

# Physics 201 Lab 8

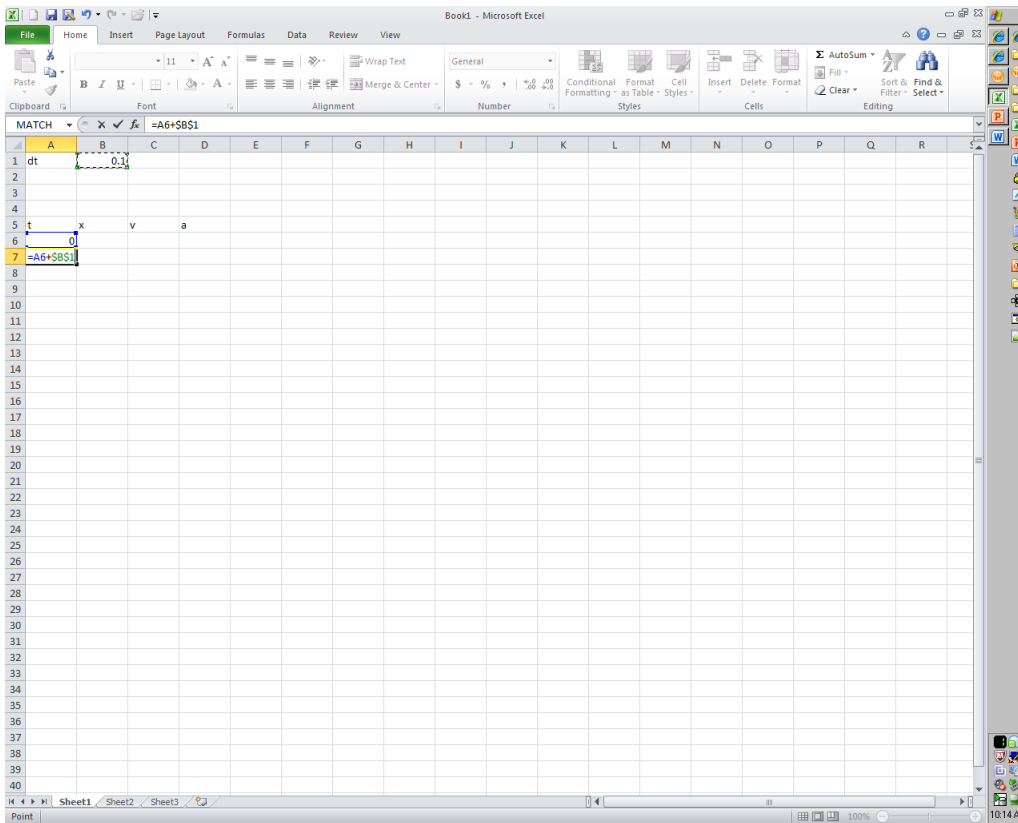
## Apollo Simulation

Mar 11, 2013

### Equipment

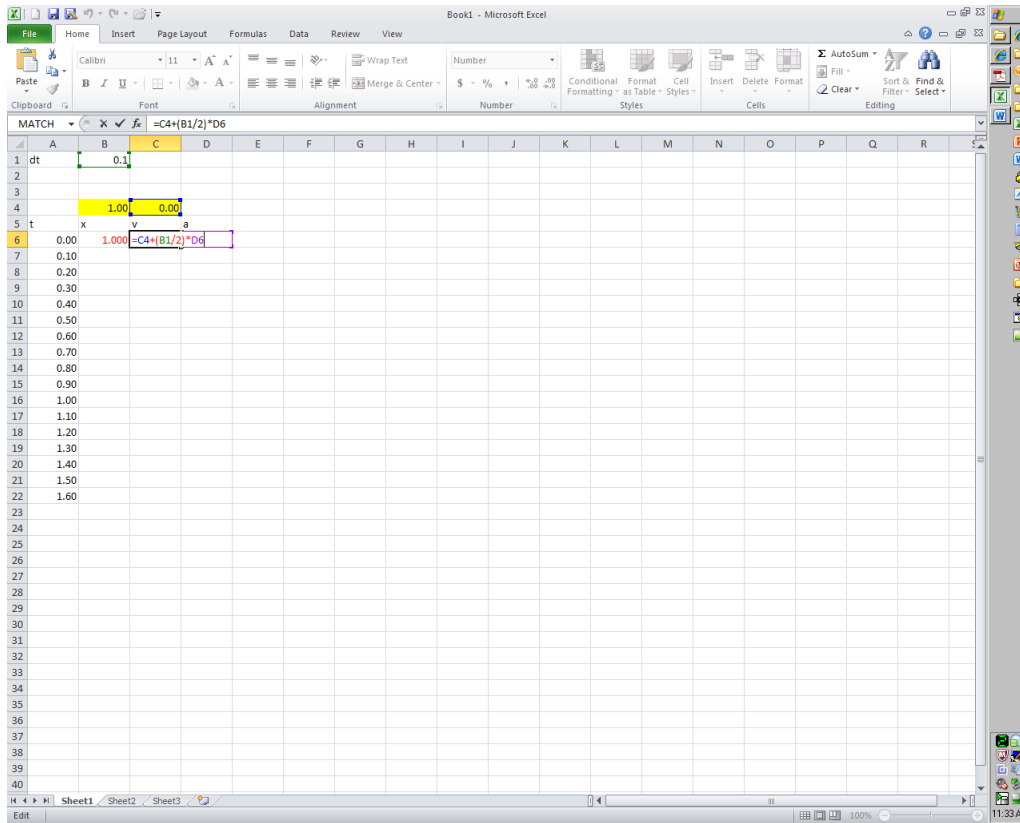
This lab is inspired by the website Apollo 11's Translunar Trajectory at <http://www.braeunig.us/apollo11-TLI.htm> by Robert A. Braeunig. The entire site is worth exploring to learn more about orbital mechanics and space flight.

### Starting out



Building out time sequence

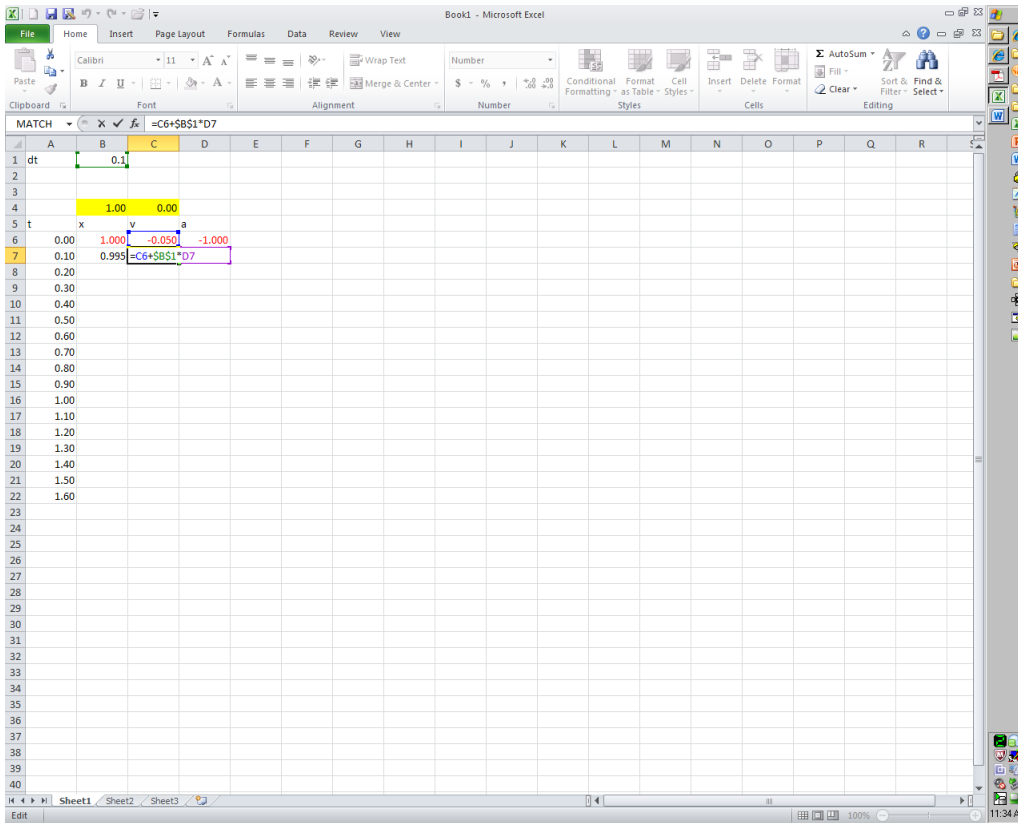
Initial velocity calc



This cell is a special case:

$$v(dt/2) = v(0) + (dt/2)a(0)$$

The iteration equations



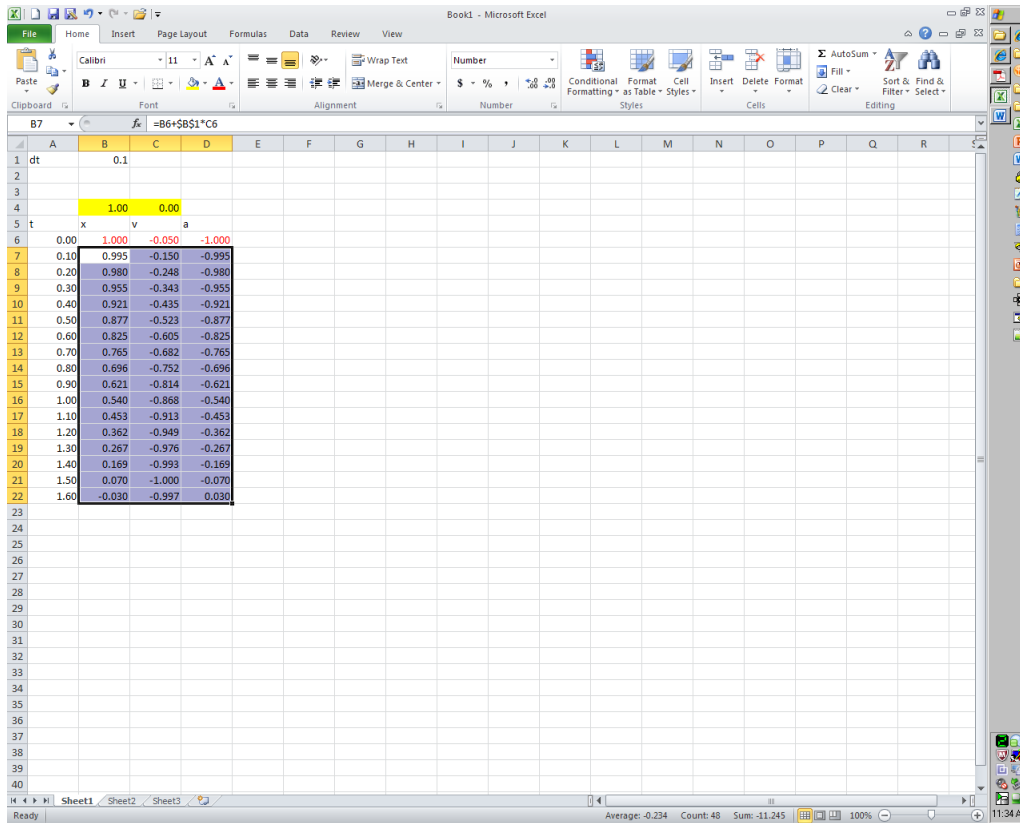
This links to prior row:

$$v(t + dt) = x(t) + (dt)v(t + dt/2)$$

This links to current row:

