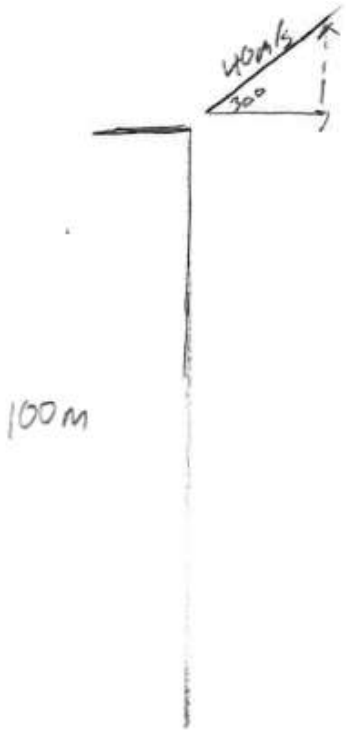
Assessment #10 Klay/Schwartz Check both sides!!!

1) I hit a baseball off the edge of a 100m-high cliff at a 30° angle above the horizon at a speed of 40 m/s.
   a) Please find the final speed of the ball when it hits the ground.
   b) Please find one or the other of the following,,, but you don't have to do both:
      a. the angle the ball makes with the ground. You don't need a calculator here. You are welcome to estimate with a reasonable good drawing.
      b. The distance the ball is from the base of the cliff when it hits the ground.



a). Energy I was because we see Energy being converted.'

$E_{kf} = E_{ki} + PE$

$\frac{1}{2}mv_f^2 = \frac{1}{2}mv_i^2 + mgh$

$v_f^2 = v_i^2 + 2gh$

$v_f^2 = (40\,m/s)^2 + 2(10\,m/s^2)(100\,m)$

$\boxed{v_f = 60\,m/s}$

b). a). We can find the horizontal velocity because we know it does not change through the course of it's flight.

$20\,m/s \quad \cos 30° = \frac{x}{40}$

$40\cos 30° = x$

$x \approx 35\,m/s$

or $\sqrt{3}(20\,m/s) \approx 35\,m/s$

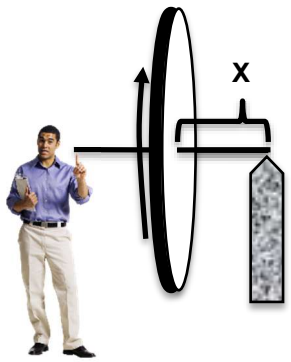
We know the final velocity.

$\cos\theta = \frac{35\,m/s}{60\,m/s}$

$\theta = \cos^{-1}(35/60)$

$\boxed{\theta \approx 54°}$

2) In the picture at right, a wheel is resting on my finger on one side and on a pedestal on the other. When I look at the wheel from your left, I see it rotating anticlockwise, or with the side nearest you moving upwards. THEN! Someone pulls out the pedestal, leaving the wheel only on my finger! Tell me what happens, please:
   a) Please identify the lens you'd like to look at this through and motivate it.
   b) Explain what the wheel will do after the pedestal is pulled out, and explain the physics why this should happen. Draw any picture you think will be helpful.



Rotational Dynamics

τ are causing $\Delta\ell$ → F_g on the r(x) cause a τ on the wheel causing a $\Delta\ell$.

$\Delta\ell$, ℓ_f, ℓ_o → The wheel will precess in the ↓ direction

$\Delta\ell$, ℓ_f, initial ℓ → The final ℓ will be back into the page & to the left.

The impulse of gravity is into the board

This will continue to happen as long as τ_g is acting on the wheel. There will be infinite amount of $\Delta\ell$'s. (precession)

…. Or if you can read the writing, the next one is also good!

Lens: Angular Momentum

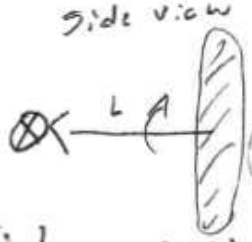
a) motivation? / why? : This system with angular momentum is expecting an impulse/change in angular momentum, due to gravity originally accelerating it

b)

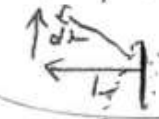
prior to being pulled out

after pulled out (rotating around finger)

side view



(top view)



(into paper, it recieves an impulse equal to dL.t

A

Prior to being pulled, the system had angular momentum to the left, then when the pedestal is removed gravity/ apply a torque INTO the paper, which will cause it to rotate around your finger "precessing", the direction of this will be clockwise from a birds eye view.