

## Lab 2: Symbolic Algebra

Name(s): \_\_\_\_\_

Originally written by Judy Buck and Ted Giebutowski (2002). This is a revised edition.

**Directions:** For this lab, you may work in groups of two (not three or more) or you may work alone. Work your way through this tutorial. Make sure you answer all questions as they appear. You will have to turn in this lab and a printout (on one page) of your work. Make sure that your name(s) appear on the printout of your work.

### Part I: Working with Mathematical Expressions

1. Open a Mathcad worksheet (see Lab 1 if you are having trouble).
2. Put your name(s) in the upper left hand corner of the worksheet.
3. Type in the expression  $\frac{x^2 - 3x - 4}{x - 4}$ .
4. Press the space bar until the editing lines contain the whole expression. Now, click on **Simplify** from the **Symbolics** menu. What is the result?
  
5. Type in the expression  $(x - 4)^4$ . Again, press the space bar until the editing lines contain the whole expression. Click on **Expand** from the **Symbolics** menu. What is the result?
  
6. Type in the expression  $8x^6 - y^9$ . Press the space bar until the editing lines contain the whole expression. Click on **Factor** from the **Symbolics** menu. What is the result?

### Part II: Calculating Limits

The limit operator can be found on the Calculus Palette. To get the Calculus Palette, look for the  $\int \frac{dy}{dx}$  button in the menu at the top of the worksheet. Note that there are options on this palette that allow you to take limits from the right or the left. Keep this palette open, as you will be using it throughout the lab.

1. Click on the limit operator and complete the expression  $\lim_{x \rightarrow 2} \frac{x^2 - 4}{x - 2}$  by filling in all placeholders.
2. Place the entire expression between the editing lines. Click on the **Symbolics** menu; then choose **Evaluate** then **Symbolically**. What value is returned?

**Note:** Limits cannot be evaluated numerically by using the “=” symbol.

3. Evaluate the following limits using this process. For each problem:

- (i) Evaluate the limit using Mathcad and record the answer below.
- (ii) After you find each limit, have Mathcad sketch the graph of the **function**. See Lab 1 if you are unsure of what to do. Also, for each graph, remember to choose **Crossed** under the **Axis Style** options when formatting the graph. To format a graph, double click on it. Be sure to choose an appropriate scale for each of your graphs
- (iii) In the space provided below, explain why the limit returned seems reasonable.

(a)  $\lim_{x \rightarrow 4} \frac{x^2 - 16}{x - 4}$

(b)  $\lim_{x \rightarrow 3} \frac{x + 3}{x^2 - 9}$

(c)  $\lim_{x \rightarrow 1} \frac{\sqrt{x} - 1}{x - 1}$

4. For (a) and (b) above, can the vertical line segments at  $x = 4$  and  $x = 3$ , respectively, be a part of the graph? If not, explain why. Also, if they are not part of the graph, then what are they?