

0.7 Graphing Features: Value (Eval), Zoom, Trace, Maximum/Minimum, Intersect

- **Value** (TI-83 and TI-89), **Eval** (TI-86)

The **Value** or **Eval** feature allows us to enter a specific x -coordinate and the cursor moves to that particular point on the graph, indicating the corresponding y -coordinate. Thus, we can evaluate the function for a given value of x , and find y , or we might find the y -intercept by entering $x = 0$.

TI-83 (see page 84), TI-89 (see page 85), TI-86 (see page 86).

- **Zoom**

The **Zoom** feature has several options available. We have already worked with **Zoom Standard** when we were graphing Polynomial Functions in section 0.2.2. Now, we will look at **Zoom Box** and **Zoom In**. We will work with **Zoom Square** when we graph circles in section 0.3.3. You may want to explore some of the other options.

TI-83 (see page 87), TI-89 (see page 89), TI-86 (see page 91).

- **Trace**

To try the **Trace** feature, graph any function you wish.

TI-83: Press **Trace**. TI-89: Press **F3 Trace**. TI-86: Press **F4 Trace**.

Using the left and right arrow keys move the cursor along the graph. Notice how the x - and y -coordinates change as the cursor moves.

Trace will also duplicate the function of **Value** or **Eval**. Press **F3 Trace**, then enter a value for x . The cursor moves to that point on the graph, showing the corresponding y coordinate.

A word of caution: Normally, **Trace** is *not* the best tool to use. There are usually other functions available that produce more accurate answers than **Trace**.

- **Maximum/Minimum**

The **Maximum** or **Minimum** feature finds the largest or smallest y value of a function within a specified interval.

TI-83 (see page 93), TI-89 (see page 95), TI-86 (see page 97).

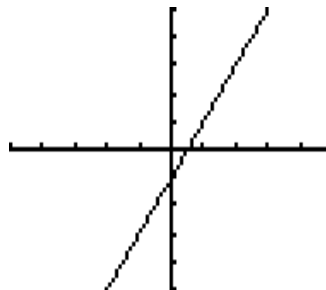
- **Intersect**

The **Intersect** feature finds the point of intersection of two functions within a specified interval. An example is worked through in section 0.9.2.

TI-83 (see page 138), TI-89 (see page 141), TI-86 (see page 144).

TI-83: Value

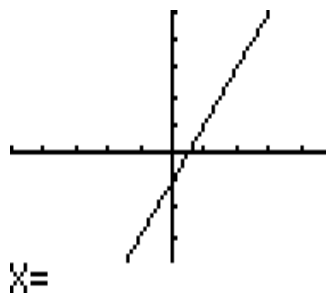
Graph $y = 2x - 1$ on $[-5, 5]$ by $[-5, 5]$



Press **2nd** and **Calc**,
then select 1:value

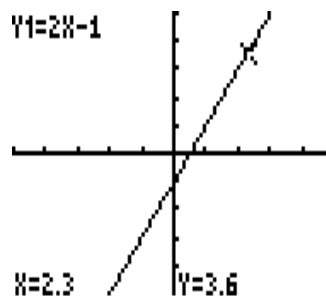
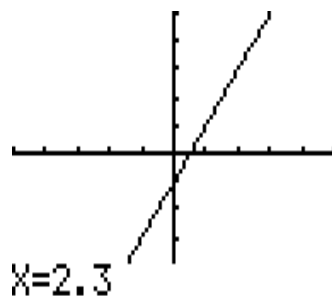
```
1:value  
2:zero  
3:minimum  
4:maximum  
5:intersect  
6:dy/dx  
7:∫f(x)dx
```

We see the graph and we
are asked for the x -coordinate.



Suppose we enter 2.3

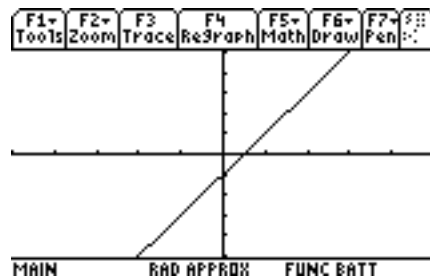
and press **Enter**.



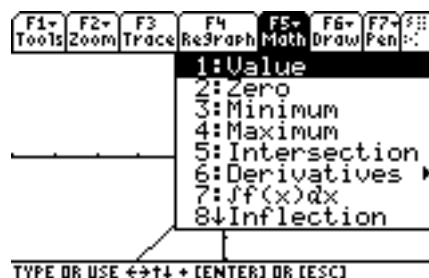
The cursor has moved to $x = 2.3$ and shows us $y = 3.6$.

TI-89: Value

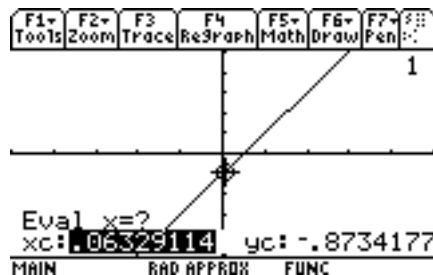
Graph $y = 2x - 1$ on $[-5, 5]$ by $[-5, 5]$



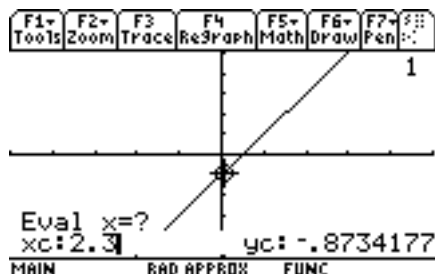
Press **F5 Math** then select 1:value



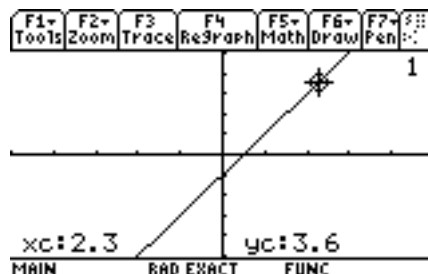
We see the graph and we are asked for the x -coordinate. (The values for x_c and y_c show the current placement of the cursor.)



Suppose we enter 2.3



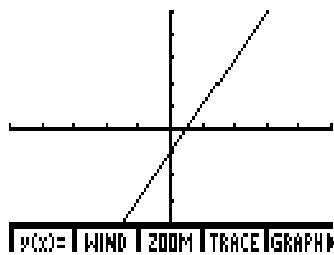
and press **Enter**.



The cursor has moved to $x = 2.3$ and shows us $y = 3.6$.

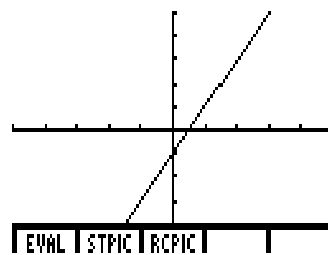
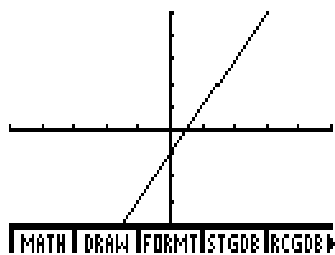
TI-86: Eval

Graph $y = 2x - 1$ on $[-5, 5]$ by $[-5, 5]$

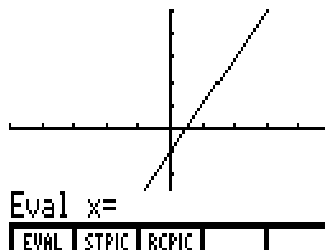


Press **More** to see additional options,

then **More** again.

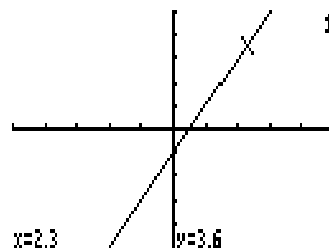
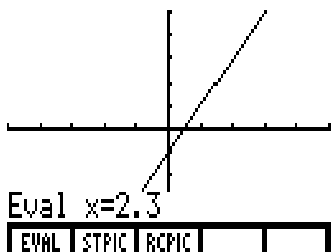


Press **F1 Eval** and we are asked for the x -coordinate.



Suppose we enter 2.3

and press **Enter**.



The cursor has moved to $x = 2.3$ and shows us $y = 3.6$.

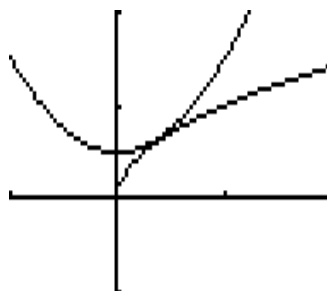
TI-83: Zoom

Graph two functions: $y = \sqrt{x}$ and $y = x^2 + 0.5$ and determine if they intersect by visually inspecting the graphs.

Enter the two functions (left picture). Using a window of $[-1, 2]$ by $[-1, 2]$, the graph looks like the right picture.

```

Plot1 Plot2 Plot3
\Y1=√(X)
\Y2=X^2+.5
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
    
```

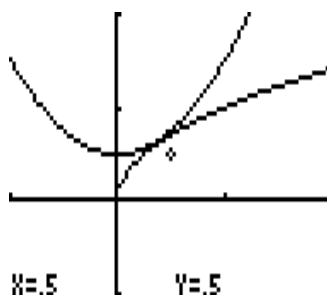


Zoom Box

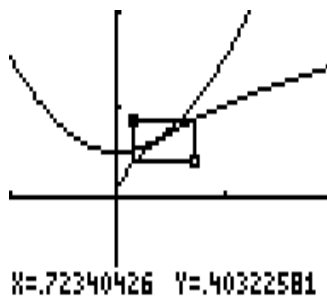
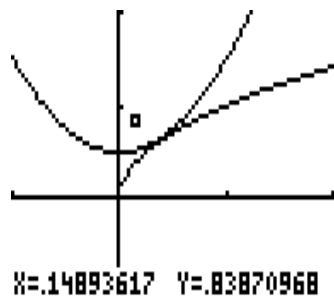
To see what is happening where the two curves appear to intersect, press **Zoom** (left picture). Select 1:ZBox to see the right picture. (The cursor may be at a different spot on your graph.)

```

MEMORY
1:ZBox
2:Zoom In
3:Zoom Out
4:ZDecimal
5:ZSquare
6:ZStandard
7:ZTrig
    
```

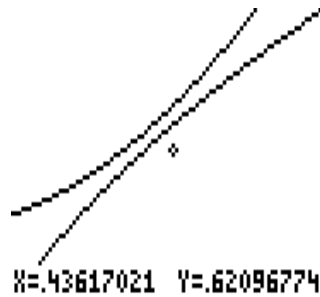


We need to draw a box around the section of the graph on which we wish to focus. First, we indicate the top left corner of the box. Use the arrow keys to move the cursor to the left and above the point of intersection. Press **Enter** and you see a small box (left picture). With the arrow keys, move the cursor and draw a box around the point of intersection (right picture).



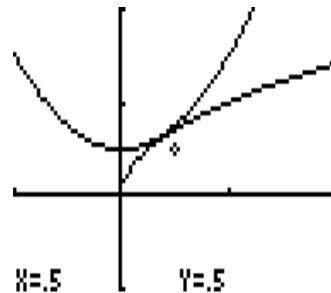
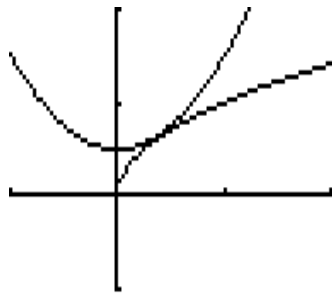
Press **Enter** and that section of the graph is redrawn.

Now it is obvious that the two curves do not intersect.

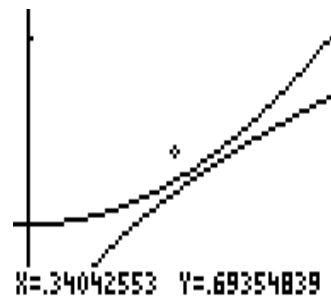
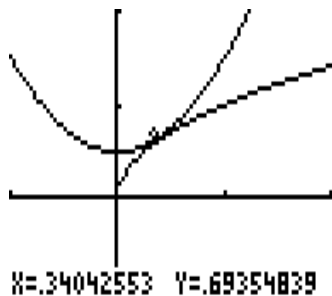


Zoom In

Return to a window of $[-1, 2]$ by $[-1, 2]$ (left picture). This time press **Zoom** and select 2:Zoom In (right picture).



Move the cursor to the spot you want to be the “center” of the new graph. Suppose we put it just above the point of intersection (left picture). Press **Enter** and the graph is redrawn (right picture).

