

Maple and LaTeX Exercises

The purpose of this document is twofold: Learn to use Maple to help you answer mathematics questions, and to write up the solutions using L^AT_EX. The L^AT_EX commands that produced this document are available on our class website to help get you started.

When you are finished,

- Create a PDF file of your result (in Texmaker, go to **Tools**, then **PDFLatex**)
- Go to CLEo and upload this PDF file to your dropbox (Due: Feb 09).

Maple Questions (In-Class)

We'll answer the following together once you've had a chance to work with Maple a bit.

1. What is the difference between the following?

```
f:=x^2+2*x;  
f:=x->x^2+2*x;  
f=x^2+2*x;
```

2. How is the percent sign % used?
3. How might we plot several functions on one axes?
4. How can we input our Maple code into LaTeX?

Maple Homework

These are the homework questions, whose solutions will be due on Feb 9. Please write the solutions up using L^AT_EX, and put in figures where appropriate. Your solutions should include the Maple code that you used (discussed in the in-class portion).

1. Consider the function

$$f(x) = \sqrt{\frac{x^4 - x + 1}{x^4 + x + 1}}$$

- (a) Use Maple to differentiate and simplify the result.
 - (b) Where does the graph of f have horizontal tangents?
 - (c) Graph f and f' on the same axes, and provide the plot in a figure.
2. Consider the curve with equation:

$$2y^3 + y^2 - y^5 = x^4 - 2x^3 + x^2.$$

- (a) Use the `implicitplot()` command from the `plots` package in Maple to graph the curve.
- (b) At how many points does this curve have horizontal tangent lines? Find the x -coordinates of these points.

3. Prove that the equation

$$100e^{-x/100} = \frac{x^2}{100}$$

has at least one solution using the Intermediate Value Theorem. Use the `solve()` command in Maple to approximate the solution.

4. Biologists have observed that the chirping rate of crickets of a certain species appears to be related to temperature. Here is some data:

Temp	50	55	60	65	70	75	80	85	90
Chirps/min	20	46	79	91	113	140	173	198	211

- (a) Make a scatter plot of the data
- (b) Find and graph the regression line (also called the line of best fit).
- (c) Use the regression line to estimate the chirp rate at 100 degrees F .

There are several commands you might use- Here are some: `pointplot()` and `LinearFit()`

5. Use the Squeeze Theorem to show that

$$\lim_{x \rightarrow 0} \sqrt{x^3 + x^2} \sin\left(\frac{\pi}{x}\right) = 0$$

Illustrate the result by graph the three functions (used in the theorem) on the same plot.

6. The sine integral function is defined in kind of a strange way:

$$\text{Si}(x) = \int_0^x \frac{\sin(t)}{t} dt$$

and it is important in electrical engineering. As a technical note, the formal definition of the integrand is:

$$f(t) = \begin{cases} \sin(t)/t & \text{if } t \neq 0 \\ 1 & \text{if } t = 0 \end{cases}$$

which makes f continuous everywhere.

- (a) Use Maple to plot $\text{Si}(x)$.
- (b) At what value(s) does $\text{Si}(x)$ have local maximums?
- (c) Approximate the solution of $\text{Si}(x) = 1$ using the `solve()` command.