Physics 113 - October 2, 2012

- Exam 1 - Thursday, Oct. 4 0800 Hoyt
- Q + A session - 6:15 pm, Wed. Oct 3, 115 Harkness
- We will have normal lecture on Thursday

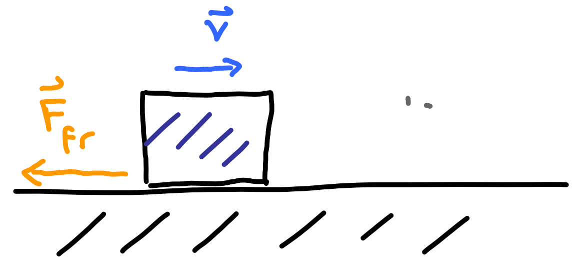
Last Week

Friction

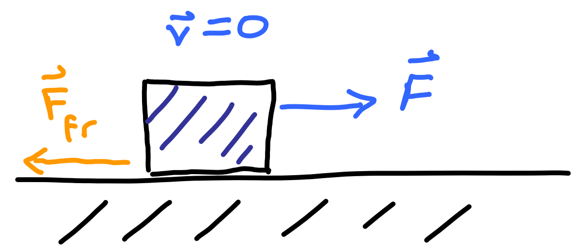
$$|\vec{F}_{Fr}| = \mu_k |\vec{N}|$$

$$|\vec{F}_{Fr}| \leq \mu_s |\vec{N}|$$

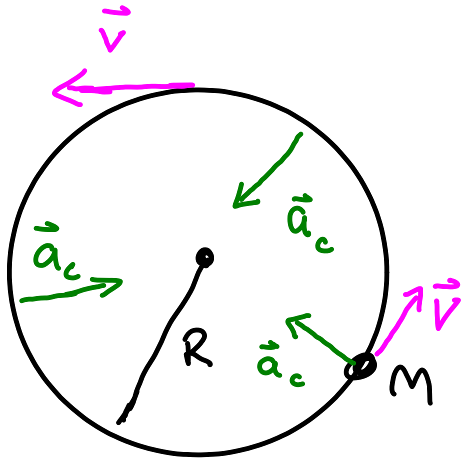
Look for indication of "threshold"



Force of friction opposes the motion



Force of friction opposes the net force



Circular Motion

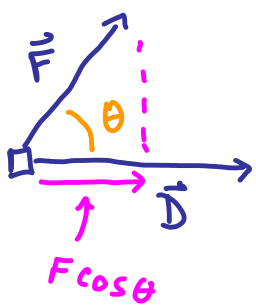
$$|\vec{a}_c| = \frac{|\vec{v}|^2}{R}$$

$$F = Ma$$

centripetal Force

$$F_c = m a_c = m\frac{v^2}{r}$$

Work + Energy



Work $= |\vec{F}||\vec{D}|\cos\theta$

Work = (Force)(Distance moved along direction of that Force)

- or -

Work = (Magnitude of force component along Direction of Movement)(Distance moved)

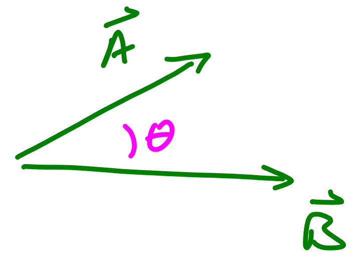
Woohoo! ☺ You can have negative work!!

