

MATH 245, Spring 2014
PRACTICE PROBLEMS
in preparation for Exam 1 on Monday, March 17, 2014.

The exam covers:

- *Concepts of Mathematical Modeling*, Sections 1.1, 1.2 (to page 18), 1.3 (to page 26), 1.4, 2.1, 2.3.3, 2.3.4, 3.1, 3.2, 3.3, and 3.4.
- All topics through page 76 of the course notes, including and not limited to: steps of the modeling process, plotting data, fitting curves to data, linear regression, correlation coefficient, extrapolation, interpolation, how a mathematical model can be good, errors inherent to the modeling process.
- The topics in Mathematica tutorials 1–4; know the important concepts and the following commands: `Table`, `Plot`, `ListPlot`, `ListLinePlot`, `Show`, `Fit`, `FindFit`

Below are some questions that practice concepts from the class.

- Book questions: 1.4.2 (p. 42), 3.1.5, 3.1.13, 3.1.14 (p. 149), 3.2.3, 3.2.5 (p. 167–168), 3.3.3 (p. 179), 3.4.9 (p. 196)

P1. What are the steps in the modeling process? What is done at each step?

P2. Question 3.1.2 (p. 149). Explain some advantages and disadvantages in complete sentences; give at least four total (advantages + disadvantages).

P3. The following data is assumed to fit a logarithmic model, $y = a + b \ln x$. Determine the best values for a and b using the least squares criterion. [You may use *Mathematica*, but that is not required.]

| | | | | | | | | | | |
|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| x | 1.1 | 1.9 | 2.8 | 3.8 | 5.1 | 6.2 | 7.2 | 8.0 | 8.7 | 9.8 |
| y | 3.2 | 5.2 | 6.4 | 7.3 | 8.0 | 8.6 | 9.1 | 9.5 | 9.9 | 10.2 |

P4. Determine and justify the category of error involved in each of the two Sidelight stories in Section 2.1 (page 76 and then page 77). After this, write a paragraph discussing the difference between the two errors encountered. Last, write a few sentences explaining the morals of these errors and how it relates in general to the modeling process in real-life.

Here are some *Mathematica* questions that would be fair game:

M1. Explain the difference between the following two lines of Mathematica code:

```
a=Table[3i,{i,1,5}];
a=Table[3i,{i,1,5}]
```

M2. What do you expect when you evaluate the code `Table[2^k,{k,1,10}]`?

M3. Explain the difference between the `Fit` and the `FindFit` commands.

M4. You need to know how to plot a list, how to plot a function, and how to incorporate two plots together.