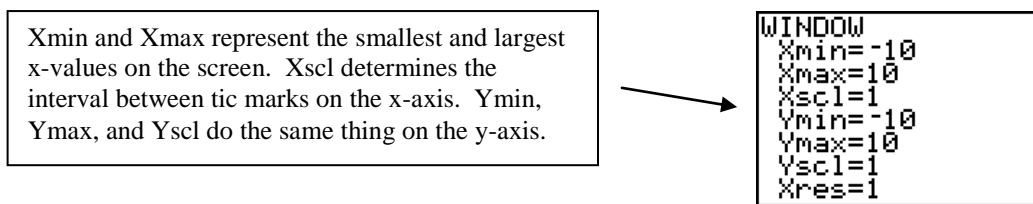The purpose of this activity is to introduce you to the graphing capabilities of your calculator. It's written with the TI-82, 83, 83+, 84 in mind. The other TI calculators are similar, but there are some differences. **I strongly urge you to read and work along with the first 3 pages of this intro before you start the problems.**
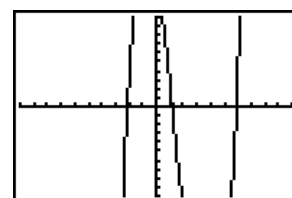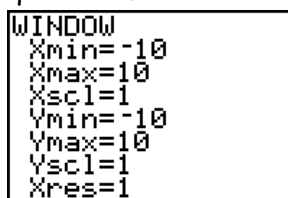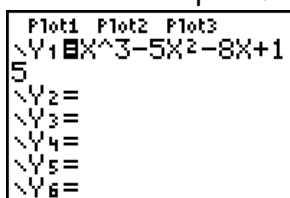
- To graph a function you must press the [Y=] button. Once there you will see that you can input many different functions. That means an equation must be "solved for y."

The "Plots" will be used later

```
Plot1  Plot2  Plot3
\Y1=
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```
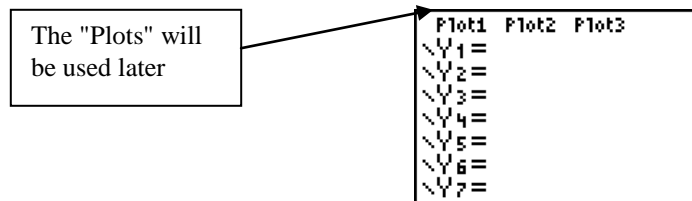
- Once you have entered your function you will want to use [WINDOW]. This will allow you to get the part of the graph you want to look at.

Xmin and Xmax represent the smallest and largest x-values on the screen. Xscl determines the interval between tic marks on the x-axis. Ymin, Ymax, and Yscl do the same thing on the y-axis.

```
WINDOW
  Xmin=-10
  Xmax=10
  Xscl=1
  Ymin=-10
  Ymax=10
  Yscl=1
  Xres=1
```

- [ZOOM] enables you to zoom-in as well as zoom-out on any part of the graph. The default setting of [-10, 10] for the x- and y-axes is accomplished with a keystroke of [ZOOM] 6:.

- The cursor arrows allow you to move about the screen while [TRACE] adheres to a graph and allows you to move along the graph with the x- and y-coordinates displayed as you travel along the graph. To move the cursor you simply push the left or right arrow. Pushing the up and/or down arrow will switch the cursor to another graph ($Y_1 \rightarrow Y_2 \rightarrow Y_3$ etc). Of course this only applies if you are graphing more than one function.

- [GRAPH] graphs everything in the [Y=] menu and all Plots (that are turned on) on the domain and range you specified in the [Window] menu. To turn a function off, cursor onto the "=" sign and press [ENTER]. Repeat to turn on. To change the shape of the line or way it's plotted, cursor to the far left and press [ENTER] to toggle through the choices.

- Here is an example of a typical sequence of windows

```
Plot1  Plot2  Plot3
\Y1■X^3-5X²-8X+1
5
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
```

```
WINDOW
  Xmin=-10
  Xmax=10
  Xscl=1
  Ymin=-10
  Ymax=10
  Yscl=1
  Xres=1
```

- The picture below is the same graph, but I changed the Ymin, Ymax, and Yscl values. Change yours so that your calculator matches mine.

Hint: The Yscl is 5.
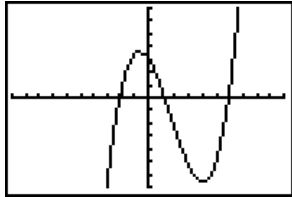
- To graph another function, you simply go back to [Y=] and type in the function.

Leave the same [Window] and graph these two functions.

