

Math 235: Maple Homework Sheet

Maple can be used as a tool to assist in the completion of exercises that rely heavily on symbolic manipulation and visualization. The purpose of today's exercises is to learn the basics of Maple.

Submit your Maple worksheet for any **four** of these problems by the due date listed for your section. Your worksheet should be clearly commented; answer the questions either by putting in text sections or by using comments.

You should work in groups of two or three with each name listed on the worksheet (and each person submits a copy of the worksheet).

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. Hint: The relevant commands are `diff` and `simplify`.
- (b) Where does the graph of f have horizontal tangents?
Hint: If there is some equation that Maple can solve, use the `solve` command.
- (c) Graph f and f' on the same axes. Explain how the graphs are consistent with the result in part (b).

2. Consider the curve implicitly defined by:

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

- (a) The curve has been likened by some to a bouncing wagon. Use the `implicitplot()` command from the `plots` package in Maple to graph the curves and see why.
- (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 real solution using the Intermediate Value Theorem. Use the `fsolve()` command in Maple to find a numerical approximation to the solution.

4. Graph the function

$$f(x) = \sqrt{x^3 + x^2 + x + 1}$$

and explain why it is one-to-one. Then use Maple to find an explicit expression for f^{-1} (the inverse of f). Maple will produce three possible expressions. Explain why two of them are irrelevant in this context.

5. Use the Squeeze Theorem to show that

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

Illustrate the result by graphing the functions f , g , and h (of the Squeeze Theorem) on the same plot.

6. Biologists have observed that the chirping rate of crickets of a certain species appears to be related to temperature. The table below shows the chirping rates for various temperatures.

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

- Make a scatter plot of the data.
 - Find and graph the regression line.
 - Use the regression line to estimate the chirp rate at 100°F
7. The sine integral function

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

is important in electrical engineering. Note that the integrand is not defined when $t = 0$, but we know that $\lim_{t \rightarrow 0} \sin(t)/t = 1$, so we define the function to be 1 at $t = 0$.

- Use Maple to verify our limit computation.
- Use Maple to plot $\text{Si}(x)$.
- At what values does $\text{Si}(x)$ have local maximums?
- Find the coordinates of the first inflection point to the right of the origin.