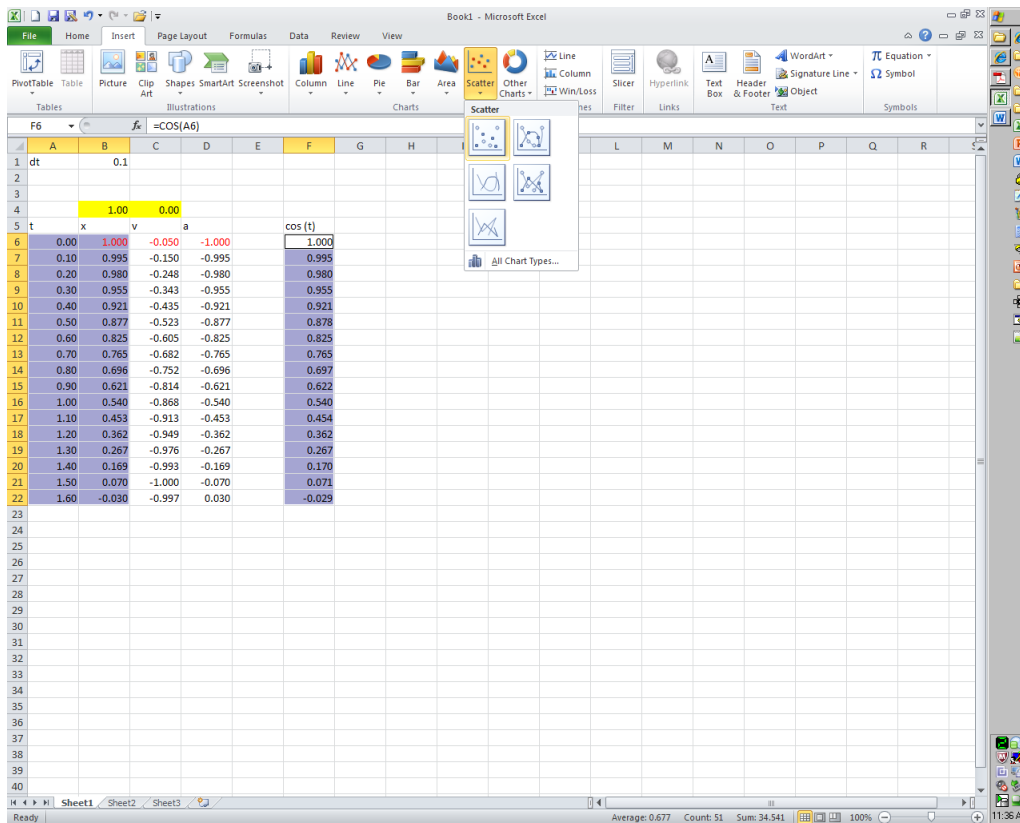
$$v(t + dt/2) = v(t - dt/2) + (dt)a(t)$$

