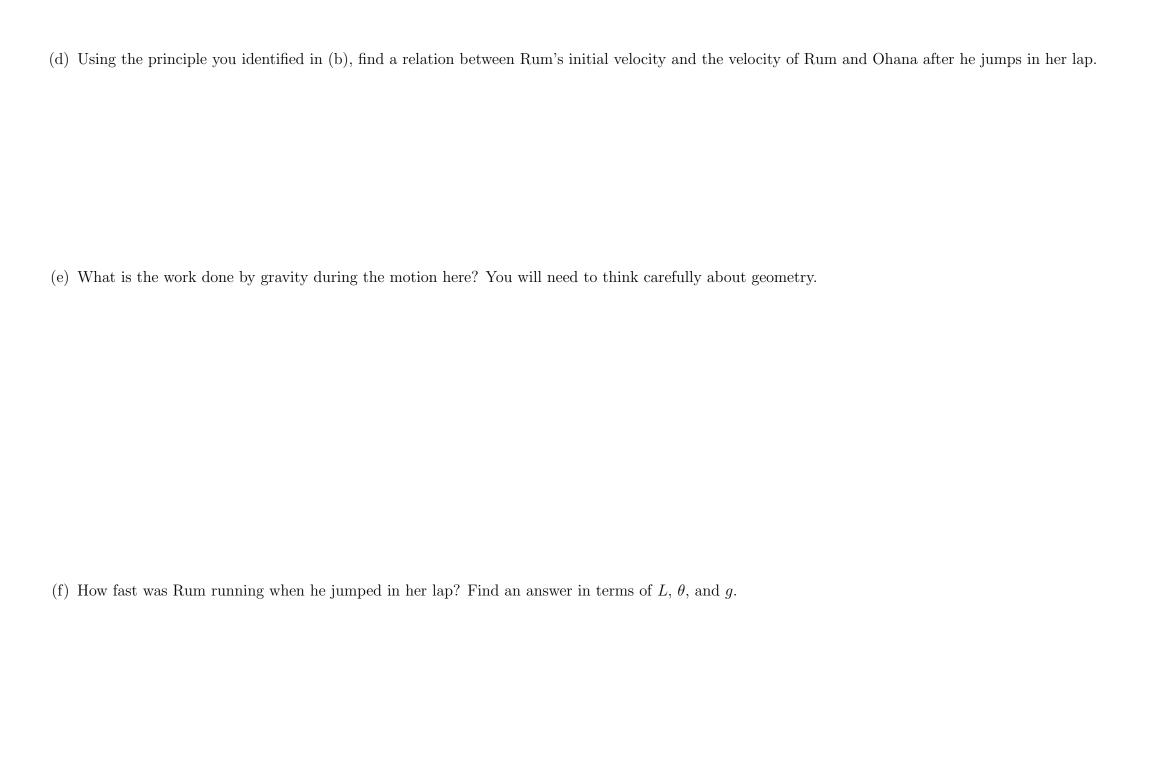# Recitation Questions
March 13

1. Someone drops a penny of mass 2.5g off of the Empire State Building (height 380 m). It strikes the ground traveling at 50 m/s, having been slowed somewhat by air resistance.

   (a) With what velocity would it have struck the ground if there were no air resistance?

   (b) What was the work done by the drag force?

   (c) This penny strikes the sidewalk and penetrates the surface, digging a hole 2 cm deep. What was the upward force exerted on the penny by the pavement? *(Note: Think carefully about whether you need to worry about the work done by gravity on the penny as it moves another 2 cm.)*

2. My laptop battery says it has a capacity of 97 "watt-hours".

   (a) What are the dimensions of this odd unit "watt-hour", and what does it measure? What is 97 watt-hours in more familiar units?

(b) My laptop has a mass of 2 kg. If it contained a motor instead of computing hardware, how far could its battery lift it (moving at constant velocity)?

This next problem also appears on your homework. If you finish it here, just tear off these pages and staple them with your homework.

3. Our former Physics 211 head TA Ohana Benevides is sitting on a tree swing, consisting of a light platform suspended by two ropes of length L. Her exceptionally friendly dog Rum (pronounced "room"), who is half her mass and far too big to be a lap-dog but doesn't know it, runs toward her and then jumps in her lap.

The impact of the dog causes her to recoil backwards, and the swing swings upward to an angle θ before coming back down.

(a) Draw cartoons of three relevant moments in time: (i) right before Rum lands in her lap, (ii) right after he lands in her lap, and (iii) when the swing is at its highest point. Label relevant things, in particular the velocities of moving objects.

(b) What physical principle can you use to relate the velocity of the dog before he jumps in her lap in cartoon (i) to the velocity of the person plus dog afterwards in cartoon (ii)?

(c) What physical principle can you use to relate the velocity of the person and dog in cartoon (ii) to the swing angle θ in cartoon (iii)?

(d) Using the principle you identified in (b), find a relation between Rum's initial velocity and the velocity of Rum and Ohana after he jumps in her lap.

(e) What is the work done by gravity during the motion here? You will need to think carefully about geometry.

(f) How fast was Rum running when he jumped in her lap? Find an answer in terms of L, θ, and g.

blep.

Rum the Physics Dog wants you to study hard.

Unless you have snacks for him.

Then he wants snacks.