

## Calculus 2

### Lab 1: Exploring areas of regions using Mathematica

Name:

Name:

Instructions:

#### 1. Open Mathematica

Double click on the Mathematica icon on your desktop, a blank Mathematica notebook will appear.

#### 2. Create a new input cell

To create a new input cell hit the **enter key on the alphabetical keypad**.

#### 3. Create a text cell to enter your names

To convert a cell into a text cell so that you can enter your names, select the cell and then go to the **Format** option on the menu bar, select **Style** followed by **Text**. Now type in your names (they should appear in black).

#### 4. Basic input palette

Check to see if the BasicInput Palette is active. If it does not appear, go to the **File** menu and select **Palettes**, followed by **BasicInput**.

#### 5. Save and name a notebook

Go to the **File** menu, select **Save As**, and save this notebook using the file name **Lab1Areas** Last name1 Last name 2, where Last name1 Last name 2 should be replaced by the last names of the team members.

### Problem 1

Using Mathematica, graph the functions

$$f(x) = x^2 - 4x + 3 \text{ and } g(x) = -x^2 + 2x + 3.$$

In order to do this you will need to

#### 6. Define the functions

- a. Create a new input cell.

- b. Define the functions  $f(x)$  and  $g(x)$

To define a function  $f(x)$  in Mathematica type  **$f[x_] :=$**   
followed by the function.

Execute the command by pressing the **numerical enter key**

To define  $g(x)$  follow the same procedure and type  **$g[x_] :=$**   
followed by the function.

Execute the command by pressing the **numerical enter key**

*As an example, if we were to define the function  $f(x)=3x+5$  we would type the following command:*

**$f[x_] := 3x+5$**

## 7. Graph each function

- a. To graph a function in Mathematica we need to specify the domain for the independent variable. Think about what is a reasonable domain for your independent variable given the problem at hand.
- b. Create a new input cell.
- c. Decide on a name for the graph of your function.  
For the case of  $f(x)$  type: **Graphf=**
- d. Immediately after the equal sign type: **Plot[f[x], {x, a, b}]**  
replacing **a** and **b** by the endpoints of the interval on which you will graph the function.

*For example, to graph the function  $f(x)=3x+5$  from above, which we called  $f[x]$ , with values of  $x$  going from  $-2$  to  $2$ , we type:*

**Graphf= Plot[f[x], {x, -2, 2}]**

*Mathematica reads it as: create a graph called “Graphf” by plotting the function “f[x]” on the interval  $[-2,2]$ .*

- e. Execute the command by pressing the **numerical enter key**. You should see the graph of your function.
- f. View the graph of your function by typing **Graphf** and pressing the enter key.
- g. Repeat the process for  $g(x)$  and call the graph **Graphg**

**8. Show the graphs together**

- a. Create a new input cell.
- b. **Show the graphs together by typing:**  
**Show[Graphf, Graphg]**
- c. Execute the command by pressing the **numerical enter key**.

**9. Print your Mathematica notebook and shade the region between the graphs.**

**10. Find the points of intersection between the two graphs.**

**11. Set up the integral to compute the area between the curves.**

**12. Compute the area between the curves.**

**Bonus points!**

- 13. Use the documentation center to find 4 (or more) commands that would help you with tasks 9-12.**

**Problem 2**

**Use Mathematica to draw a picture of the situation and to find the area between the graph of  $y = \sin x$  and the line segment joining the points  $(0,0)$  and  $(\frac{7\pi}{6}, -\frac{1}{2})$ .**

**Problem 3**

**Use Mathematica to find the area of the region between the graphs of  $f(x) = 3x^3 - x^2 - 10x$  and  $g(x) = -x^2 + 2x$ .**