PICUP

Why Spreadsheets?

- Used everywhere
  - Free (OpenOffice, LibreOffice, Google Sheets)
  - Kinda Free (Excel)
- Good level for interacting with a computer (optimum for intro students?)
- Transition to programming languages (on-ramp for python, MATLAB, C/C++, etc.)
  - Students do not fear the spreadsheet
  - Visual one-to-one correspondence with components of a programming language
- Visually build algorithms (Live Pseudocode)
- More functionality than you might expect
  - Control panel
  - Slider bars anyone?
  - Million rows

	Max. Rows	Max. Columns
Excel 2010	1,048,576	16,384
Excel 2007	1,048,576	16,384
Excel 2003	65,536	256
Excel 2002 (XP)	65,536	256

PICUP

The Roos
Excel → XXXXX* Method
(aka "Live Pseudocode" Approach)

- Guided Activities
  - build model together in class with students in Excel
  - students' mission is to produce a correct XXXXX version
  - students have a working model (Excel)
  - students know what the results are and how to assess accuracy
  - eventually (after 3 or 4 GA's) students go directly to XXXXX ***without*** my guiding them via Excel

- Benefits
  - gets students into XXXXX confidently so they know if their code is doing what its expected to do (Excel is the visual guide)

  - avoids having the students code from scratch at the beginning when they're just learning how to program something for the first time

* XXXXX = Python, MATLAB, or whatever you want your students to use

BRADLEY University

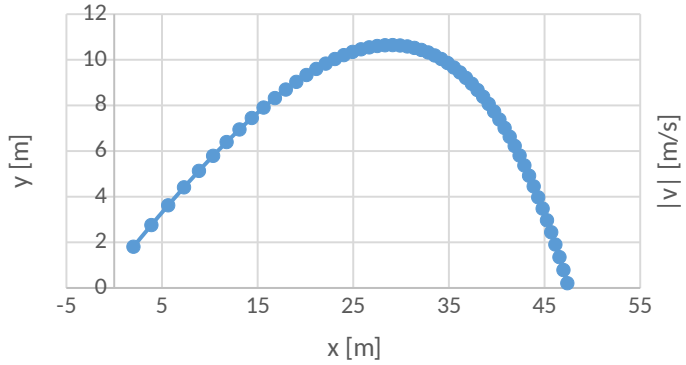
PICUP

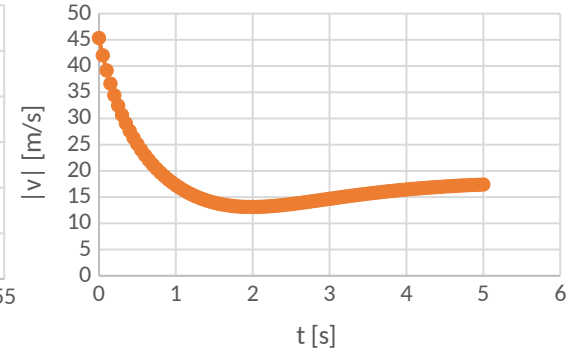
Spreadsheets in Introductory Mechanics at Bradley U. by K. Roos
(Mostly implemented in Lab meeting times)

- Kinematic Equation Solver (HW) – **Evaluate a Function**
- Ball Drop Experiment - Basketball and/or Beach Ball -
  - with air resistance proportional to v (LAB/HW) – **Euler**
- Falling Sphere with air resistance proportional to v^2 (HW) – **Euler**
- Saturn V Launch (HW) – **Euler**
- 2-Body Gravitation Orbit – Moon-Earth System (HW) – **Euler-Cromer**
- SHO Euler-Cromer (LAB/HW) – **Euler-Cromer**
- Damped Driven HO (LAB/HW) – **Euler-Cromer**

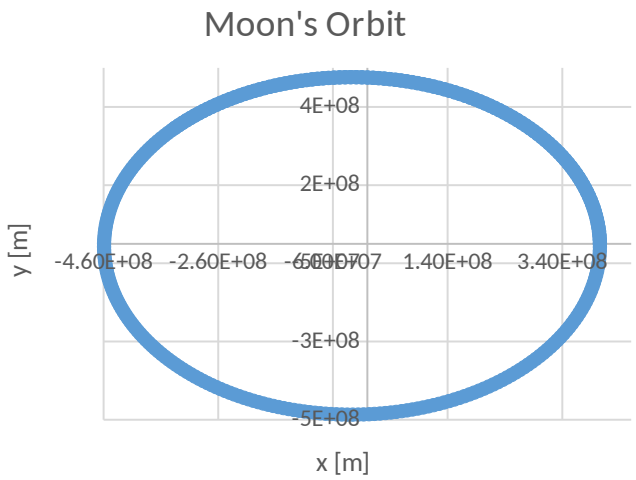
There are 4 labs that implement the Euler-Cromer method to solve the equations of motion using spreadsheets:

Lab 3: 2D Falling Sphere with Air Resistance

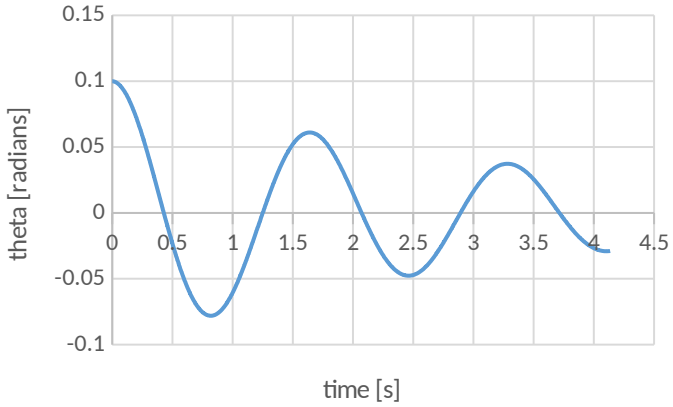




Lab 5: Orbital Motion



Lab 10: Damped Rigid Pendulum



Lab 11: Driven Systems