

Homework 0

ME 581

Complete the steps described below to print, as a PDF, the HW0 Jupyter notebook provided at <https://nanohub.org/tools/purdueme581>

Submit this PDF on Gradescope as your submission for HW0.

Step 1: Create a Nanohub Account

Create an account in nanoHUB.org:

- Go to nanohub.org.
- Click “Sign Up” in the top right-hand corner.
- Choose one of the registration options and complete the registration.
- You may now log into nanohub.org.

Step 2: Learn about Jupyter Notebooks

View the presentations in the following links:

Short Jupyter Tutorial:

<https://youtu.be/jZ952vChhul?t=1m53s>

Jupyter Notebooks for Scientific Programming:

<https://youtu.be/5wJ9yz8iV2c>

Step 3: Solution of the Example Problem using Jupyter

An Example Problem is provided here:

EXAMPLE PROBLEM:

The function $f(x) = x^3 + 2x^2 - 3x - 1$ is known to have a zero $f(x) = 0$ for some x in the interval $(1,2)$. Apply four iterations of the bisection method to determine an estimate for the zero of $f(x)$ on the interval $(1,2)$.¹

Solutions to the example problem using Jupyter are posted on nanoHUB blackboard as Jupyter notebooks in both the Python and Octave programming languages. Follow the instructions below to run and download either notebook:

1. Go to: <https://nanohub.org/tools/purdue581>

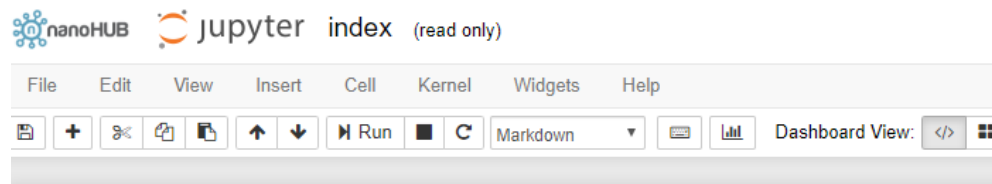
2. Click the “Launch Tool” button.

Note: Launching the tool starts a “session” which will remain open for an extended period of time or until it is manually closed. A limited number of sessions may be run at a time. Running sessions may be viewed and closed at your account home page, <https://nanohub.org/members/myaccount>

The screenshot shows the nanoHUB website interface. At the top, there is a navigation bar with links: RESOURCES, EXPLORE, NANO HUB-U, PARTNERS, COMMUNITY, ABOUT, SUPPORT. On the right, it says 'Logged in Help Search'. Below the navigation bar, there is a breadcrumb trail: Home > Tools > Purdue ME 581 > About. The main title 'Purdue ME 581' is prominently displayed. Below the title, it says 'By Marisol Koslowski¹, Peter Kolis' and '1. Purdue University'. There is a description: 'Jupyter notebooks with an introduction to python and examples for Numerical Methods in Engineering.' A red arrow points to a blue button labeled 'Launch Tool'. To the right of the button, it says 'Version 1.50 - published on 26 Nov 2018' and 'doi:10.4231/D3F47GW90 cite this'. Below that, there are links for 'Open source: license | download' and 'View All Supporting Documents'. On the far right, there is a sidebar with statistics: '207 users, detailed usage', '0 Citation(s)', '0 questions (Ask a question)', '0 review(s) (Review this)', and '0 wish(es) (New Wish)'. At the bottom of the sidebar, there is a 'Share' button with social media icons.

¹ The bisection method is described in Bradie’s A Friendly Introduction to Numerical Analysis (2006) on pages 58-68. The fundamental algorithm is seen on page 65. The example problem is taken from Example 2.1 on page 59. The bisection method algorithm will be discussed in class.

3. Click on HW0_Octave to open the Octave version of the notebook, or alternatively click on HW0_Python to open the Python version of the notebook.



