Calculus I   Name: _____

Maple Lab #1

Introduction to Maple   Email address: _____

Maple is a Computer Algebra System (CAS). In other words, it is a computer program that will perform all kinds of algebra and calculus computations, in addition to all kinds of graphing that can be done on a graphing calculator. The main purpose of this first Calculus I lab is to introduce you to some of the capabilities of the Maple program. *(**Notice step 20 on the last page** - the lab must be complete and correct before it can be turned in. Please feel free to get help from the lab aide at any time. If you are not doing the lab at the Math Computer Lab at the Academic Success Center, indicate where you did it in the indicated space. You will be contacted if the lab is not complete and correct.)*

Starting Maple

Find "Maple 17" on the program list, and click it to start. It should open to a page with a blinking cursor.

1. Type: **12 + 5** (enter)   Maple returned _____.

2. Type: **3*5+2**   **but before you hit** (enter), what answer do you expect? _____

     Maple returned _____. Is that answer what you expected?

3.   More order of operations: Very important!!

   a. Type: **3+5*2 but before you hit** (enter), what answer do you expect? _____ (enter)

   Maple returned _____. Explain why the answer is not 16.

   _____

   b. Type 4*5^2 **but before you hit** (enter) what answer do you expect? _____ (enter)

      Maple returned _____. Explain why the answer is not 400.

      _____

   c. Type -3^2 **but before you hit** (enter) what answer do you expect? _____ (enter)

      Maple returned _____ Explain why the answer is not 9.

      _____

Algebra

Maple can do algebraic computation and simplification. An entire expression can be given a name with the := sign.

1. Type: **g := x^2** *(right arrow)* **- 3 x + 2**

2. Type: **factor(g)** What does Maple return? _____

3. Type: **f := (x+2)^3** *(right arrow)* Maple will print this in normal mathematical format.

4. Type: **expand(f)** Maple expands the expression f into a polynomial in standard form.

5. Type: **subs(x=5,f)**   What does Maple return with? _____
                                Explain in English what subs(x=5,f) must mean.

_____

_____

6. Now type: **solve(f = 0, x)** What does Maple return with? _____
   Explain what that statement means.

                          _____

_____

7. Use the solve command to find all solutions of the equation $x^4 + 8x + 16 = 2x^3 + 8x^2$.
   (Remember to use the right arrow, or mouse to reposition the cursor after each
   exponent.)   The solutions are:

_____

8. Use the **evalf** command to get decimal approximations for the solutions.
                                                        evalf(%)
The solutions are:

_____

9. Unfortunately, there are some equations that Maple cannot solve using this command.
   What happens when you type: **solve(sin(x) – x + 1 = 0, x)**

                                        _____

_____

10. Another way to find approximate solutions is by looking at a graph of an equation.
    The command for plotting the graph of an expression p, depending on x, with the x
    axis going from a to b is **plot(p, x = a..b)** If the domain (the extant of the x axis) is
    not specified, Maple will assume that it goes from –10 to 10. Now type
    plot(sin(x) – x + 1, x) You can tell that there is a root of the equation somewhere

    between _____ and _____.

11. Now, we will use the plot command with smaller and smaller ranges for x to get
     a better approximation. Type: **plot(sin(x) – x + 1, x = 1.8 .. 2.2)** Now, you use a
     couple more plot commands, with smaller and smaller x ranges until you believe you
     can come up with a solution correct to 2 decimal places. What do you come up with?

     _____

12. If the **solve** command does not work, (as we saw in step 9) sometimes the fsolve command will. This command uses a process similar to what you did in step 11 to come up with a decimal approximation of the solutions.
Type: **fsolve(sin(x) – x + 1 = 0, x)** Maple replies with _____. Was your answer in 11 correct? _____

13. You can also use the solve command to solve an equation with more than one variable in terms of one of the variables. For example, Type:
solve (x^2 *(right arrow)* ***y - 2x + y = 0, y)** What does Maple return as the solution?

_____ To solve the same equation for x in terms of y, you need to replace the last y in the command by x. (Hint: you can save a little time by cutting and pasting the preceding line, then changing the y to an x.) What does Maple return this time as the solution?

