# Phys 223

**Inertial balance:**

Astronauts in space can’t just step on a typical bathroom scale to measure their weight (Why?). Instead they use their body to generate oscillations in a system of springs (called an inertial balance). By measuring the period of the oscillation, they find their mass.

* Clamp the inertial balance to the table. Place a known mass in the balance pan and measure the period of the oscillation. Try 0g (empty pan), 100g, 200g, 300g, 400g, and 500g. For small masses, the balance might oscillate too fast for the eye to get an accurate visual measurement of the period. Use the computer and a motion detector to make the measurement.
* Plot the mass in the balance pan versus T2.
* Use your graph to measure an unknown mass, and compare with the value given by a usual scale.
* From the formula, show that min pan is a linear function of T2 (i.e. ). Note that in the formula T(m), m is the total mass and **not** just the mass in the pan: . This computation shows that your graph should be a straight line that doesn’t go through the origin.

**Spring constant:**

Select 2 different springs and measure the spring constant of each spring with the following procedure

* Hang a known mass on the spring and measure the distance the spring stretches. Do so with 5 different masses (50, 100, 150, 200 and 250g).
* Plot the magnitude of the spring force versus the distance the spring stretches.
* Find the spring constant from your graph.

**Springs on a cart:**

* Attach the two springs on both sides of a cart on a level track (as in problem 15.74 of your textbook).
* Measure the period of oscillation.
* How well does the experimental value match the value given by the formula in 15.74? (Note that you will need to measure the cart’s mass).
* Theory: Derive the formula given in 15.74.

**Springs in series**

You will measure the spring constant of the two springs when attached one after the next (in series)? You could repeat what you did for one spring. But for a change, you will do it differently.

* Hang a known mass on the two springs and measure the period of the oscillation (average over several oscillations). Repeat with 4 other masses.
* Compute an average of the spring constant from your measurements (Since , )
* Theory: Find the theoretical value of the spring constant of the two springs attached one after the next from the values of the spring constants of the two springs (justify the formula you are using).
* What is the error between the experiment and the theory?

**Springs in parallel**

Go through the same steps as for the springs in series, but this time attach the two springs side by side (in parallel).

**Write-up**

## Turn in a typed report. For each part, organize the data in a table.