Now it's easy



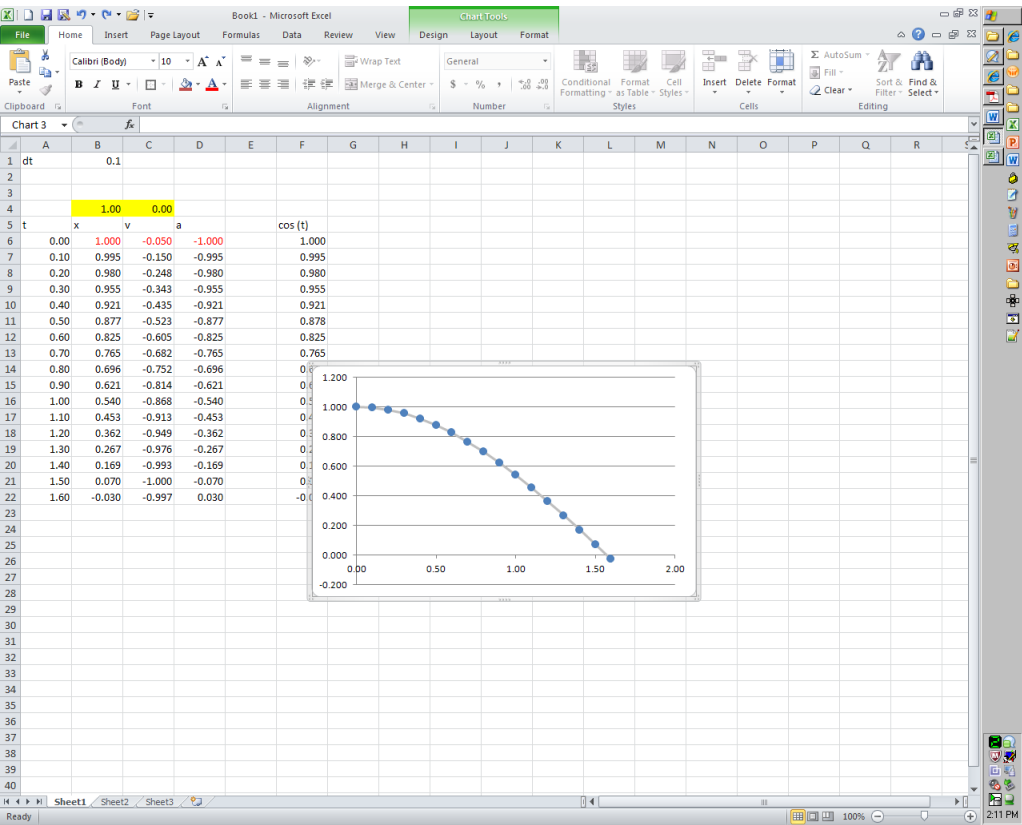
Drag the cells down as far as you want

## Double-check



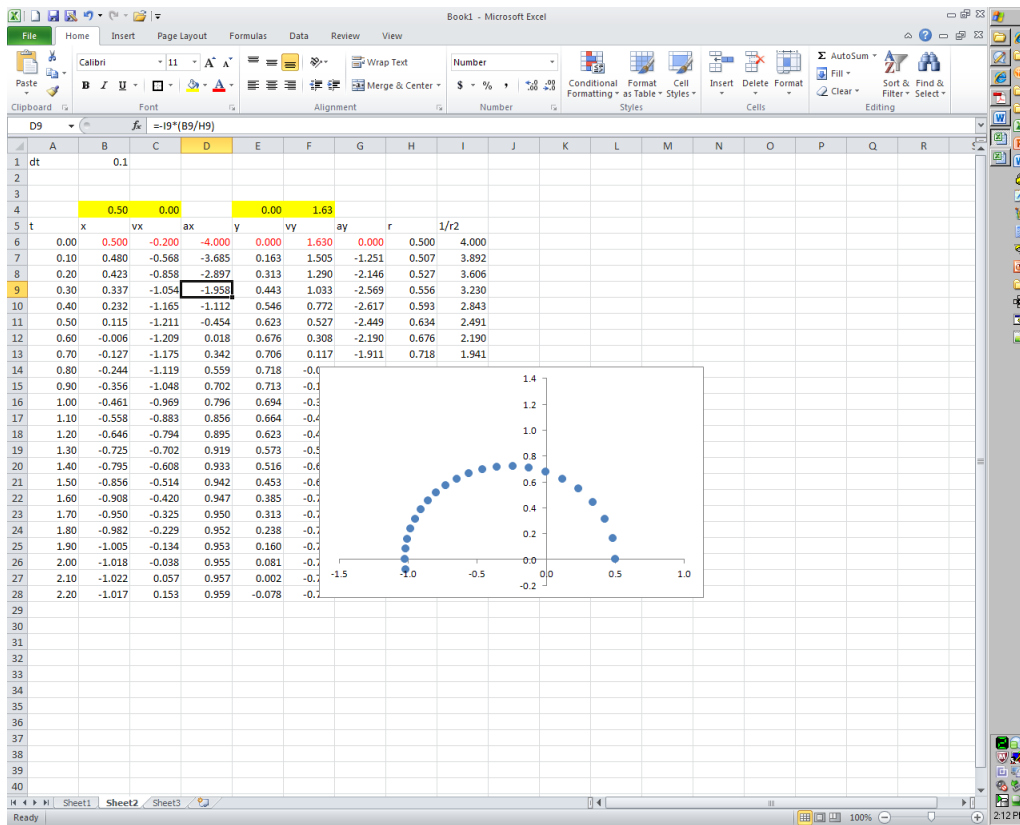
We want to compare to the  $x = \cos(t)$  graph.