_____

14. The solve command can also be used to solve systems of equations. Here the equations and the unknowns must be placed within braces. Type:
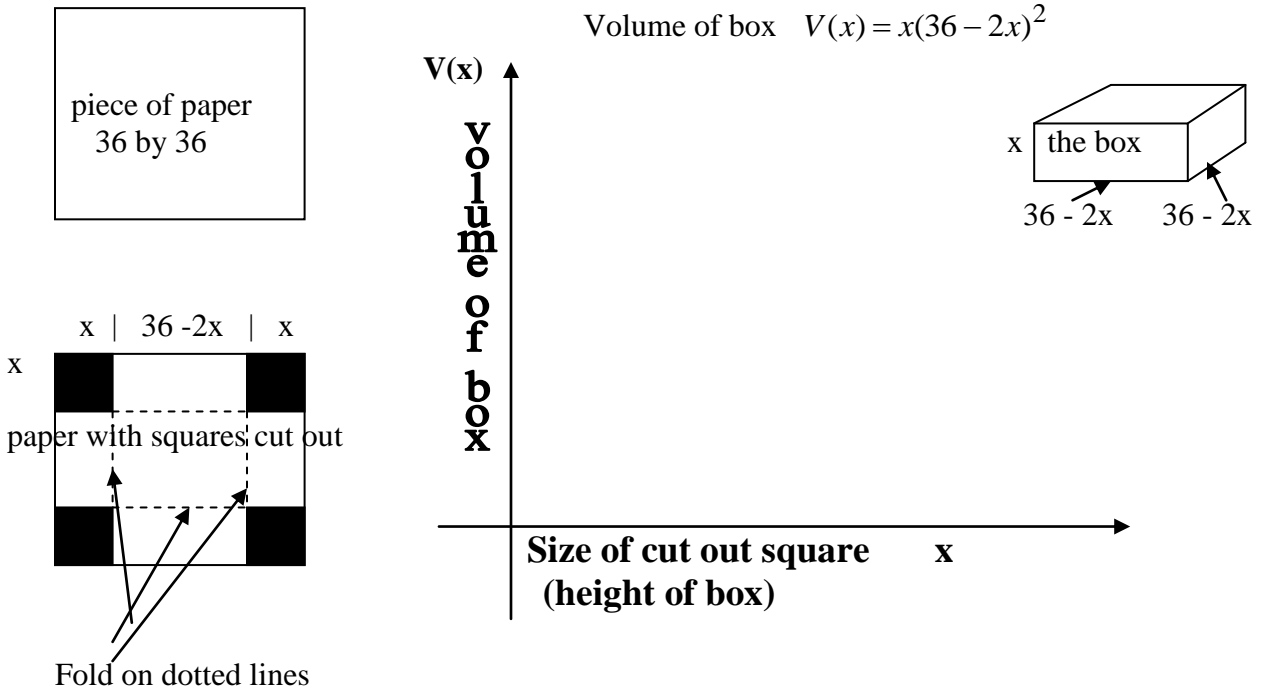**solve({2x + 3y = -1, x - y = 2}, {x,y})** What is the solution? _____

15. Using Maple, let p be the polynomial $4x^4 + 8x^3 - 13x^2 - 2x + 3$. (See step one under Algebra.). Evaluate p at x =3 , 1.34, and -120.

_____

16. Find all of the roots of p by using the solve command.

_____

17. Have Maple factor p, and write the result here. Does this factorization lead to the same roots as in 16?

_____ _____

18. If an open box is made from a square piece of material, 36 inches on a side, by cutting equal squares of length x from the corners and turning up the sides, then the volume of the box is given by the function $V(x) = x \cdot (36 - 2x)^2$. Use the plot command (see step 10 and 11) to sketch a graph of the function. Make sure you set up the x axis so that you have a good overall view of the graph. Sketch it below. Make sure you label all of the x and y intercepts, and all of the highest and lowest points with their x and y coordinates.

You will need a multiplication sign here.

piece of paper
36 by 36

Volume of box $V(x) = x(36 - 2x)^2$

V(x)

v o l u m e   o f   b o x

x | 36 -2x | x

x

paper with squares cut out

Fold on dotted lines

x | the box

36 - 2x   36 - 2x

Size of cut out square   x
(height of box)

19. What does it look like is the highest possible value for the volume?_____

How large do the cut out squares need to be to get this maximum volume? _____

20. Take this sheet to the lab assistant. S/he will check the lab for accuracy. If the lab is incomplete, or any of your answers are incorrect,s/ he will direct you back to your computer for you to complete or correct them. This lab cannot be handed in until it is completely correct.

This lab is complete and correct. _____ _____
                                                                        Lab assistant   date

I completed this lab on my own at _____

21. I want your opinion: Strongly agree   strongly disagree

The directions in this lab were easy to follow   5   4   3   2   1

This lab gave me an idea of how computers   5   4   3   2   1
can be useful in math.

How long did it take you to complete this lab? _____

Comments: