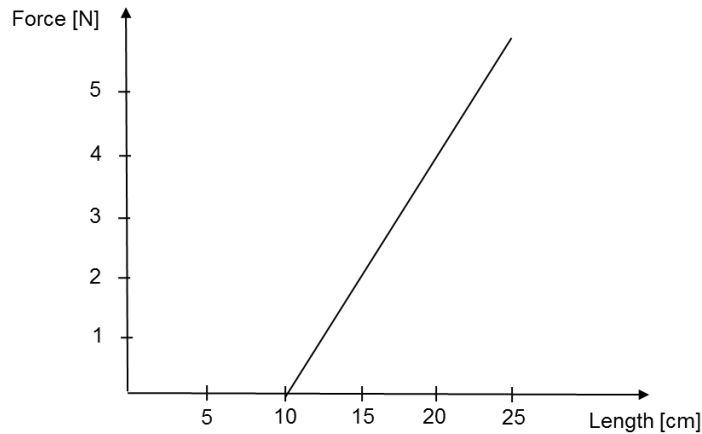
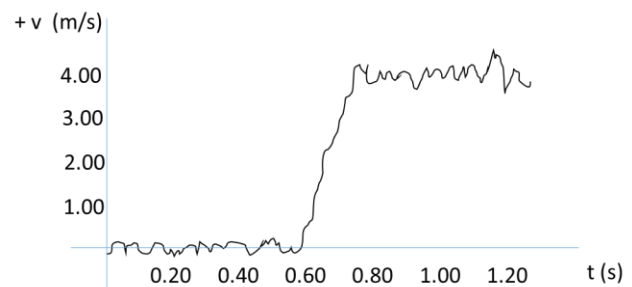


Instructions: You have 40 minutes to work individually on this assessment. Your solution is not complete if you have not shown all your working and reasoning, including a picture (possibly a before and after picture) and coordinate system! Do not forget to include the net force on any free body diagrams. You may request extra paper if you run out of space.

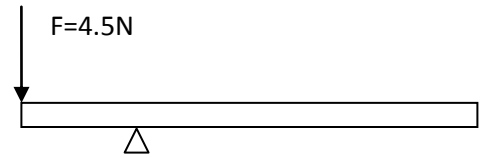
1. (3 pts) You have taken the job to sort and label springs in the physics department of your favorite community college (this is not a well paid job). The graph shows the force you use pulling on the spring with versus the length of the spring. What is the spring constant?



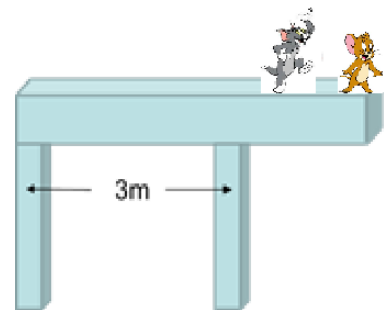
2. (2 pts) In what range of values was the magnitude of the impulse that resulted in the following change of velocity of a car on a track that has a mass of 502g.



3. (4 pts) Say you own a massless meter ruler. If you place the pivot $1/4$ of the length from the end, and push down at the shorter edge with 4.5N . What force (and what direction) should you apply to the opposite end?

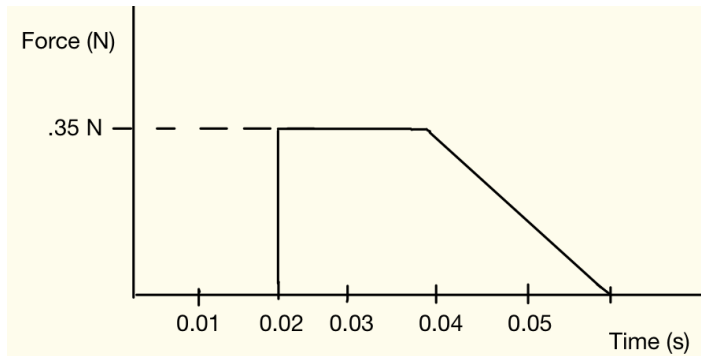


4. (7 pts) Tom (mass = 10kg) chases Jerry (mass = 2kg) out to the edge of a 5-meter beam (mass = 20kg) balanced on two posts that are spaced 3 meters apart as shown. Jerry runs out to the very end of the beam. How close to the right end of the beam can Tom go walk, until the beam begins to become unbalanced and they tip over?



5. You are playing mini golf and need to get your ball in the hole in one shot. The hole is 5.0 m away. The force that your golf club applies to the 50g ball with respect to time is shown in the figure below. Assume all motion is along the line between the ball and the hole, and that the grass is level.

- I. (3pts) What is the impulse of the club on the ball?
- II. (4pts) What is the speed of the ball just after you have hit it?
- III. (3 pts) If the coefficient of rolling friction between the ball and the fake grass is 0.04, did you hit the ball too hard, too soft, or just right to roll exactly to the whole



6. (4pts) You are playing pool billiard. The cue ball hits the 8 ball (initially at rest) straight on with a velocity of 12m/s. Both balls have exactly the same mass of 160g.
- I. What is the velocity of the center of mass before the collision? Explain.

 - II. What is the velocity of the center of mass after the collision? Explain

7. (3pts XC) The figure shows scale drawings of four objects, each of the same mass and uniform thickness, with the mass distributed uniformly. Which one has the greatest moment of inertia when rotated about an axis perpendicular to the plane of the drawing at point P? Disc A and C are solid, but made of different material, so that indeed all 4 objects have the same mass.
State your reasoning.