It works!



Twice as hard

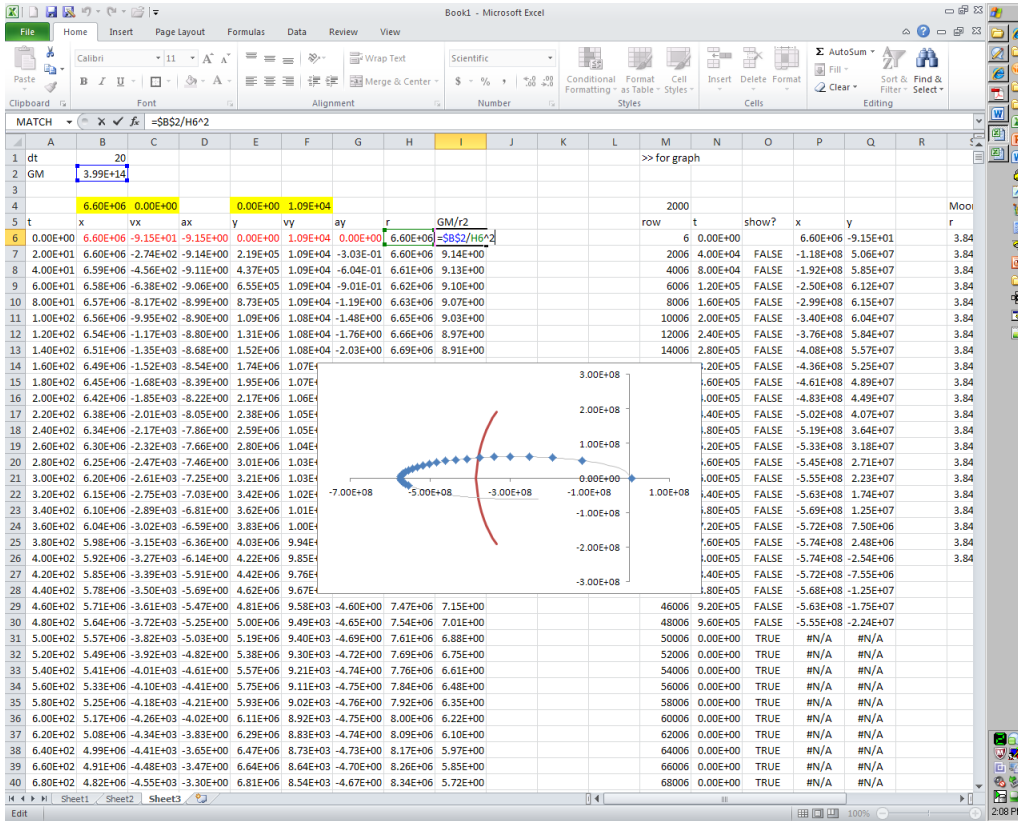
But it still works!



## The moon shot

Calculating the moon shot is the same but MUCH longer (50,000 rows).

Red line represents orbit of the moon, and gray is based on Robert Braeunig's calculations from <http://www.braeunig.us/apollo/apollo11-TLI.htm>



## Supporting docs

- <http://spot.davidjulrich.com/static/assets/misc/flp-v1-c9.pdf>
- <http://spot.davidjulrich.com/static/assets/misc/apollo-shot.xlsx>