

Revised 8/21/2013

Calculus I  
Maple Lab #1

## Introduction to Maple

Name: \_\_\_\_\_

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 Learning and Advising 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 16" 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) -  $3x + 2$
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.

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

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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:

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8. Use the **evalf** command to get decimal approximations for the solutions. They are:

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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)**

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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 extent 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?

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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.

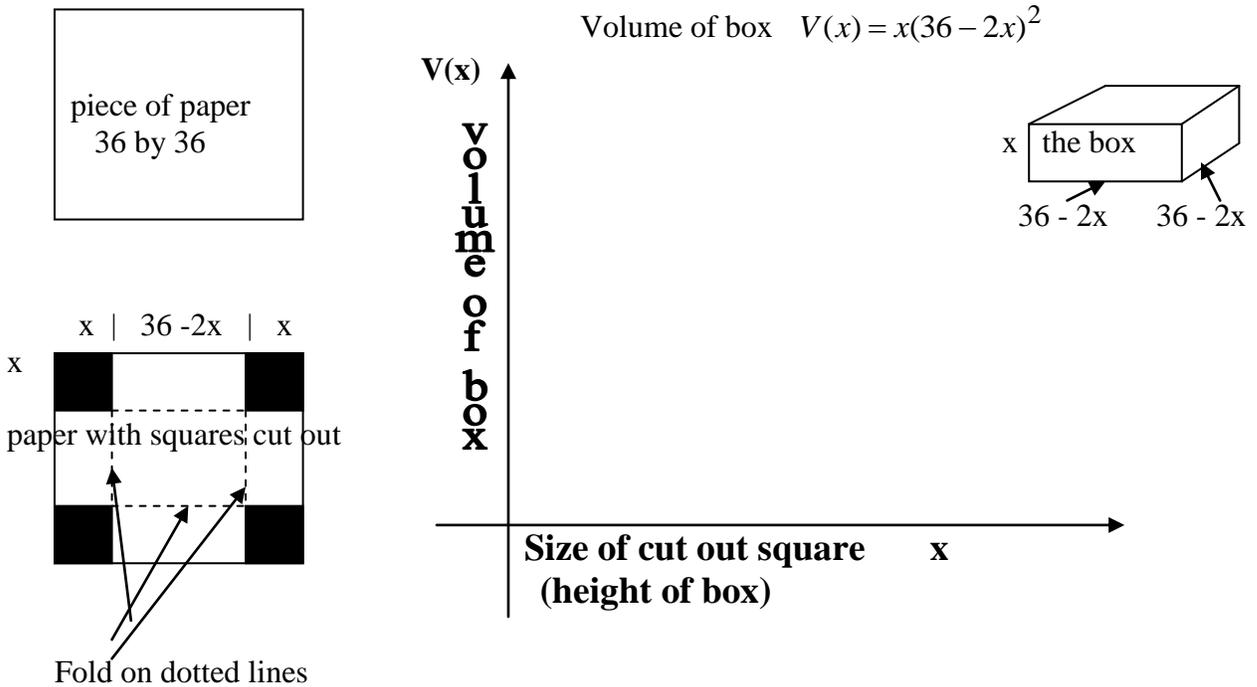
\_\_\_\_\_

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  $V(x) = x(36 - 2x)^2$ . 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.



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. He will check the lab for accuracy. If the lab is incomplete, or any of your answers are incorrect, 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 can be useful in math. 5 4 3 2 1

How long did it take you to complete this lab? \_\_\_\_\_

Comments: