Procedure

1. Go to my teacher page and download the video listed under Physics 122 (http://jmh.nbed.nb.ca/teacher/note/physics-122-2d-motion-analysis-videos). Be sure to right-click and select "save video as".
2. Open up Tracker on the computer (hit the start button and search for Tracker is the easiest way).
3. Load the video.
    a. Set the frame rate to 300.
    b. Use the calibration stick to set the length of the cart to 0.26.
    c. Set up your coordinate system so the origin is to the left of the cart when the ball lands in it. Lock your coordinate system (under the coordinate system menu at the top of the screen).
    d. Set start and end frames using the black triangles.
    e. Track the metal sphere as it leaves the cart to the point just before it hits the cart on the way down.

Analysis

Note When answering the following questions never read one data point, your answers should be based off a mathematical analysis (line of best fit, for example).

Open a blank WORD document to copy your graphs and write your answers.

1. What was the horizontal velocity, v_x, of the metal sphere?
2. What was the initial vertical velocity, v_{oy}, of the metal sphere?
3. Use your answers from 1 & 2 to calculate the initial velocity, $\vec{v}$ of the metal sphere.
4. Calculate the velocity of the metal sphere at the 0.05 second and 0.34 second marks.
5. What is the equation for the height of the metal sphere, d_{fy}, as a function of time?
    a. Take the derivative – what is this a formula for?
    b. Take the derivative again – what important value is this?
6. What is the equation for the height of the metal sphere as a function of horizontal position?
    a. Take the derivative – what is this a formula for?
    b. Calculate the rate of change of height when the metal sphere is 0.58 m and 0.32 from the origin. Do your answers make sense based on the motion of the metal sphere?
    c. Calculate the x-position of maximum height.
7. What are possible sources of error that could lead to inaccuracy in the analysis?