

# Who's Your Mom-entum? Final Lab and Report

## *Physics*

This lab report is an individual assignment and should be turned in with all work shown, all calculations clear (including equations and derivations), and diagrams and drawings where necessary. Submit your work through Showbie when you have it completed.

Using your experience from the preliminary lab as a guideline, complete the following tasks. Please note that there is an implied frame of reference; if one cart has a positive velocity and the other has a negative velocity, it implies the two carts are moving toward each other.

### **Part I: Prediction**

Set up two motion carts. Each cart should have a force sensor mounted; one should have two additional mass bars as well. Both force sensors should have rubber bumpers attached. At least one of your carts needs to be non-magnetic.

With the force sensors disconnected from the LabPro, roll the carts together so they collide: the more massive cart should have a speed of around 0.25 m/s and the less massive cart should have a speed of around 0.5 m/s. This will take some practice!

1. Using the data from the graph (along with measured masses of the carts), calculate the momentum of each cart before and after the collision. Make sure to adjust your frames of reference to take into account the fact that the two sensors are facing opposite directions. **Show your measurements, calculations and final results.**
2. Using the average change in momentum from the carts along with the amount of time that goes by during the collision (from the graph), predict the size of the average force between the two carts during the collision. **Show your measurements, calculations and final results.**

### **Part II: Test**

3. With the carts set up as above, connect one force sensor to the LabPro. (Or both – but each should show the same amount of force and you should understand why!)
4. Roll the carts together again, doing your best to match the velocities from part I.
5. Record the force between the two carts during the collision from the graph. (If the collision lasts long enough, calculate an average using the LoggerPro program.)

### **Part III: Error Analysis**

6. In a paragraph of 5-6 sentences, discuss your results. How well did your test match your prediction? What are some of the reasons why your test results may not have matched up with your predictions? (Hint: “Measurement error”, “Human error”, and “Equipment error” are not specific enough. What are some specific ways in which measurements could be incorrect, human error could have contributed to differences in theoretical and actual values, and the equipment could somehow lead you astray?)