Lab1: Introduction to Mathcad 11

Name: _____

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

Directions: 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.

Mathcad combines a computer algebra system (CAS) with the abilities of a word processor, which allows for the creation of high quality reports. With Mathcad, it is possible to typeset equations on the screen exactly as they would appear in a math textbook. However, Mathcad has the added ability of being able to actually **do** the math, something word processors cannot do! Mathcad can do simple arithmetic, evaluate expressions, even find derivatives and integrals.

To begin Mathcad
1) Log in
2) Click the button (the "**Start**" or "**Windows**" button) at the bottom left hand corner of the screen.
3) Click on "**All Programs**"
4) Click on "**Departments**"
5) Click on "**math**"
6) Click on "**Mathcad 11 Enterprise**". Depending upon how your computer is set up, you may now have to do steps seven and/or eight:
7) A window may pop up asking if you wish to connect to a RemoteApp. Click "**connect**."
8) You may have to retype your username and password in the proper spots.
9) The Mathcad worksheet should appear.

Part 1: Using Mathcad as a word processor
1. **Typing Text**
    a) Click anywhere in the worksheet (you should see a red plus sign…this means you are in **Math Region** mode).
    b) Choose **Text Region** from the **Insert** menu. A text box should appear.
    c) Type your first and last name in the text box.
    d) Notice how a vertical line moves as you type. This line is called the **insertion point**.
    e) Notice also how the text box "grows" to fit your typing.
    f) Click outside the text box. It should disappear. To get the text box back, click inside the text box.

Note: Use your mouse, together with the arrow keys and delete keys on your keyboard to move and/or make corrections in your text just as you would with a word processor. You can also highlight text and use the cut and paste items in the **Edit** menu (or the items on the toolbar) just like you would with a word processor.

2. **Changing the size of the text box**
    a) To change the width of an existing text box, move the mouse until the pointer touches the little black box on the right edge of the text box. Notice that the pointer of the mouse will change to a double arrow (⇔).
    b) You can now change the width of the text box by dragging the mouse.

3. **Moving the text box**
    a) To move a text box, hold the cursor over a boundary of the text box until it becomes a hand.
    b) Press the mouse button and drag the text box to any location on your screen. When done, please place the text box containing your name in the upper left corner of the worksheet.

Note: Your worksheet consists of everything to the left of the gray vertical line. So, your name should be to the left of that line, near the top of the page

Part II: Using Mathcad as a simple calculator

4. **Evaluating expressions**

   a) Click somewhere on the left side (near the top) of the worksheet and type $2 + \frac{5}{8}$.

   b) Note the blue vertical and horizontal editing lines that leave a trail as you type. This indicates that you are entering a mathematical expression rather than text.

   c) How was this expression recorded on the worksheet?

   d) When you press the equals sign after an expression, Mathcad will evaluate it. Evaluate the expression you just typed…what is the result?

5. **More complicated expressions**

   a) Click below your previous expression and try to enter this: $2 + \frac{3^2}{4} - 5$. Use the ^ symbol for exponentiation.

   b) Notice that, after you type the exponent 2, the editing lines surround just that number.

   c) To divide the expression 3^2 by 4, you need to **expand the editing lines** to include 3^2. So…

   d) Press the **space bar**. The editing lines should expand properly.

   e) Now, you should be able to divide by 4.

   f) To subtract the five, you'll have to expand the editing lines again.

   g) Evaluate the expression by pressing "="…what is the result?

Note: Each equation or piece of text is a **region**. Mathcad creates a rectangle to hold each region…you can see this rectangle by clicking on the region. A Mathcad worksheet is really just a collection of all of these regions.

Part III: Entering Algebraic Expressions

6. **Simple algebraic expression**

   a) Below the previous expression, type $\frac{3 + 4x}{x^2 - 9}$. (You can type 4 * x to indicate the multiplication.)

   b) Note that while you are entering this expression, you will need to press the **space bar** to expand the editing lines.

7. **Algebraic expression using the arithmetic palette**

   a) For some symbols, you will need to click on the **arithmetic palette**, which is the button that looks like a calculator (it is located on the bottom row of buttons on the left). You can drag it to another part of the screen, i.e. to the right of the gray vertical line, if it pops up in a bad spot.

   b) Below the previous expression, enter this expression using the arithmetic palette: $\frac{x - 3a^2}{-4 + \sqrt{y+1}} - \pi$

Part IV: Defining a function

In Mathcad, the trigonometric, logarithmic, exponential, and other functions are built in. That is, you can type $\sin(x)$ and the software will understand that you are defining the sine function.

8. In the top middle of the page, type "*f(x):sin(x)*" (without the quotes) making sure you have no spaces. The colon is used to **assign** values or expressions to variables and functions, while the equals sign (=) is used to **evaluate** an expression. Note that what gets printed on your screen is slightly different than what you typed. What was printed on the screen as you typed?

9. To find the sin of $\dfrac{\pi}{3}$, simply type $f(\pi/\ 3)=$. This **MUST** be typed **to the right and/or below** the place on your worksheet where you defined *f(x)*. What did the software return?

Note: Variable and function names in Mathcad can contain upper or lowercase letters, digits, Greek letters, and the symbols _ and %. A name cannot begin with a digit.

10. To evaluate *f(x)* for a restricted domain (such as between 0 and 2π), you can define a range for *x* by typing the following: "x:0; 2π ". What was printed on the screen?

11. Below that, type "*f(x)=*". <u>Describe</u> what happens.

12. To change the increment of the table, insert a comma and the increment after the zero. For example, change the statement from #10 to "x:0, $\dfrac{\pi}{12}$ .. 2π ". Describe what happens.

Note: If you wish to change the precision of the decimals in the output table you can go to **Number** in the **Format** menu. You can also move the table the same way you moved your name box.

V: Creating a Graph

13. To create a graph, follow these steps
    a) Click in a blank space where you wish the graph to appear. Try putting it under your name.

    b) Choose **Graph** $\Rightarrow$ **X – Y Plot** from the **Insert** menu.

c) You can drag the graph box similarly to how you dragged your name and/or the table. Try to make sure the box is on the page to the left of the gray line.

d) Insert the independent variable, *x*, in the center of the bottom axis (a placeholder is already there).

e) Insert the dependent variable, *f(x)*, halfway up the left axis (a placeholder is already there).

e) The remaining placeholders are for the high and low values of each axis. If you leave these blank, Mathcad will fill them in when it creates the graph.

f) Click anywhere outside the graph. What happens?

14. Select the graph by clicking near or inside it. You can format the graph by going to the **Format** menu and choosing **Graph** ⇒ **XY Plot**. Go to **X – Y Axes** and check only the boxes that say "Numbered". Where it says "Number of Grids" type in 5 for each. Finally, for "Axes Style" choose "Crossed". Click "OK" when done.

You can save this file if you wish. To do so, go to **File** then **Save As**. Type a name for the file (such as "lab one"). Make sure you pay attention to the folder where the computer saves your file! You can, of course, move the folder location in the usual way.

If you want to see if everything will be on one page, choose **Print Preview** from the **File** menu instead. If everything isn't on one page, **Close** the print preview, go back to your page and move the boxes around until everything is on one page. As long as everything is to the left of the gray line, it should appear on one page.

To Print this page, choose **Print** from the **File** menu. The printer should default to the one in the lab. Click on **OK** and get your printout.

To complete this Lab, turn in:
   1) This handout with all questions answered.
   2) A one page printout of all of your work for this lab.