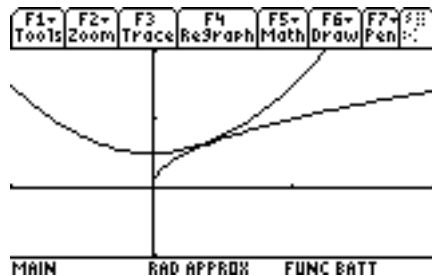
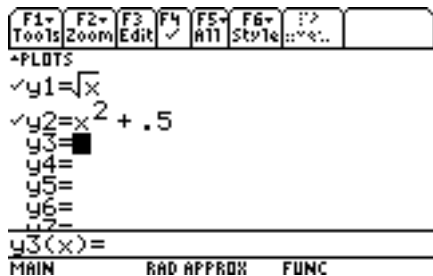


Again, it is obvious the two curves do not intersect.

TI-89: Zoom

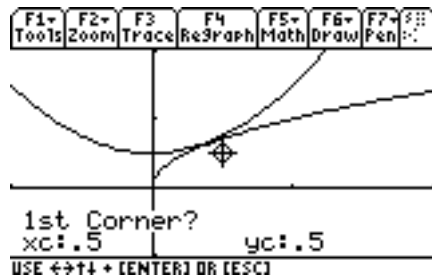
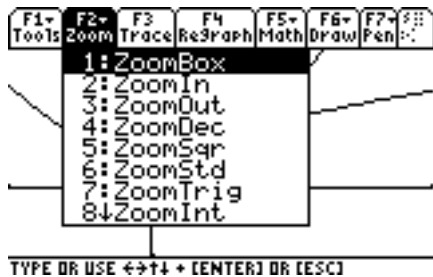
Graph two functions: $y = \sqrt{x}$ and $y = x^2 + 0.5$ and determine if they intersect by visually inspecting the graphs.

Enter the two functions (left picture). Using a window of $[-1, 2]$ by $[-1, 2]$, we see the graph in the right picture.

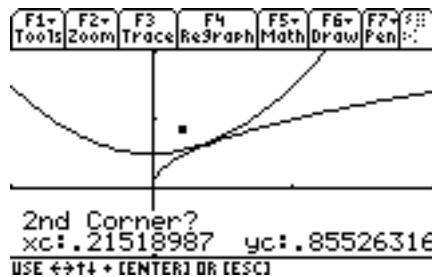
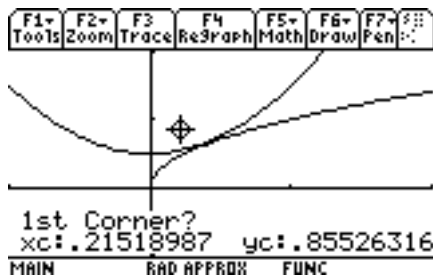


Zoom Box

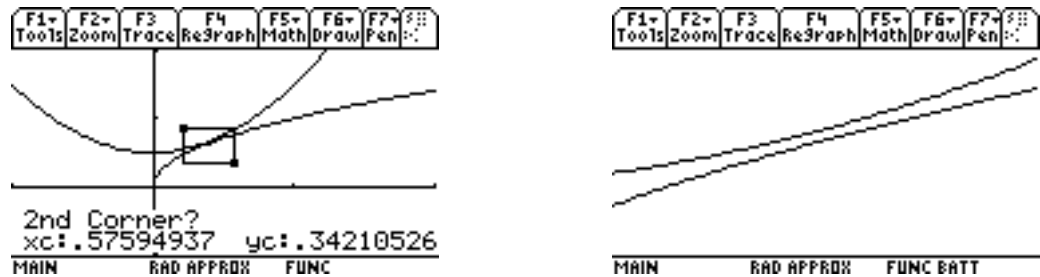
To see what is happening where the two curves appear to intersect, press **F2 Zoom** (left picture). Select 1:ZoomBox to see the right picture. (The cursor may be at a different spot on your graph.)



We are asked for the 1st Corner?. We need to indicate the top left corner of the section of the graph on which we wish to focus. Use the arrow keys to move the cursor to the left and above the point of intersection (left picture). Press **Enter** and you see a small box at that spot, plus the question 2nd Corner? (right picture).



