MMAE 350 — Computational Mechanics

Homework 1: Getting Started with Computational Thinking

Due Tuesday 1/20/2026 11:59pm

10 Points

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M. Gosz

Purpose. This first homework is intentionally low-stakes. The goal is to confirm your computational workflow, practice running a Jupyter notebook, and begin thinking about how numerical computation supports engineering modeling and interpretation.

What to Submit. Submit a single PDF containing your written responses to Problems 1–3. You may also submit your edited notebook file (`Notebook 01`) as a separate upload (recommended, but not required).

Clarity and interpretation matter. Full sentences are expected where requested.

Problem 1 — What Is Computational Mechanics?

In your own words (approximately 5–8 sentences total), answer the following:

(a) What is computational mechanics?

(b) Where does computation enter the engineering modeling process?

(c) Why is interpretation or validation necessary even when code runs without errors?

Your response should emphasize concepts rather than specific software tools.

Problem 2 — Running and Modifying Notebook 01

Open **Notebook 01 — Python as a Computational Tool** and complete the following tasks.

(a) In the "Scalars" section of the notebook, set

$$L = 3.0, \qquad q_0 = 1500.0.$$

Report the resulting value of `total_load`.

(b) In the plotting section, change the function definition from

$$y = \sin(2\pi x)$$

to

$$y = x^2.$$

Include the updated plot in your PDF (a screenshot is acceptable).

(c) In 2–3 sentences, describe how and why the plot changed when you modified the function.

(d) Modify the array definition so that `x` contains **100 equally spaced points** between 0 and 1. View the plots again and include the updated plot in your PDF. In 2–3 sentences, describe how increasing the number of sampling points affects the appearance and interpretation of the plot.

Problem 3 — Interpretation

Consider the linear system solved in Notebook 01:

$$A\mathbf{x} = \mathbf{b}.$$

In approximately 3–5 sentences, address the following:

- What does it mean to "solve" a linear system numerically?
- What quantity is being computed?
- Why do linear systems appear so frequently in computational mechanics?

Focus on interpretation rather than mathematical formalism.

Submission Notes

- Your PDF may be typed or neatly handwritten.
- Clearly label each problem and subpart.
- This assignment emphasizes understanding and interpretation rather than technical difficulty.

Reminder. Struggling slightly with new tools is normal. The goal is steady progress and developing intuition, not perfection.