```
Plot1 Plot2 Plot3
\Y1■X^3−5X²−8X+1
5
\Y2■-.5X²+3X+10
\Y3=
\Y4=
\Y5=
\Y6=
```

- Once you have Y_1 and Y_2 graphed push [TRACE]. Push the left, right, up, and down arrows until you understand what these buttons do.

- If you need to get a closer look at part of a graph you can use one of the [Zoom] features. Here is an example of the [Zoom] [Box] feature. To see if Y_1 and Y_2 have the same x-intercept near x = -2 hit the [Zoom] key and then select 1:Zbox. You'll see a little "plus" sign floating somewhere on your screen. Place it above and to the left of our point of interest by using the arrow keys. Do they have the same x-intercept?
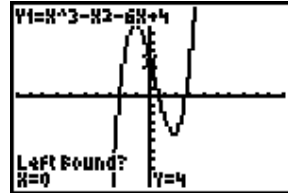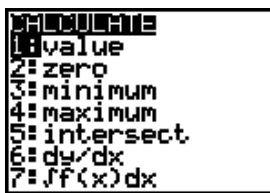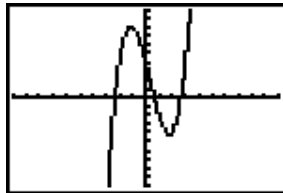
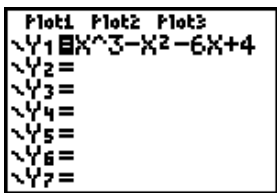Move your cursor to about here, then hit [Enter]
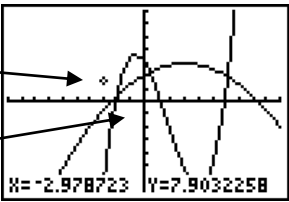
Then move the cursor to the right and below our point of interest and hit [Enter]

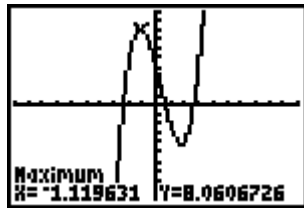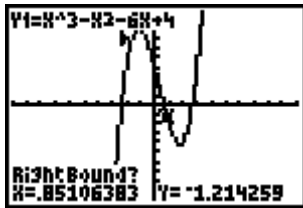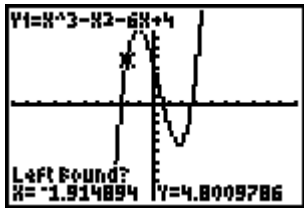X=-2.978723 Y=7.9032258

X=-1.06383 Y=-6.774194
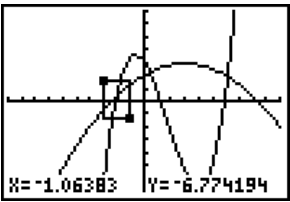
Once you hit [Enter], the little box becomes the entire graph window. This automatically changes your Window settings. What are they now?

- A very powerful and useful menu in your calculator is above the [TRACE] key. It is usually just called [2nd] [Calc]. We can use this menu to find x-intercepts, local minimums, local maximums, and where two functions intersect. This is a VERY IMPORTANT feature to learn.

- To find the local maximum on the graph of $y = x^3 - x^2 - 6x + 4$ we first type the above equation into Y_1, then set up your window to the Standard setting using Zoom 6. Once you have your graph, push [2nd] [Calc], then choose 4: maximum.

Plot1 Plot2 Plot3
\Y1⊟X^3-X²-6X+4
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=

CALCULATE
1:value
2:zero
3:minimum
4:maximum
5:intersect
6:dy/dx
7:∫f(x)dx

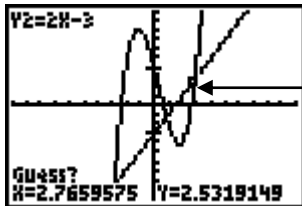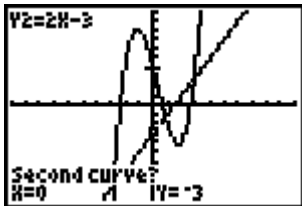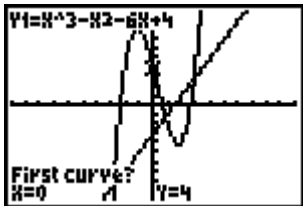Y1=X^3-X2-6X+4
Left Bound?
X=0   Y=4

- At this point the calculator is asking you if you are to the left of what you are looking for. Since we are not, we simply move the cursor to the left until we are to the left of what we are looking for (Simply use the left arrow). Once there we hit [ENTER] (yes), then the calculator wants us to move to the right of the maximum. Use the right arrow until you are to the right of the maximum. Then hit [ENTER] again to make the calculator find the maximum.

