

MATH 245, Spring 2016  
PRACTICE PROBLEMS  
in preparation for Exam 1 on Monday, March 16, 2016.

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 77 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

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 are the differences between `()`, `[]`, and `{}`?

**M3.** What do you expect when you evaluate the code `Table[2^k,{k,1,10}]`?

**M4.** Explain the difference between the `Fit` and the `FindFit` commands.

**M5.** You need to know how to plot a list, how to plot a function, and how to incorporate two plots together.