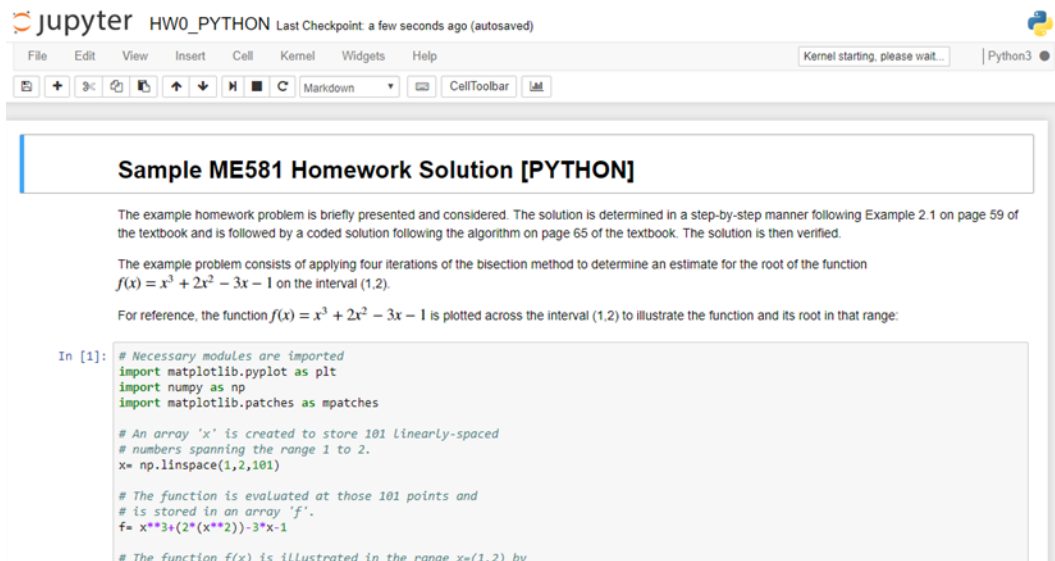
Purdue ME 581 Notebooks

Marisol Koslowski

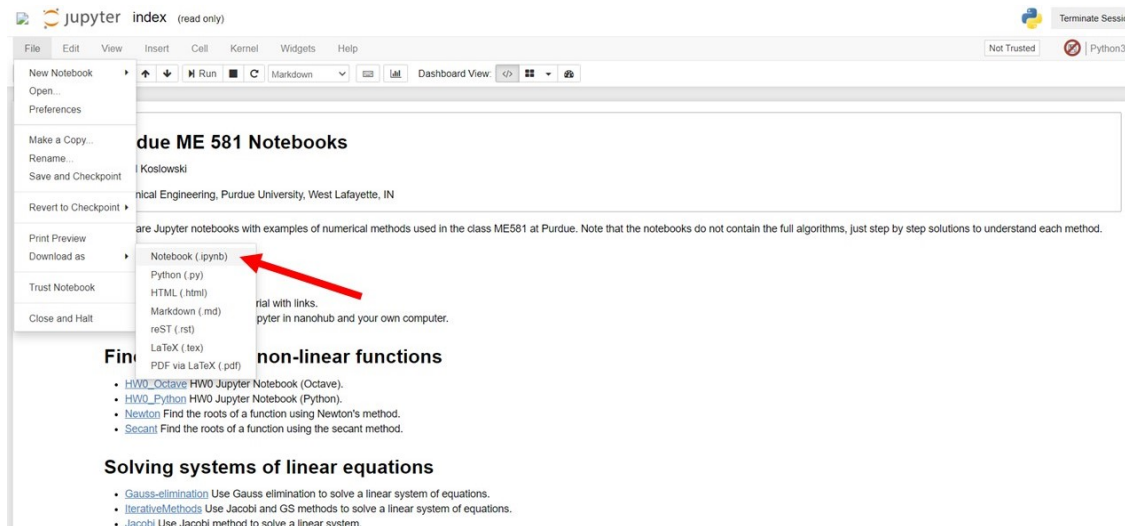
Mechanical Engineering, Purdue University, West Lafayette, IN

