Problem Set #4 due beginning of class, Monday Feb. 4. Please state the lens you are using and why. Remember that you are graded on your ***communication*** of physics understanding.

1. Exercise 1 in 3.0, changing reference frames. We did this in class. Please do it in good form.

2. Exercise 2, in 3.1, What are the final velocities in this elastic collision? We also did this in class… please do this in lovely form.

3. Dragsters have a mass of about 1000 kg and the best dragsters get to 44 m/s in about 0.8 s.
   a) What's the average acceleration?
   b) Estimate the coefficient of friction necessary to make this happen if you were in a regular car on flat ground.
   c) What's the average power output during this 0.8 s?
   d) According to my calculations, the engines kick out about 18 kg of exhaust every second at about 230 m/s. What is the momentum that this gas gained from the engine?
   e) Dragsters have their exhaust pipes pointed *upwards*. What effect does this thrust put on the vehicle? In which direction? What does this do to the normal force between the road and the wheels.
   f) What effect does this *downforce* have on the ability of the car to accelerate? *Why?*
   g) With this extra "downforce", what coefficient of friction is necessary in order to accelerate the dragster?

4. Exercise 5 in 2.7, potential energy graph. Traditionally, students have a hard time with this. Please consider reading through 2.7 while you do this example and/or watching the associated video. …. In particular, students have a hard time with turning point. The turning point is where the body turns around… it stops… there's no kinetic energy. But if it's not clear, please read the section again, OK?

5. Ballistics Pendulum: Please calculate the speed of the ball that was thrown by Drew. The mass of the cooler is 2.0 kg, the mass of the ball is 41 g, the length of the string that the cooler was hanging from is 60 cm, and the cooker swung back ~ 7 cm. First, use some Pythagorean Theorem to find that the cooler gained 4.1 mm of elevation in the process. Hannah used a video (and a kinematics lens) to calculate the speed at about 16 m/s… is this about what you got?

6. Skidding to a stop. Please do exercises 2 and 3 in section 3.2.