Y1=X^3-X2-6X+4
Left Bound?
X=-1.914894 Y=4.8009786

Y1=X^3-X2-6X+4
Right Bound?
X=.85106383 Y=-1.214259

Maximum
X=-1.119631 Y=8.0606726

Note: You can also move to the 'left' or 'right' position more quickly by typing an x-value. Try it.

- So we find that the local maximum occurs approximately at the point (-1.12, 8.06). The minimum or x-intercept is done in a similar fashion. To find the x-intercept you choose the "Zero" option inside the [2nd] [Calc] menu.

- To find an intersection between two graphs we select the 5:intersect option. Here is the sequence of windows we would see to find an intersection point between the graph above and the line y = 2x – 3. The first step is to type y = 2x – 3 into Y_2, then select the 5:intersect option inside the [2nd] [Calc] menu. The calculator will ask you if you are on the first curve, hit [ENTER] to include this graph. The calculator will automatically switch to the another graph. To include this graph hit [ENTER] again (to move through [Y=] list use up and down arrows). When the calculator displays "Guess?" hit [ENTER]. If there are multiple intersections, use the cursor close to the point of intersection you want and hit [ENTER]. The calculator will then find that point of intersection.

Y1=X^3-X2-6X+4
First curve?
X=0   Y=4

Y2=2X-3
Second curve?
X=0   Y=-3

Y2=2X-3
Guess?
X=2.7659575 Y=2.5319149

Notice I moved the cursor close to this intersection point.

PRACTICE PROBLEMS

When graphing functions on your calculator it is usually a good idea to start with the default settings for the [Window] menu. Recall that this can be done quickly by using [Zoom] [6].

1. Graph $f(x) = x^3 - 3x^2 + 2$. Adjust your [Window] settings to match the graph that is shown here. What are the settings for Xmin, Xmax, Xscl, Ymax, Ymin, and Yscl?
    Hint: Just counting the tic mark will help.
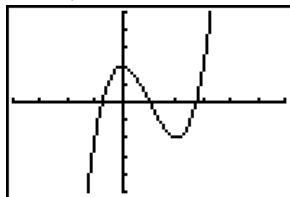
2. Find the intersection of $y = 2x - 3$ and $y = -x + 9$

3. Find the intersection of $2x + 4y = 3$ and $y = 4x + 3$

4. Find the intersection of $2x + y = 3$ and $3y = -6x + 5$

5. Find the intersection points for the graphs of $y = 2x - 3$ and $y = x^3 - 2x^2 - 3x + 4$.

6. Find the coordinates for the local maximum and local minimum for the graph of
    $y = x^3 + x^2 - 3x - 7$.

7. Find the x-intercept for the graph in number 6.

8. Use the "Maximum" feature of your calculator to find the vertex of the parabola given by
    $y = -1.4x^2 + 9.6x + 1$