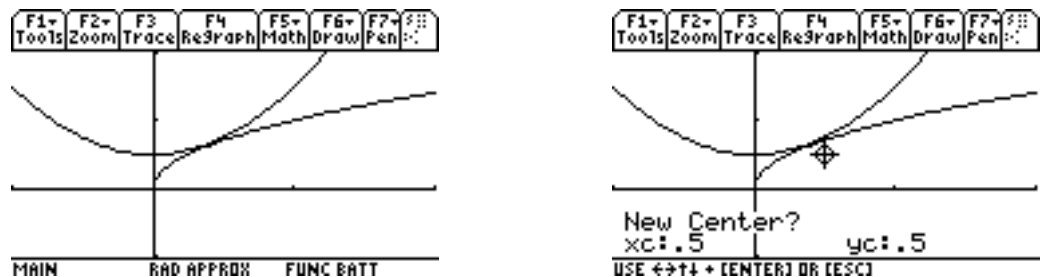
With the arrow keys, move the cursor and draw a box around the point of intersection (left picture). Press **Enter** and that section of the graph is redrawn (right picture).



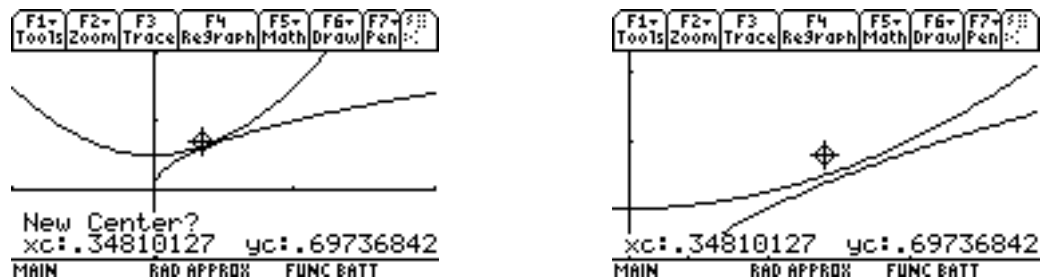
Now it is obvious that the two curves do not intersect.

Zoom In

Return to a window of $[-1, 2]$ by $[-1, 2]$ (left picture). This time press **F2 Zoom** and select 2:ZoomIn (right picture).



We are asked New Center? Move the cursor to the spot you want to be the “center” of the new graph. Suppose we put it just above the point of intersection (left picture). Press **Enter** and the graph is redrawn (right picture).

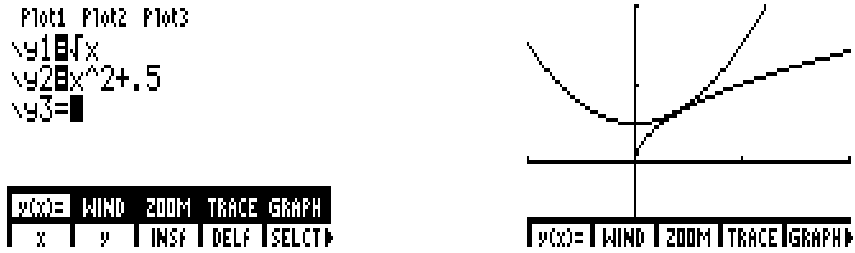


It is now obvious the two curves do not intersect.

TI-86: Zoom

Graph two functions: $y = \sqrt{x}$ and $y = x^2 + 0.5$ and determine if they intersect by visually inspecting the graphs.

Enter the two functions (left picture). Using a window of $[-1, 2]$ by $[-1, 2]$ we see the graph in the right picture.



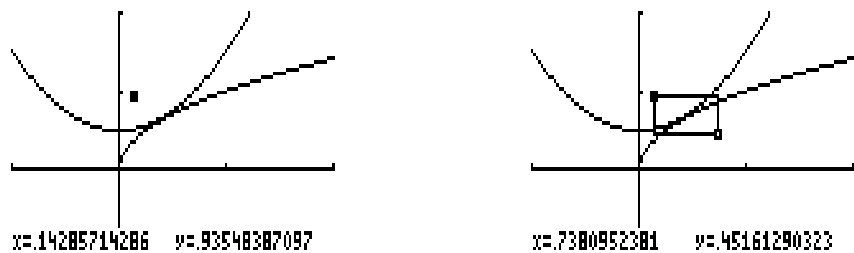
Zoom Box

To see what is happening where the two curves appear to intersect, press **F3 Zoom** (left picture). Press **F1 Box** which stands for Zoom Box and the graph is redrawn (right picture). The cursor may be at a different spot on your graph.



