Project 2A. Derivatives 1D. Vinnie's Pudding

Vinnie suggested that it might be fun for the physics club to determine whether or not it would be *better* to parachute (without a parachute) into a big tub of jello or a big tub of pudding. To decide, one might drop a ball from some height h into said substance and measure its maximum decceleration. Dropping onto a pile of feathers would result in a smaller decelleration than landing on a cement floor. If the ball's entrance into the jello/pudding were filmed using a high speed camera, one could measure x(t) directly from the video. Finally, take two derivatives and you've got the ball's acceleration.

It is on this last step that we will dwell today. Suppose you are provided a set of points for x(t) but need take two derivatives of x w.r.t. t. If you knew the form of x(t) as an equation you might be able to use some of your rules from calculus, but we only have a set of points. What to do?

This exercise has two steps.
1. Calculate a derivative using Excel (due Monday)
2. Implement a program to do the same thing in c++ (due Wednesday)

For part 1.

(a) Create three columns in Excel labeled t,x,v. In the first column place t values from 0-2s using steps of 0.1 seconds. In the second, set $x(t) = 2t^2$ (m). In the third column, calculate an estimate for the derivative, dx/dt. Graph x(t) and v(t) on the same graph and place a linear curve fit on v(t). What do you get? What equation would you have expected? Why might it not be the same as what you got? What happens to the difference if you use a step size of 0.2 instead of 0.1?

(b) Repeat, but use c++. We will do this on Monday and I will provide more detailed instructions then along with an @ activity.

Style Notes for this Assignment

- Your excel file should contained one well labeled graph.

- Your excel file must have answers to the questions included in a sensible manner.

Due Monday. Place .xls file in D2L dropbox.