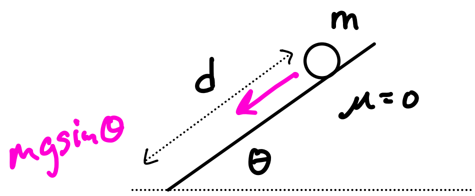
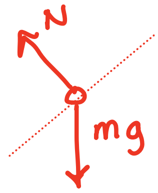
A Closer Look at GRAVITY and WORK



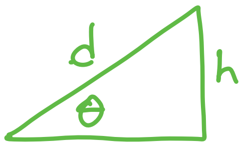


$\Sigma F_{\parallel} = ma$

$mg\sin\theta = ma$

$\Sigma F_{\perp} = 0$

$N - mg\cos\theta = 0$



what is the work done by gravity on object going down the ramp?

$W = Fd$ → but F is component parallel to d.

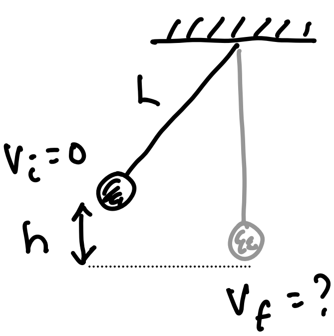
$\therefore \quad W_g = (mg\sin\theta)d$

hey! $(\sin\theta)d = h$ (the "height" the mass "fell")

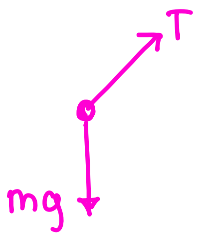
$$\therefore W_g = mgh$$

BIG IDEA: The work done by gravity ONLY depends on change in HEIGHT!

This can make difficult problems easy! Let's do an example!



A mass is on the end of a string of length L. The mass is pulled back so that it is a distance h above its lowest point. How fast will it go at the bottom of its swing after being released?



There are ONLY 2 forces acting on the mass. We need to find the work done by each force so we can say

$$\Sigma W = \Delta K.$$

Notice that the tension in the string is ALWAYS $\perp$ to its velocity - meaning it is always $\perp$ to the displacement of the mass.

* This means the work done by the Tension is 0!

$$W_T = 0$$

The work by gravity is easy:

$$W_g = mgh$$

So

$$\Sigma W = \Delta K$$

$$W_T + W_g = \tfrac{1}{2}mv_f^2 - \tfrac{1}{2}mv_i^2$$

$$0 + mgh = \tfrac{1}{2}mv_f^2$$

$$\boxed{v_f = \sqrt{2gh}}$$