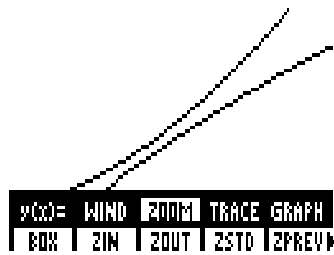
We need to draw a box around the section of the graph on which we wish to focus. First, we indicate the top left corner of the box.

Use the arrow keys to move the cursor to the left and above the point of intersection. Press **Enter** and you see a small box (left picture). With the arrow keys, move the cursor and draw a box around the point of intersection (right picture).



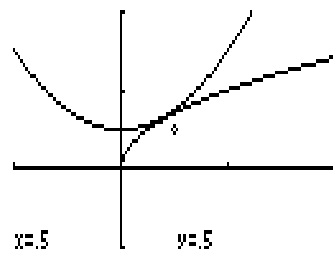
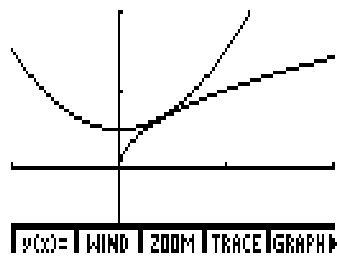
Press **Enter** and that section of the graph is redrawn.

Now it is obvious that the two curves do not intersect.

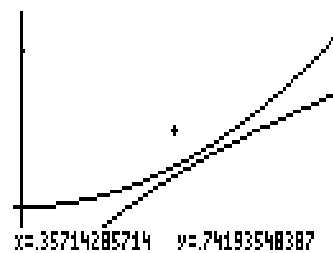
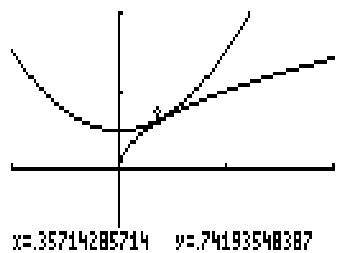


Zoom In

Return to a window of $[-1, 2]$ by $[-1, 2]$ (left picture). This time press **F3 Zoom** and **F2 Zin** for Zoom In (right picture).



Move the cursor to the spot you want to be the “center” of the new graph. Suppose we put it just above the point of intersection (left picture). Press **Enter** and the graph is redrawn (right picture).



Again, it is obvious the two curves do not intersect.

TI-83: Maximum/Minimum

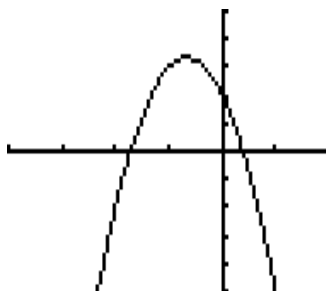
To see how **Maximum** works, graph $y = -3x^2 - 4x + 2$ with a window of $[-4, 2]$ by $[-5, 5]$. Since the leading coefficient -3 is negative, we know the graph of the parabola turns down, and thus, has a *maximum* value.

Press **(Y=)** and clear any function(s) left over from previous work.

Enter the formula for y (left picture) and appropriate values for the window (right picture).

<pre> Plot1 Plot2 Plot3 \Y1=-3X^2-4X+2 \Y2= \Y3= \Y4= \Y5= \Y6= \Y7= </pre>	<pre> WINDOW Xmin=-4 Xmax=2 Xscl=1 Ymin=-5 Ymax=5 Yscl=1 Xres=1 </pre>
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Press **(Graph)** to see

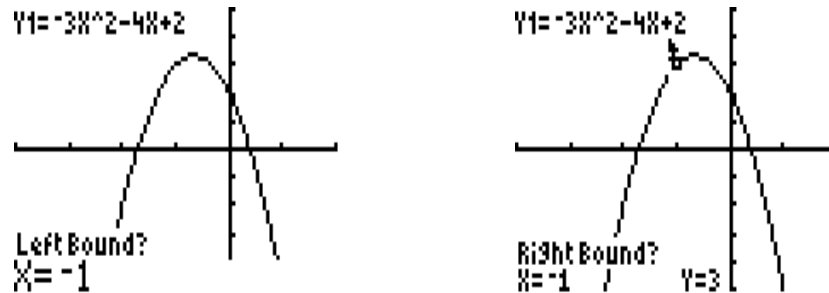


To find the *maximum* value for this function, press **(2nd)** and **(Calc)** (left picture). Select 4:maximum by typing 4, or by moving the cursor to 4 and pressing **(Enter)** to see the graph on the right.