- [Intro](#) A brief Python tutorial
- [Newton](#) Find the roots of a function using Newton's method
- [Secant](#) Find the roots of a function using the secant method.
- [Gauss-elimination](#) Use Gauss elimination to solve a linear system of equations.
- [Jacobi](#) Use Jacobi method to solve a linear system.
- [ConjugateGradient](#) Describes the concepts behind Conjugate Gradient Method.
- [IVP](#) Describes algorithms to integrate Initial Value Problems.
- [HW0_Octave](#) HW0 Jupyter Notebook (Octave)
- [HW0_Python](#) HW0 Jupyter Notebook (Python)
- [Stiff IVP and Two-Point BVP](#) Notes on Stiff IVPs and a Two-Point BVP Example
- [BVP and Poisson Examples](#) BVP and Poisson Equation Example Problems

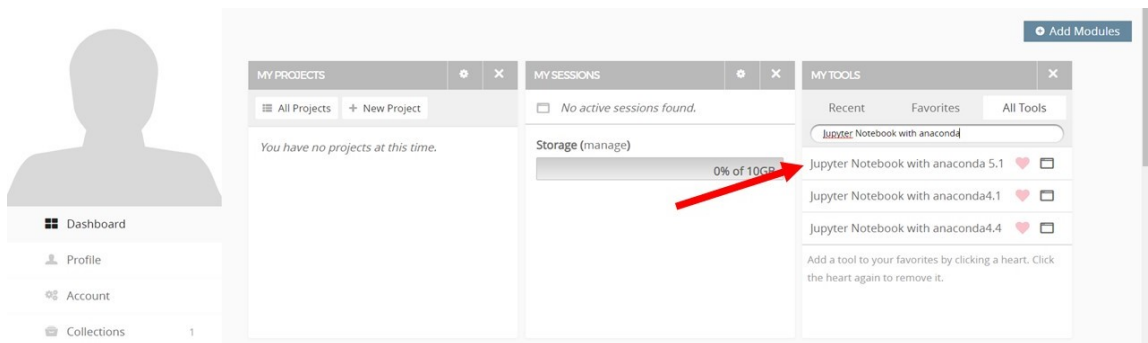
4. You will see this (or an equivalent Octave notebook):



5. If you edit file here in ME581 tool, you won't be able to save changes to the file. You will need to download the file and edit it in your home folder. To do that, click on 'File' tab and download the Jupyter Notebook file (.ipynb extension for python file).



Go to your nanoHub dashboard. Choose 'Jupyter Notebook with Anaconda 5.1' from 'My Tools' and launch tool.

