Physics 2211 – IPLS flavor

Lab report

The lab report contains three sections:

Journal

This corresponds roughly to Materials and Methods in a scientific paper. A description of what you did, detailed enough that a third party could reconstruct (or replicate) your experiments.

Data and Interpretation

Your findings, displayed in an easy-to-understand form, with the important features explicitly described and explained.

Evaluation

Deeper reflection on what your results mean. Do they make sense? Are they consistent with other things you know? How could the lab have been improved?

Teams

Roles within the team rotate from lab to lab:

Journalist

Takes notes of everything that happens during the experiment. Writes the “Journal” section of the lab report.

Data Interpreter

Tabulates and and displays data, operates the computer. Writes the “Data and Interpretation” section of the lab report.

Critic

Performs outside research (if required), and thinks critically about the structure of the experiment. Writes the “Evaluation” section of the lab report.

Checker

Checks all sections of the lab report for legibility and consistency. Acts as a project manager for the lab. In a group of three, the role of checker is shared by all group members.

Computers and computer programs

Video acquisition

Phone, OS, webcam software, or AmscopeX (proprietary to our microscope)

Video transcoding

OS, VLC, online services or Adobe Premiere

Extracting data from video

ImageJ (aka Fiji)

Mathematical manipulation of data

Excel, MATLAB or python.

Graphical representation of data

Excel (barely), MATLAB or python.

Report preparation

Word or Word clone, or a real typesetting language (LaTeX)

I highly encourage you to bring your own computer with these tools installed and ready to use.
Lab computers are sluggish, cannot be configured, and **delete data frequently**.

Conventions in scientific writing

Scientific writing is still *writing*.

- It requires complete sentences with subject / verb agreement, proper capitalization, and so on.
- Less is more: avoid extraneous words.
- You do not have to write in the passive voice.
  - You may use *I* if it is appropriate to do so.
- Tables and graphs are there to support the written words.
  - You should explain (in words) your graph in a sentence or two. This is usually done in a caption.

Conventions in scientific writing

Tables

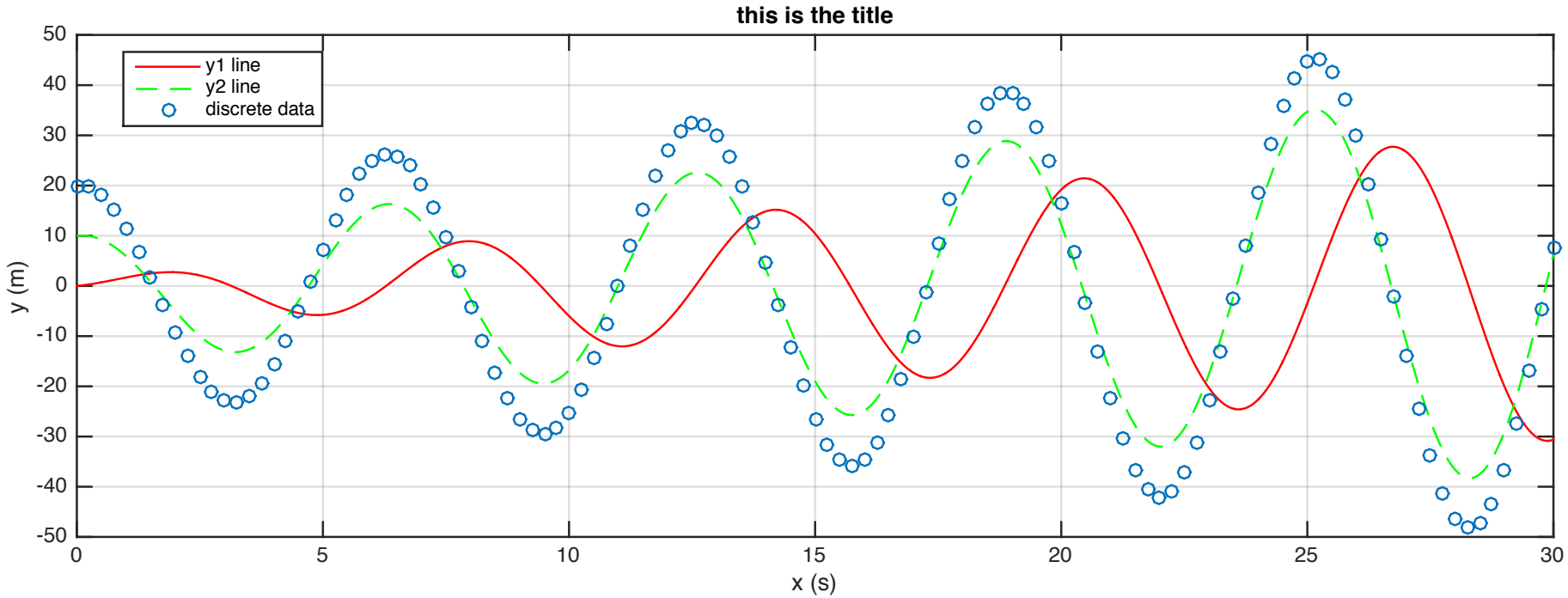
- If at all possible, graph or histogram numbers rather than tabulating.
  - Tables with fewer than a small handful of values would be better prose; tables with more than a dozen values are too overwhelming.
  - Exceptions:
    - Someone forces you to make a table.
    - Your numbers aren't related to each other in a graphable way (e.g. they all have different units).
- Give your table a caption. If you have more than one table, label it (e.g. Table 1) and use the label when referring to it.
- Supply units for your measurements.
  - Usually this is done once in the column header.

Conventions in scientific writing

Graphs

- Label your axes, including units.
  - Use easy-to-understand round values for your axis limits, but your data should fill the available space.
  - Try to avoid nonzero intercepts (since they can confuse or mislead people); if you can't, be explicit about it.
- Make your graph large enough to read, and the lines thick and dark.
  - It's considered polite to use mechanisms other than (or in addition to) just color to distinguish different lines.
  - For discrete data, use symbols (rather than a continuous line) so the reader can identify your measured values.
    - If it doesn't distract, you can connect the symbols with a line to guide the eye, but this is often misleading. Omit the symbols if there are so many measurements that your graph gets cluttered.
- Give your graph a caption and possibly a title. If you have more than one graph, label it (e.g. Figure 1) and use the label when referring to it.

Conventions in scientific writing



Last week's lab

The grading scale leaves some dynamic range.

- The average score should be 75%. Don't expect 90% on a typical lab.
- We will scale at the end of the semester so you aren't penalized relative to other flavors of Physics 2211.

Observations

- Only include a legend on a graph if it's meaningful and useful.
- Each table / graph should be a separate item so it can be labeled and referred to individually.
  - There should be a reference (with a sentence or two of description) somewhere in the written text.
- Answering a question requires an explanation – not just a statement of fact.

Lingering questions

- Was your v an average or instantaneous velocity?
- Is the amoeba "slow"?
- Everyone's data looked slightly different. Why?

This week's lab

Rotate team roles.

The full writeup is due one week from today.

- Collaborate in person (better) and/or via a shared document (OneDrive or Google docs).

Use ImageJ on the smaller video files to get accurate position data.

You will need more than one data point for each measurement video to make a convincing argument.

- Plan your data analysis (i.e. Excel spreadsheet, probably) so you don't have to type formulas more than once.
  - I often do a dry run with one data point, then tweak my columns / formulas so that they work with N data points.

For next week

Do the pre-lab reading and readiness assessment quiz

Will be posted on WebAssign asap.

Bring your laptop, with functioning software for

1. Extracting data from video
   - ImageJ
2. Mathematical manipulation of data
   - Excel, MATLAB, …
3. Graphical display of data
   - Excel, MATLAB, ...
4. Presentation and publication of data to PDF format
   - Word, Google docs, ...