Energy = Ability to do work

Energy = Work

1 Joule = 1 Newton-meter

Scalar ("Dot") Product



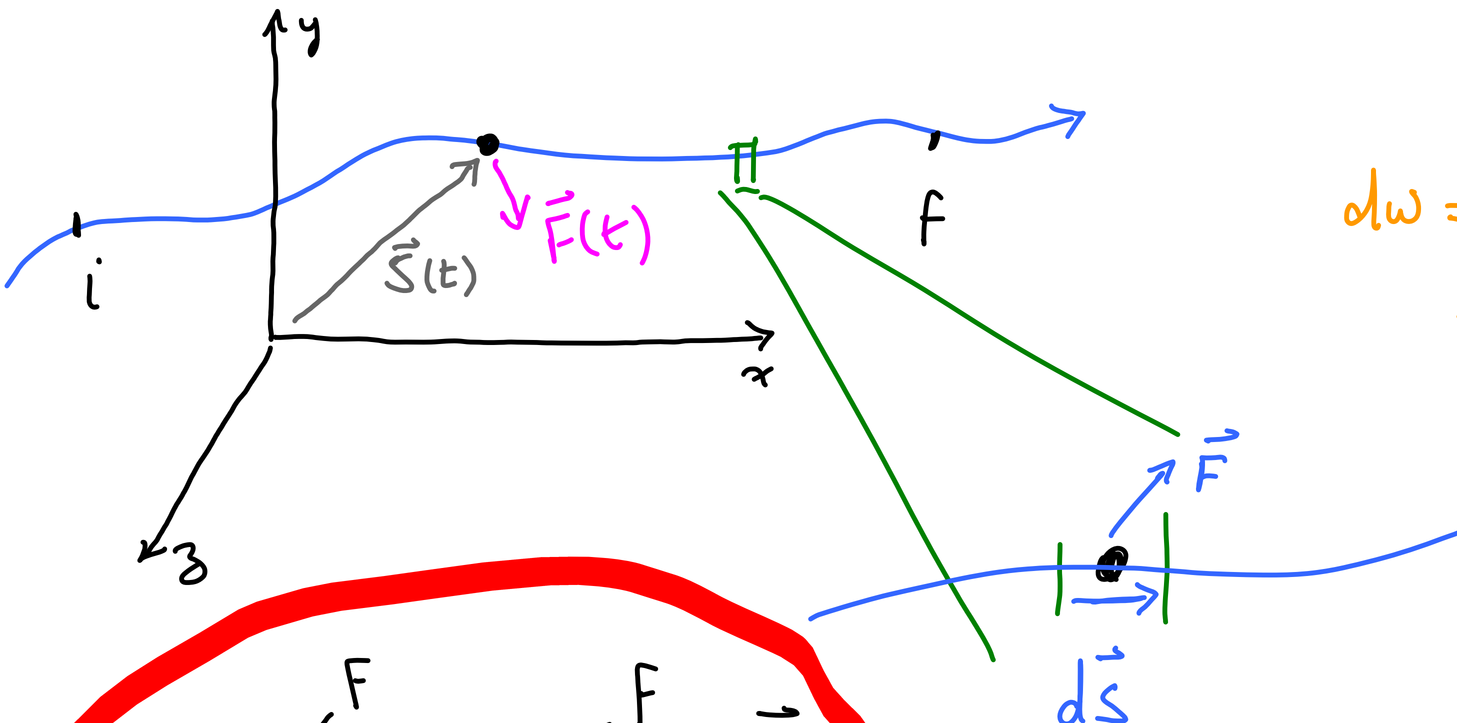
$$\vec{A}\cdot\vec{B} = |\vec{A}||\vec{B}|\cos\theta$$

$$= \vec{B}\cdot\vec{A}$$

projects out magnitude of one vector along other and multiplies it by mag. of the other.