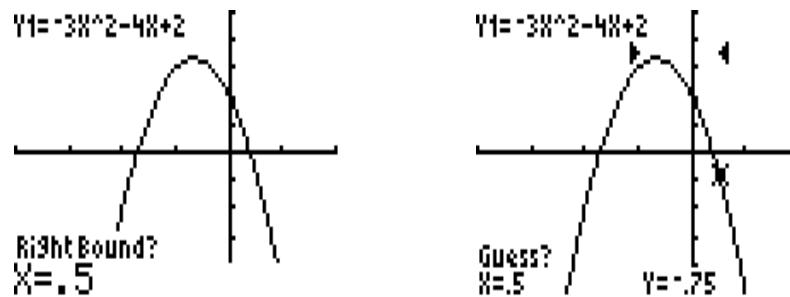
<pre> MATH PRG 1:value 2:zero 3:minimum 4:maximum 5:intersect 6:dy/dx 7:∫f(x)dx </pre>	<pre> Y1=-3X^2-4X+2 Left Bound? X=-.2978723 Y=2.9253056 </pre>
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We have to indicate an interval surrounding the x -coordinate of the *maximum* value we need. We are asked for the *Left Bound*. Move the cursor to the left of the high

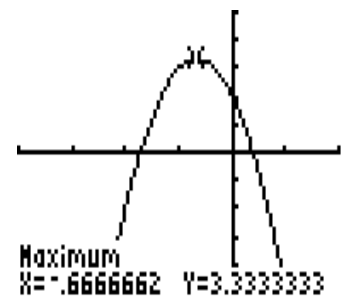
point of the curve, or type in something like -1 (left picture) and press **Enter** (right picture).



For the *Right Bound*, move the cursor to the right of the high point, or type in, say $.5$ (left picture) and press **Enter** (right picture).



We are asked to make a *Guess?*. Notice the arrows above the curve which indicate the interval we are using for our search. Move the cursor closer to the high point, or just press **Enter**.



The *maximum* value, using two decimal places is $y = 3.33$ when $x = -.67$.

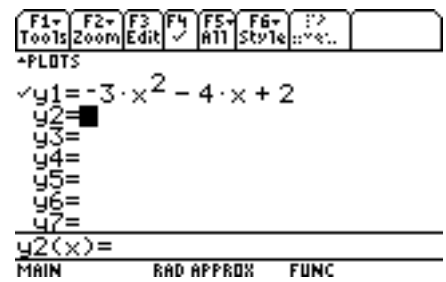
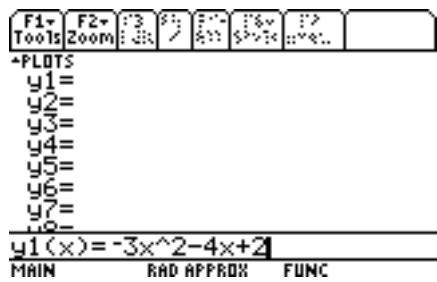
The *Minimum* feature works in a similar fashion.

TI-89: Maximum/Minimum

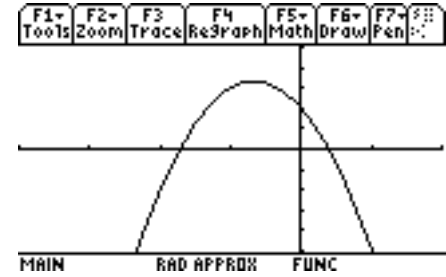
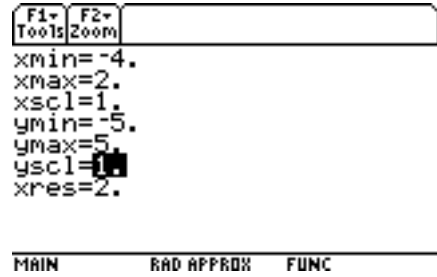
To see how **Maximum** works, graph $y = -3x^2 - 4x + 2$ with a window of $[-4, 2]$ by $[-5, 5]$. Since the leading coefficient -3 is negative, we know the graph of the parabola turns down, and thus, has a *maximum* value.

