Experiment setup:
1 The 750 interface should be powered on (green light comes on).
2 The launcher should be plugged into power (white end glows) and its output should be plugged into input A of the 750.
3 Download and run the Projectile Motion program. Do NOT run it from the web, download it first. We are L10.
4 The apparatus should be set up as shown in the writeup for upward shots.
5 Be sure the point the ball leaves the tube is beyond the edge of your table.
6 You can set the angle by loosening the black thumb screw and screwing it into a different hole. Angles are separated by 15 degrees.

Calibrating launch velocity:
1 Decide who runs the computer, who launches the ball, and who catches it.
2 Adjust the angle to the desired value.
3 To launch the ball, hold the white cylinder (not the clear tube), pull out the washer at the end (see arrow at right in upward photo in the writeup) until the trigger clicks into the slot on the metal cylinder.
4 Drop the ball in the end of the tube.
5 On the action menu, select “Measure”. The “Run” light glows bright green.
6 Push the free end of the trigger bar on the side of the white cylinder to fire.
7 If not already there, go to the “Graph” tab. You should see a squarish peak near the left end in the blue plot. If not, something is wrong. Try again. If you still don’t see this, ask for help.
8 You can repeat this several times (select Measure, hit Run, drop the ball) to see that the peak appears very similar each time.

9 On the graph control (found at top left of graph, see picture above), select the crosshair-shaped option at the far left. This lets you click on and move the vertical red dotted line back and forth. The cursor will change to vertical lines with arrows when you are close enough to the red line to grab it. Press and hold the left mouse button to move the red line. Notice that as you move the red line, the boxes above the graph show you the X and Y position of the marker.
10 Position the red line on a point about 1/2 way up the left side of the peak and click the “RISE” button.
11 Position the red line on a point about 1/2 way down the right side of the peak and click the “FALL” button.
12 Go to the “Results” tab.
13 Enter the angle (measured from the horizontal in degrees) in the appropriate box.
14 Select “Analyze Data” from the action menu. Numbers will appear in the boxes for speed and $V_0$ times the sine and cosine of the angle. Record these on your report.

Making a prediction:
1 Measure the distance that the center of the ball falls.
2 Use the formulas in the writeup to calculate the flight time and the range of the ball. Record these in your report. Under Windows, “Start”, then “Program”, then “Accessories” will lead you to a calculator program. In the calculator menu, select “View”, then “Scientific” for trig functions, square root, etc.

Checking your prediction:
1 Adjust the angle to the desired value.
2 Do a test shot first to see where to put the clipboard. The ball should hit near the center of the clipboard. Place a blank sheet of paper and above it carbon paper, carbon side down, on the clipboard, both clipped down.
3 Set the angle and fire away! Do several shots to look for variation. Be careful that neither the launcher nor the clipboard move between shots.
4 Mark all the spots you made with the angle used.
5 Hold the plumb-bob so it touches the floor at a point right below where the center of the ball is when it leaves the tube (use yellow lines to position the string). Measure from this point to the middle of the spots you got with your shots.
6 Record your results in your report and answer the questions.

Downward shooting:
1 Pull the insert with the rod out of the clear plastic tube (hold the clear plastic tube while twisting and pulling on the white cylinder to remove the assembly).
2 Rotate the apparatus and reclip to the table.
3 Adjust the angle to the desired value.
4 Click the “Run” button, then drop the ball in the end of the tube so it rolls down.
5 Repeat the above analysis procedure for at least one angle of downward shooting.

Learning LabView Graph Controls
For future experiments, we’ll do much more complicated graph manipulations. Take time now to play with them.
1 Select expand (center icon with magnifying glass at top left of plot).
2 Press left mouse button, then select horizontal expand (top center icon in submenu), then release mouse button.
3 Put cursor (now like a magnifying glass) to one side of the blue peak, press left mouse button, hold and move to the other side of the peak, release mouse button. Region you selected expands to fill plot.
4 Go back to cursor mode (cross-hair icon) and move red line around.
5 Under expand (magnifying glass icon), select full screen (bottom left icon in submenu). You should see the full plot on your screen again.
6 Now expand a region not including the red line. The red line disappears!
7 Go back to full screen, go back to cursor mode and move the red line somewhere else.
8 Go to expand mode and blow up a region including the red line.
9 In the future, when you need to use a cursor in an expanded region, don’t forget to move the vertical lines into the desired region before expanding.

If you finish early, you are encouraged to play with the equipment and the LabView controls or try different angles, either upward or downward, but don’t forget to finish your report.