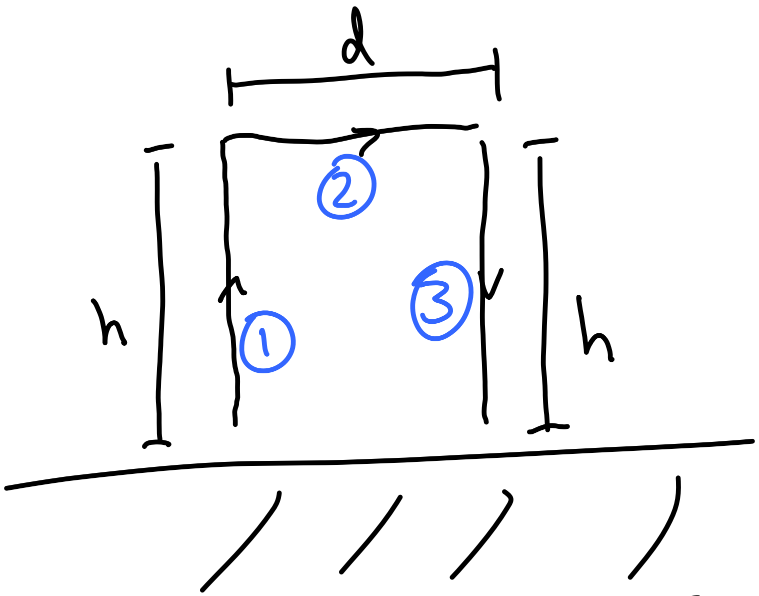
Two vectors ➡ a Number

$$\vec{A}\cdot\vec{B} = A_x B_x + A_y B_y + A_z B_z$$



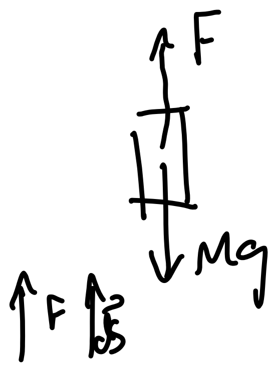
$$dw = \vec{F} \cdot d\vec{s}$$
$$= |\vec{F}||d\vec{s}|\cos\theta$$

$$W = \int_i^F dw = \int_i^F \vec{F} \cdot d\vec{s}$$



Climber w/ backpack mass M

What is the work done by the climber on backpack in each segment and in total?



$$\int \vec{F}\cdot d\vec{s} = \int_{1} + \int_{2} + \int_{3}$$

$$\int \vec{F}\cdot d\vec{s}$$

$$= \int F\,ds$$

$$= Mg\int_{1} ds = mgh$$

$$\int \vec{F}\cdot d\vec{s}$$

$$0$$

$$\int \vec{F}\cdot d\vec{s}$$

$$-Mg\underbrace{\int ds}_{h}$$

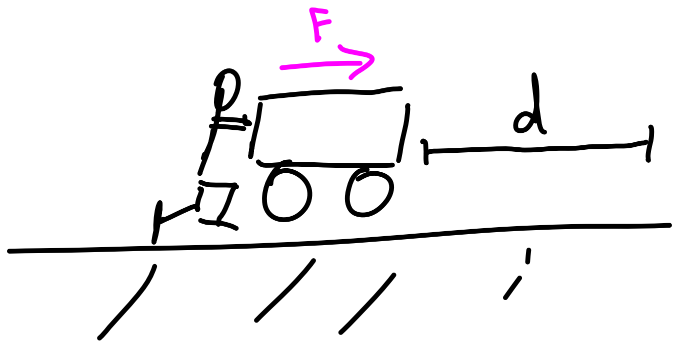
$$-Mgh$$

Total work = $Mgh + 0 + (-Mgh) = 0$

Net change in height is zero

Conservative system

gravitation is conservative force



Starting from rest, frictionless

$$F = ma$$

$$W = F d$$

const a eqns

$$v^2 = \underbrace{\cancel{v_0^2}}_{0} + 2ad$$

Work done

$$v^2 = 2ad = 2\frac{Fd}{M}$$

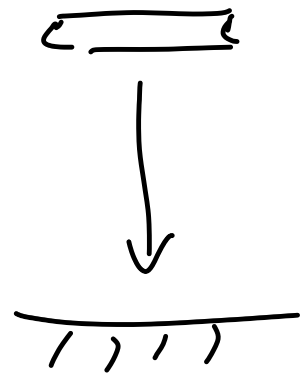
$$\text{Work} = \frac{1}{2} M v^2$$

= Energy

Kinetic Energy $\equiv \frac{1}{2}mv^2$

of motion

$F = mg$



let it drop

what is v at this point

$$v^2 = v_0^2 + 2ah$$

$$v^2 = 2gh$$

$$\underbrace{\frac{1}{2}mv^2}_{\text{KE}} = \frac{1}{2}m\,2gh = \underbrace{mgh}_{\text{Work}}$$

