

Calculus I Lab 1

1. Calculate the following using Mathematica. Express each answer as an exact value (such as $\frac{1}{2}$ or $\sqrt{2}$) and as a decimal number (such as 0.5 or 1.41421).

(a)

$$\frac{1 + \frac{1}{2} - \frac{2}{3} \cdot \frac{5}{7}}{\frac{6}{13}(23) + 7}.$$

(b) $\sin(\frac{\pi}{3})$.

(c) $\ln(5)$.

(d) $\log_{10}(5)$.

(e) $\sqrt[3]{91}$.

(f) e^8 .

2. Perform the following algebraic tasks in Mathematica.

(a) Define $x = 17 + 61\sqrt{37}$, and evaluate $5x^3 - 14x^2 + 6x + 9$.

(b) Simplify

$$\frac{(a+h)^3 - a^3}{h}.$$

(c) Expand $(x-2)^{10}$.

(d) Factor $x^4 - 6x^3 + 10x^2 - 6x + 9$.

(e) Solve $35 - 5x = 7x^2 - x^3$ for x , providing both exact solutions and decimal approximations.

3. In this problem, you will investigate the behavior of $f(x) = \frac{\sin(x)}{x}$ near $x = 0$.

(a) Is $f(0)$ defined?

(b) Calculate $f(x)$ for the following values of x : 0.1, 0.01, 0.001, and 0.0001. Also evaluate $f(x)$ at the negatives of these values. Based on this information, estimate $\lim_{x \rightarrow 0} \frac{\sin(x)}{x}$.

(c) Plot the graph of f using the window $-2 \leq x \leq 2$, $0 \leq y \leq 2$. Based on this plot, estimate $\lim_{x \rightarrow 0} \frac{\sin(x)}{x}$.

(d) Calculate $\lim_{x \rightarrow 0} \frac{\sin(x)}{x}$ directly using Mathematica's *Limit* command.

(e) How could you use the *Manipulate* command to investigate $\lim_{x \rightarrow 0} \frac{\sin(x)}{x}$?

4. Explore Mathematica's capabilities further. For instance, you could pose your own problems and figure out how to solve them or think of creative uses of the *Manipulate* command.