Maple Homework Hints

Overall hint: One goal for this homework is to get you to use Maple to solve mathematics problems. You should have already gone over the "Introduction to Maple" examples, and you should use that, together with the help files and hints below to solve the problems.

Once you've solved the problems, write up your solutions using LaTeX. We'll do the first one together.

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` The example on p. 7 shows how to differentiate a function, but you can also differentiate an expression. For example:

   ```
   F:=x^2+exp(3*x)-sin(x/4);
   dF:=diff(F,x);
   ```

   (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, and provide the plot in a figure.

   Hint: See page 6.

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.

   Hint: To get help in Maple, type the question mark followed by the command. Here, type `?implicitplot` then go down and find the examples.

   (b) At how many points does this curve have horizontal tangent lines? Find the $x-$coordinates of these points.

   Hint: Find equations to solve.

3. Prove that the equation
$$100\mathrm{e}^{-x/100} = \frac{x^2}{100}$$
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()`

   HINT: In the help for `LinearFit`, the first example finds a function of the form

$$y = a + bt + ct^2$$

   that "best" fits the given data points, $(1, 2), (2, 3)$, etc. Here is a little larger version of the example given in the help file:

```
> with(Statistics):
> with(plots):
> X := Vector([1, 2, 3, 4, 5, 6], datatype = float);
> Y := Vector([2, 3, 4, 3.5, 5.8, 7], datatype = float);
> A := LinearFit([1, t, t^2], X, Y, t);
> B:=pointplot(X,Y);
> C:=plot(G,t=0..7);
display({B,C});
```

   Questions 5 and 6 should be straightforward in terms of Maple commands.