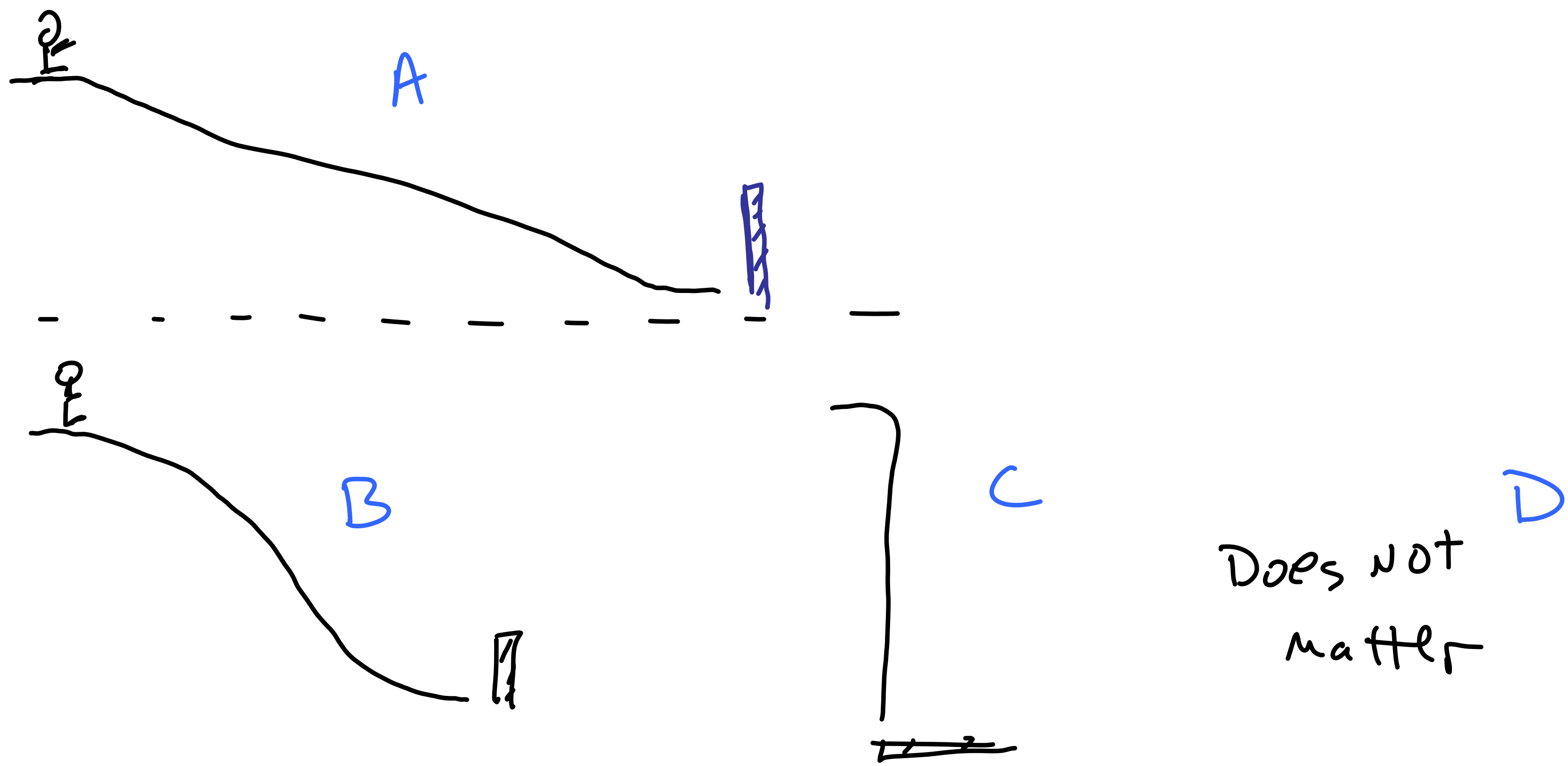
$PE = mgh$

$KE = \frac{1}{2}mv$

Conservative force

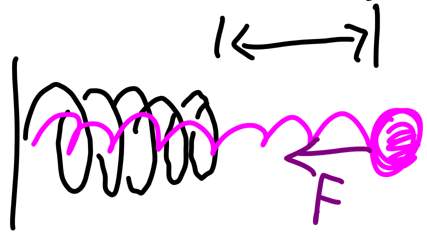
$$\sum E_i = \sum E_f$$

Energy conservation


A
B
C
D
Does not matter

Spring

$x - x_0$



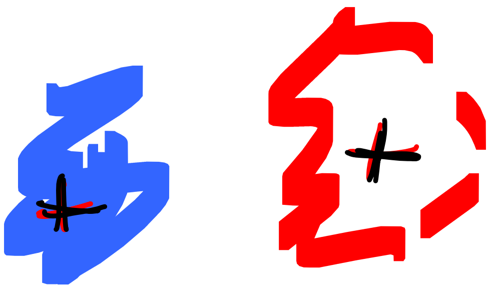
$\rightarrow +$

$l_0 \equiv$ natural length

x_0

$F \propto x - x_0$

$F = \underbrace{k}_{\text{spring constant}}(x - x_0)$



restoring force back to natural position

$$\boxed{\vec{F} = -k(x - x_0)}$$