?

9. A 300-kg piano slides at constant speed 4.5 meters down a 25° incline. It is kept from accelerating by a man who is pushing back on it. The effective coefficient of friction is 0.39. Calculate
   a) the net work done on the piano. $= F_{net} \cdot d = 0$
   b) the work done by the man on the piano.
   c) the work done by gravity on the piano.



$a = 0$

μ

$\Sigma F = ma = 0$ (in the dir. of motion)

$\Sigma F_y = 0$

$F_N = mg\cos\theta$

$F_{Fr} = \mu F_N$

$F_{Fr} = \mu mg\cos\theta$

$F_{app} + F_{Fr} - mg\sin\theta = 0$

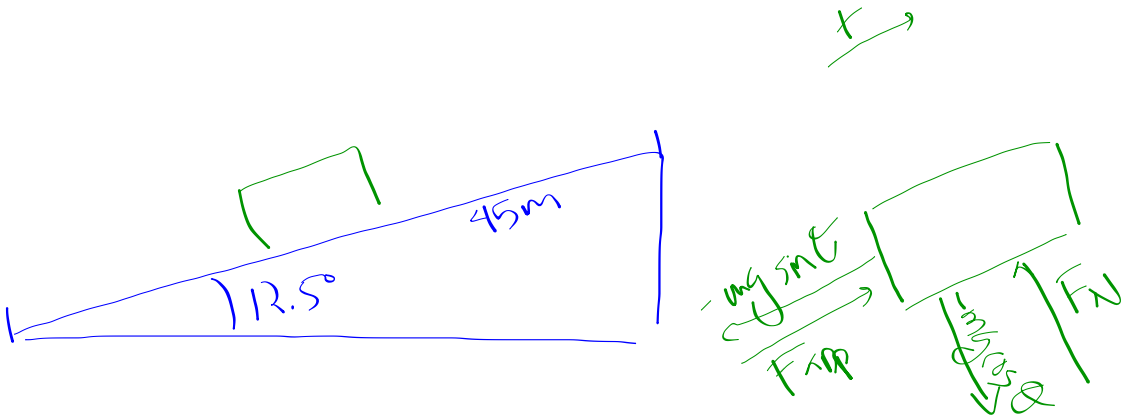
$F_{app} + \mu mg\cos\theta - mg\sin\theta = 0$

$W_{app} = F_{app} \cdot d$ (−)

$W_{fr} = F_{fr} \cdot d$ (−)

$W_g = F_g \cdot d$ (+)

5. What is the minimum work needed to push a 1000-kg car 45.0 meters up a 12.5° incline?
   a) Ignore friction.
   b) Assume the effective coefficient of friction is 0.30.



Min. work = F · d

minimum

$\Sigma F = 0$

$F_{app} = mg \sin\theta$

$W_{app} = mg \sin\theta \cdot d$

Conservation of Energy: "CLEE"

Crazy long energy equation

Start with Work - KE Theorem:

$W_{net} = \Delta KE$

Think about other types of energy storage:

gravitational potential energy

elastic P.E.

$W = \underbrace{\Delta KE}_{\frac{1}{2}mv^2} + \underbrace{\Delta GPE}_{mgh} + \underbrace{\Delta EPE}_{\frac{1}{2}kx^2}$

Rearrange:

$$\frac{1}{2}mv_0^2 + mgh_0 + \frac{1}{2}kx_0^2 + W = \frac{1}{2}mv^2 + mgh + \frac{1}{2}kx^2$$

Conceptually apply to a SYSTEM, not one object:

all initial: kinetic, gravitational, and elastic energy of a group of objects

+/− any work done from outside!

will be the same at any later time.

Preliminary Lab:

Everything starts with CLEE!

Objectives:

1. Understand how CLEE can be used as the basis for predicting many aspects of an object's motion and the forces an object feels
2. Use CLEE to develop equations to simplify future calculations