So let's talk about energy!

1 | Types of Energy

- Potential Energy $PE_{grav} = mgh$ (which is work (force times distance) for moving stuff up $\vec{F} \cdot \vec{h}$)
- Kinetic Energy $KE_{translational} = \frac{1}{2}mv^2$ + $KE_{rotational} = \frac{1}{2}I\omega^2$

Where…

- I: moment of inertia
- ω: rotational velocity

2 | Work

$W = \vec{F} \cdot \vec{d}$, where $\vec{F}$ force and $\vec{d}$ change of distance that the force manifest.
=> $W = |\vec{F}| \cos\theta \times |\vec{d}|$
which, => $W = |\vec{d}| \cos\theta \times |\vec{F}|$
so, essentially, work is either displacement times parallel as part of force, or visa versa.
Why?

2.1 | The Dot Product, a review

2.1.1 | What is it

The Dot product is a measure of the "pararllelity" of $\vec{F}$ with $\vec{D}$.

=> Dot product: the component of the first vector parallel to the second vector multiplied to the magnitude of d.

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

2.1.2 | Calculating it

Given two vectors

- $\vec{V_1} =< a_x, a_y, a_z >$
- $\vec{V_2} =< b_x, b_y, b_z >$

The dot product is…
$\vec{V}1 \times \vec{V}2 = a_x b_x + a_y b_y + a_z b_z$

3 | Potential Energy

Potential energy exists because of a force field. There is an object ”propping” it up pending release of energy.

3.1 | Where did $\Delta PE = W = mg\Delta h$ come from?

So, define $PE = -W_{AB}$. Which is ”potential energy of A to B.” Gravity will do a certain amount of work from one point to anther, it will do the opposite the other way.

$\Delta PE_g = -W_{AB} = -\vec{F} \cdot \vec{d}$

$\Delta PE_g = -((-mg) \cdot \Delta h)$ The negative again! $ is