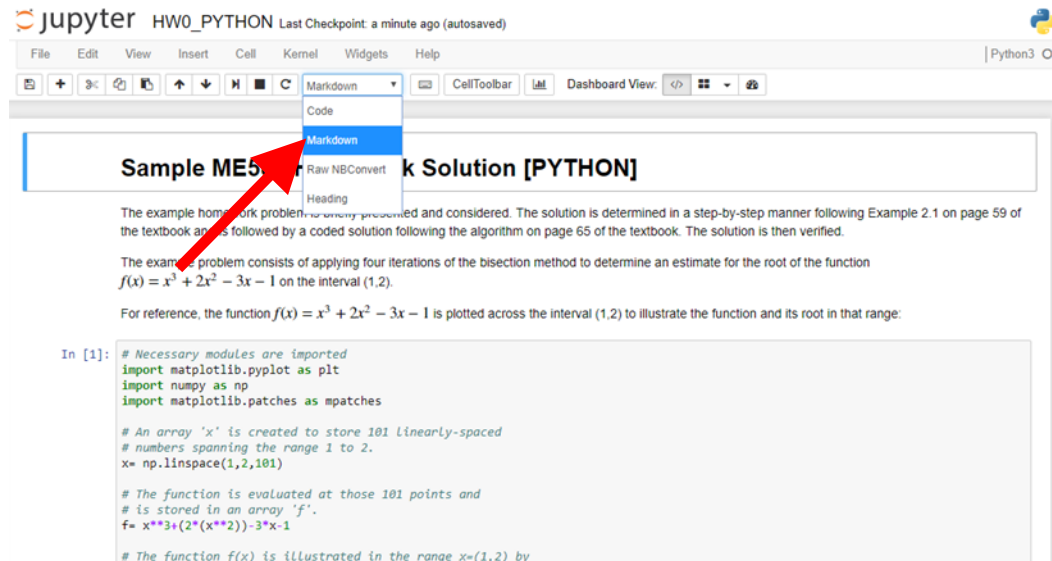


Upload the Jupyter Notebook file to your home directory in this tool. You will be able to edit and save the changes in the file in your home directory.



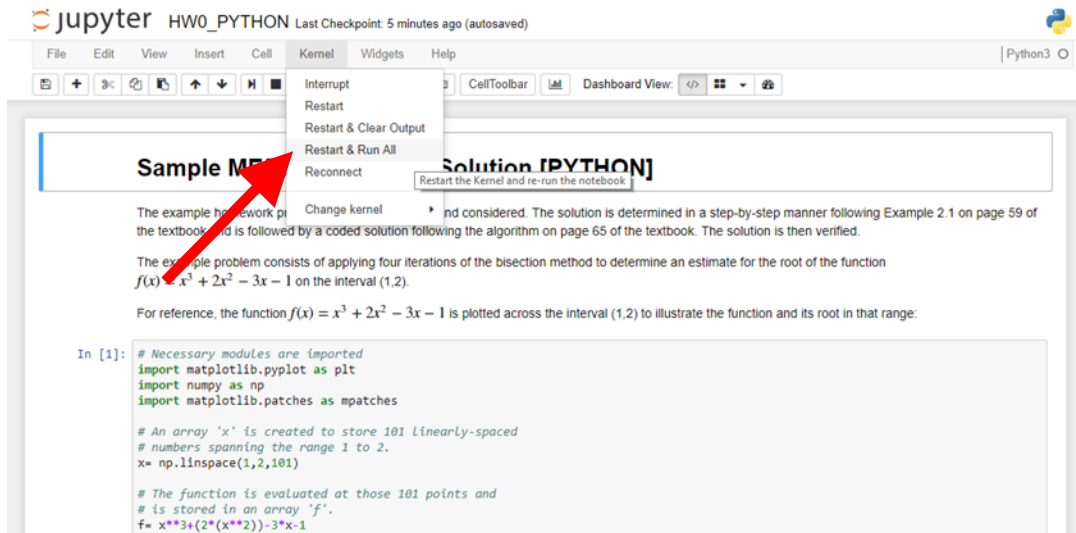
6. Now start navigating the notebook and read the comments. Double-click on a cell to edit it, then evaluate the cell with "Shift+Enter."

The first cell in either notebook is 'Markdown', or formatted text. The option to change a cell from code to text is found in the drop-down menu at the top of the notebook:



'Markdown' cells may be used to write text, and are formatted properly when they are evaluated with "Shift+Enter". LaTeX formatting may be used to write equations, as seen in the second cell.

