MATH 245, Spring 2013
Homework 2
due 10:50AM on Wednesday, February 20.

Background reading: Section 1.3 to page 25 and Section 1.4.

Follow the posted homework guidelines when completing this assignment.
Don't forget to include acknowledgments for those who helped you with the assignment!

2-1. (10 pts) Here is some data that represents an independent variable x and a dependent variable y.

x	1	3	4	7	9	10	13	15	18	20
y	3	10	2	20	31	27	33	39	41	50

It is thought that y satisfies a function of type (a) $y = Cx^k$ or type (b) $y = Ck^x$.

- Use the method of transforming the data using logarithms combined with visual fitting to determine the curve of best fit. Do this twice—once for a curve of type (a) and once for a curve of type (b).

- Compare your two curves of best fit. Create the residual graphs for each fit. In a paragraph or two, discuss which one you think gives a better fit and why.

2-2. (10 pts) This question involves *Mathematica.*

(a) I first ask that you watch two webcasts, on http://www.wolfram.com/broadcast/.

- The first video is named "Hands-on Start to *Mathematica*: Notebooks", found http://www.wolfram.com/broadcast/video.php?channel=86&video=862. It is 4.5 minutes long and introduces you to how to add sections and into your notebooks.

- The second video is named "Hands-on Start to *Mathematica*: Methods to Get Started", found at http://www.wolfram.com/broadcast/video.php?channel=86&video=863. This one is 10 minutes long and discusses how *Mathematica* 8 and 9 allow you to use "free-form input" and how else to input information.
  [*It is important to realize that free-form input is nice, but to use Mathematica's full capability, you will need to understand its language.*]

(b) Create a new *Mathematica* notebook that satisfies the following properties.

- Your notebook must have a Title (with relevant title), Subtitle (Your name, date, class). Change the stylesheet (Format > Stylesheet) to your liking.

- Name a first Section "List Questions" and create two subsections, named as you wish. The two subsections should answer the following two questions. **Every question should be answered completely and must include** *text cells* **that explain what you are doing**.

- Use the `Range` command to create a list of the numbers from 0 to 100 that are three more than a multiple of seven.
  [*Hint: Your output will start* {3,10,17...}]
  Next, use the `Table` command to create a list that is the square of each of these numbers.
  [*Hint: Your* `Table` *code will be similar to your* `Range` *code and the output will start* {9,100,289...}]
- The function `Prime[n]` gives the n-th prime number. For example, `Prime[1]` outputs 2, `Prime[2]` outputs 3, `Prime[3]` outputs 5, etc. Use the `Table` command to create a list which has as its entries 30 ordered pairs $\{x, y\}$, where x ranges from 1 to 30 and y is the x-th prime. For example, the first of the thirty ordered pairs will be $\{1, 2\}$, the second will be $\{2, 3\}$, etc.

- Name a second Section "Plotting Questions" and create subsections as necessary to answer the following question. Generate three three individual plots and combine them in a fourth plot, as follows.
  - First, plot $\sin(2x)$ from 0 to 2π using a thick blue line.
  - Second, plot $\tan(3x)$ from 0 to 2π using a thin dashed line that is not blue.
  - Third, plot ten to twenty large bright fluorescent points of the form $\left(x, 3x - \frac{x^3}{10}\right)$ with x values between 0 and 6.
  - Last, combine all three graphs on one set of axes.

- Name a third Section "Neat Mathematica things"
  - Find two neat things that you have seen that *Mathematica* is able to do. Copy the code into your notebook and describe what it does. Discuss where you found this code and explain why they are interesting. Further discuss in what ways it would be interesting for you or someone else to modify these things in a new and innovative way.