

Self-Assessment

Can I Explain It, Do It, and Validate It?

Ungraded · for your own learning · work at your own pace



AI First Engineering

Figure: AI First Engineering (AIFE) course logo

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AI TUTOR MODE — read this first

You do not need to complete every question in one sitting. Start with each group. If you can confidently solve the first questions independently, sample the remaining questions. Spend more time in groups where you need AI or human help. If you become stuck, AI may be used as a tutor. Instead of asking for the answer, try:

"I am working on this problem. Do not give me the answer. Ask me a question or give me one small hint at a time until I can solve it myself."

The purpose of this self-assessment is to determine what YOU understand — not what your AI can answer. **This is the course protocol in action: AI › Investigate › Test › Human Help.**

After each group, rate yourself with the four checkboxes. Your pattern of ratings — not a score — is the output: it tells you exactly what to review, practice, or bring to office hours before Part 2.

GROUP 1 · Explain It — the Ideas in Your Own Words

1. List the six stages of the engineering workflow in order, and state in one sentence what happens at the Validate stage that cannot happen at Compute.

2. Using the ball drop as your example, explain the difference between the physical MODEL and an IMPLEMENTATION of it. Give one example of each.

3. A Python program runs without any error message. What does that establish — and what does it NOT establish?

4. State three assumptions of the simple free-fall model $t = \sqrt{2h/g}$, and for each, one real-lab circumstance that would violate it.

5. Why must predictions be committed to the engineering record BEFORE the first drop? What exactly is lost if the prediction is written afterward?

6. In one sentence each: what does the engineering RECORD do, and what does the engineering REPORT do?

RATE YOURSELF on this group before moving on:

- I can do this independently.
- I can do this with a small AI hint.
- I need substantial AI help.
- I still need human/instructor help.

GROUP 2 · Do It — Quick Calculations

$g = 9.81 \text{ m/s}^2$ throughout. A basic calculator is fine; the reasoning matters more than decimals.

7. Predict the fall time for a drop from $h = 1.75 \text{ m}$.

8. A run from $h = 1.60 \text{ m}$ measures $t = 0.60 \text{ s}$. Estimate g from this single run.

9. Without computing either time: if the drop height increases by a factor of 9, what happens to the predicted fall time — and why?

10. Invert the model: from what height would an object need to fall for a predicted fall time of exactly 1.00 s ?

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GROUP 3 · Read the Code — the Part 1 Notebook

```
import math
h = 2.0          # height (m)
g = 9.81         # gravity (m/s^2)
t = math.sqrt(2*h/g)
print(t)
```

11. Which names in this program are variables you would change between runs, and which is a physical constant? Which single line IS the model?

12. If line 2 becomes `h = 8.0`, roughly what will the program print — without running it? (Use your Group 2 scaling insight.)

13. A classmate's version has line 4 as `t = math.sqrt(h/(2*g))`. The program runs perfectly. What is wrong, how does its output relate to the correct answer, and how would you catch this bug without reading the code?

14. Describe the one-line change that would make the program report the fall time in milliseconds.

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GROUP 4 · Interpret the Experiment

A team's first three runs:

Run	h (m)	t_meas (s)	g_est (m/s ²)
1	1.60	0.59	9.19
2	1.90	0.64	9.28
3	1.60	0.60	8.89

15. Do these g estimates show scatter, bias, or both? State the direction of any bias and one physically plausible cause for it.

16. Over the narrow range 1.5–2.0 m, the team's t-vs-h plot looks almost like a straight line. Does that contradict $t \propto \sqrt{h}$? Explain why or why not.

17. The manual (trim-method) time and the Tracker time for run 2 agree within 0.01 s. What has this agreement checked — and what has it NOT checked?

18. Suppose run 4 comes in with $g_{\text{est}} = 12.3 \text{ m/s}^2$ while its siblings sit near 9.2. What is the FIRST thing you inspect, and name two specific procedural errors that would push the estimate high.

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GROUP 5 · Validate It — Independence Has Levels

19. Rank these three checks from most to least independent of your Python prediction, with one phrase of justification each: (a) recomputing the same equation in Excel, (b) a second filmed drop analyzed from scratch, (c) deriving $t = \sqrt{(2h/g)}$ by hand from $h = \frac{1}{2}gt^2$.

20. What exactly do the Python and Excel computations SHARE that limits what their agreement can prove?

21. Propose one genuinely independent check of your ball-drop result that your team did NOT perform in lab, and say what it would and would not test.

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GROUP 6 · BREAK THE AI — Judge the Machine

22. Your dense golf ball fell 2.0 m and your measurement disagrees with the model by 8%. An AI ranks “air resistance” as the most important explanation. Classify this suggestion (Reasonable / Irrelevant here / Physically insignificant / Potentially incorrect) and defend your classification with a size argument.

23. An AI reports $t = 0.319$ s for a 2.0 m drop. Without a calculator, make a quick physical-reasonableness argument that something is wrong — then identify the classic bug that produces exactly this number.

24. AI-generated code runs cleanly and prints a confident, nicely formatted answer. Name three different checks — of different KINDS — you would perform before trusting the number.

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GROUP 7 · Transfer — a Slightly Different Situation

25. On the Moon ($g = 1.62 \text{ m/s}^2$), predict the fall time for a 2.0 m drop. Which parts of your Part 1 lab procedure would transfer unchanged, and which assumption becomes MORE accurate there?

26. A teammate proposes replacing video timing with a hand-held stopwatch. Using what you know about human reaction time ($\approx 0.2 \text{ s}$) and your fall times ($\approx 0.6 \text{ s}$), evaluate this proposal as an engineer.

27. You are asked to measure a fall time to within $\pm 0.005 \text{ s}$. Which single change to the Part 1 measurement setup buys you the most — and why does it work? (CHALLENGE — Looking Ahead)

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Reading your ratings. Mostly “independently” → you own Chapter 1; help a teammate. “Small AI hint” clusters → redo just those questions tomorrow without the hint. “Substantial AI help” → rework the matching lecture section and lab part, then retry. Any “human/instructor help” → bring that exact question to your instructor or ask an expert — that is what they are for.

AI assists. Humans observe. Humans verify. Humans decide. Humans approve.