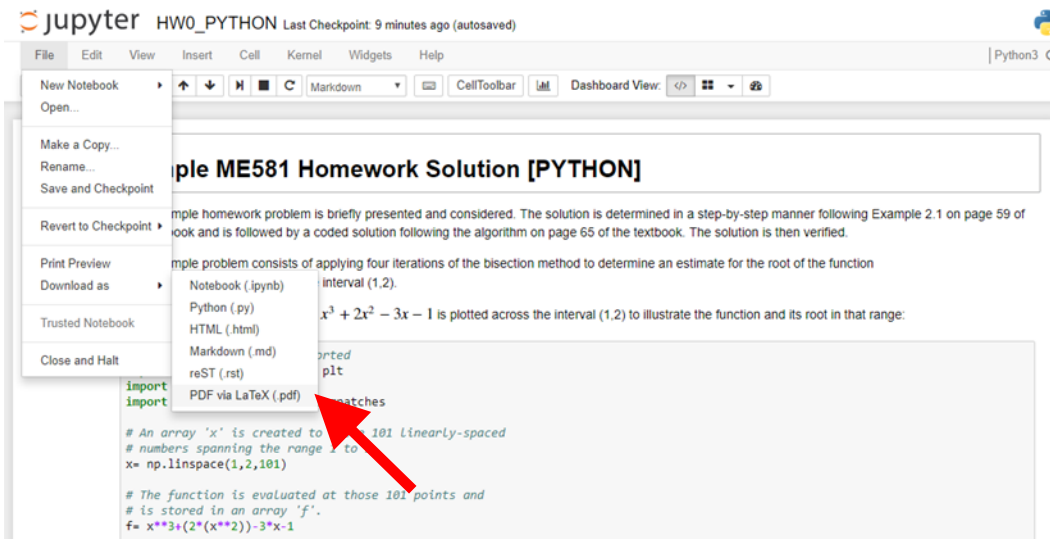
'Code' cells may be used for well-commented code. Code cells are evaluated in the order in which "Shift+Enter" is used. If the Python or Octave kernel is restarted and all cells are run, they will be evaluated in the order in which they appear:



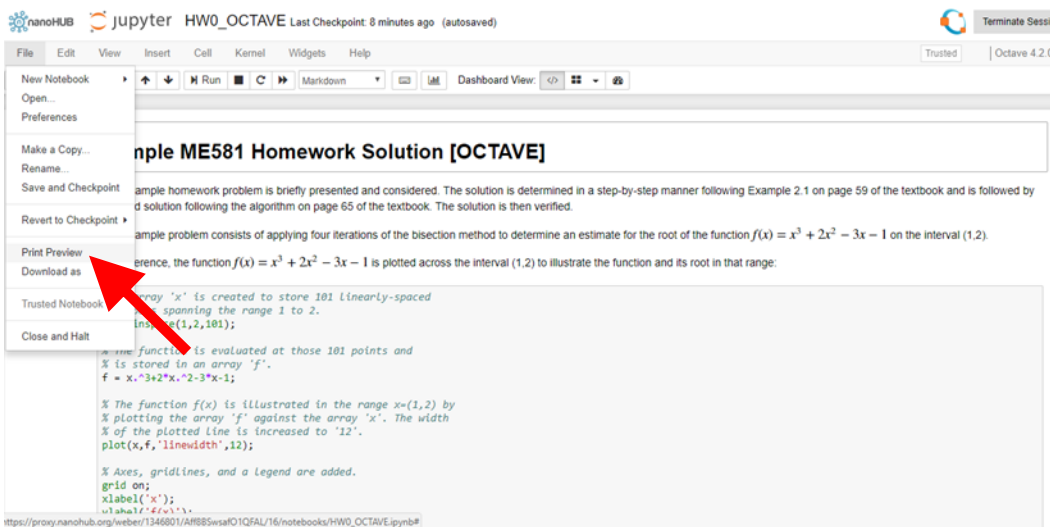
Care must be taken in the evaluation of code cells, as it is possible to evaluate code cells with “Shift+Enter” out of order or multiple times, with wrong results.

7. Download the notebook in PDF format to turn in as homework. You can download the notebook in PDF format as follows:

With the notebook now open, click “File > Download As > PDF via LATEX (.pdf)”.



Note: Errors in LaTeX formatting can cause the built-in PDF writer to cut off the document at the error. If the error cannot be found, one workaround is to view the “Print Preview” by clicking “File > Print Preview” and to print the resulting web page to a PDF using the browser of your choice:



8. **NOTE:** The HW0 notebooks at <https://nanohub.org/tools/purdueme581> are read-only. To create, modify, save, and print Jupyter notebooks for HW1 and future assignments, launch the Jupyter tool at <https://nanohub.org/resources/jupyter51> and create a new Octave or Python notebook.