

Here is a short *Mathematica* assignment to work on, to help you develop your skills with *Mathematica*. The solutions are in a *Mathematica* notebook you can download from the course webpage. You can use *Mathematica*'s Help Browser to learn about the commands you need to solve the problems. The commands you need to use are listed with each problem. You may want to make notes on the *Mathematica* commands you used, since you will be able to use *Mathematica* on some tests.

IMPORTANT NOTES:

- 1) The function $f(x) = 4x$ is defined in *Mathematica* by the following command `f[x_] = 4*x`.
- 2) Once you have typed the command in, you must use the <enter> key on the keypad to send it to the *Mathematica* kernel! The other <enter> key will simply take you to a new line to enter more input. Alternately, you can type <shift+enter>.
- 3) Spaces and the symbol `*` represent multiplication in *Mathematica*.
- 4) Once something has been defined in the kernel it stays there.

Problem 1. Get graphical representations of the following:

- a)

| n | $f(n)$ |
|-----|--------|
| 0 | 0 |
| 1 | 2 |
| 2.5 | 4 |
| 3 | 7 |
| 4 | 5 |

 b) $f(x) = e^x$ c) $f(t) = t^{10}, g(t) = e^t$ on a common axis. Which is which?

Mathematica commands used in Problem 1: ListPlot, Plot, Exp, ^

Problem 2. Find $\sqrt{20}$ and $20^{1/3}$ to 4 decimals.

Mathematica commands used in Problem 2: Sqrt, N, SetPrecision, ^

Problem 3. Verify graphically that $f(x) = x^4 - 56x^2 + x + 100$ has four real valued roots. Find the value of these roots to 20 decimal places.

Mathematica commands used in Problem 3: Solve, NSolve, SetPrecision, Plot, == (double equal sign)

Problem 4. Are the following even, odd, or neither? Explain your answer algebraically and with a graph.

- a) $f(x) = x^3 + x^6$ b) $g(x) = \cos x$ c) $h(x) = 1/x$

Mathematica commands used in Problem 4: Plot, Cos

Problem 5. Sketch a graph of the following functions.

- a) $f(x) = |x|$ b) $g(x) = \begin{cases} 1 & x \geq 2 \\ x^2 & x < 2 \end{cases}$ c) $h(x) = \frac{2x^4 - x^2 + 1}{x^2 - 4}$

Mathematica commands used in Problem 5: Plot, Abs, If

Problem 6. In this problem you investigate some of *Mathematica*'s behaviour.

- (a) Factor the function $f(x) = x^3 + 1$, and determine that there is a root of f given by $x = -1$.
- (b) The roots of $f(x)$ are given by $x^3 + 1 = 0$, which means the roots are given by $x = (-1)^{1/3}$. Evaluate $(-1.0)^{1/3}$ and compare with what you found in (a).
- (c) Can you explain why there is a discrepancy between (a) and (b)? You should solve the equation $f(x) = 0$ to help understand what is going on.

Mathematica commands used in Problem 6: Factor, Solve, NSolve, ^