Press the green \blacklozenge key and $\boxed{\text{F1 Y=}}$. Move the cursor to any function definition that appears and press $\boxed{\text{Clear}}$.

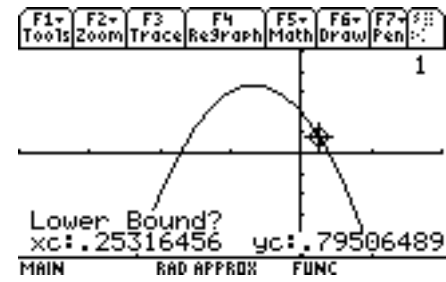
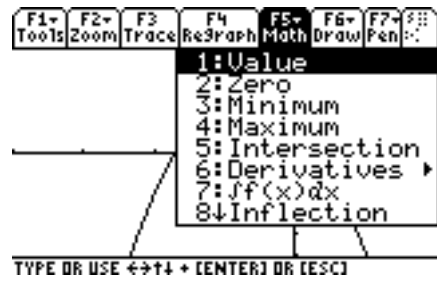
Enter the formula for y (left picture). Press $\boxed{\text{Enter}}$ and verify the formula is correct (right picture).



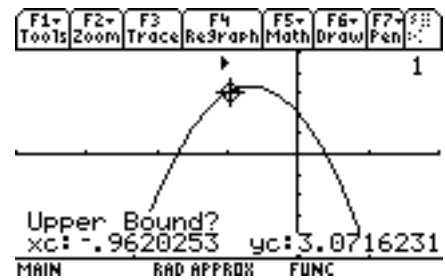
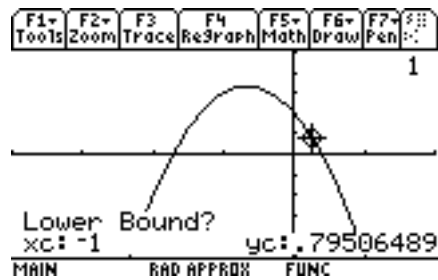
Enter appropriate values for a window of $[-4, 2]$ by $[-5, 5]$ (left picture). Then press \blacklozenge and $\boxed{\text{F3 Graph}}$ to see the graph on the right.



To find the *maximum* value for this function, press $\boxed{\text{F5 Math}}$ (left picture). Select 4:Maximum by typing 4, or by moving the cursor to 4 and pressing $\boxed{\text{Enter}}$ to see the graph (right picture).

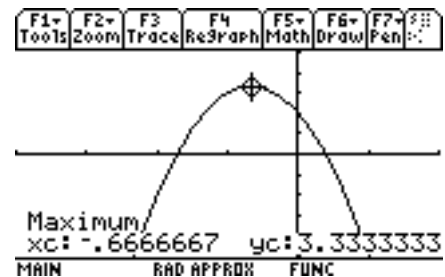
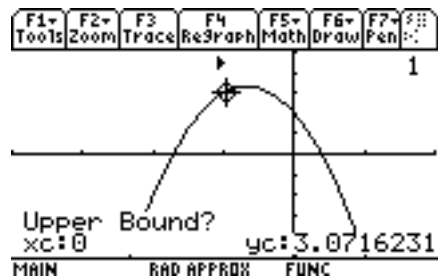


We have to indicate an interval surrounding the x -coordinate of the *maximum* value we need. When asked for the *Lower Bound*, move the cursor to the left of the high point of the curve, or type in something like -1 (left picture) and press **Enter** (right picture).



Notice the arrow above the x -value indicating the leftmost endpoint of the interval for our search.

For the *Upper Bound*, move the cursor to the right of the high point, or type in, say 0 (left picture) and press **Enter** (right picture).



The *maximum* value, using two decimal places, is $y = 3.33$ when $x = -.67$.

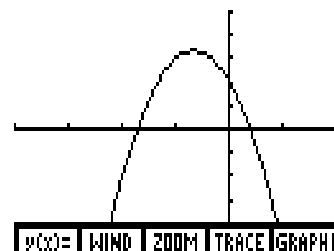
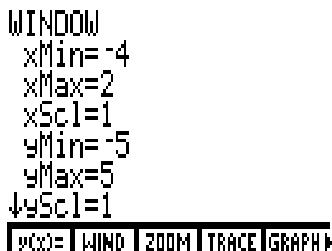
The *Minimum* feature works in a similar fashion.

TI-86: Maximum/Minimum

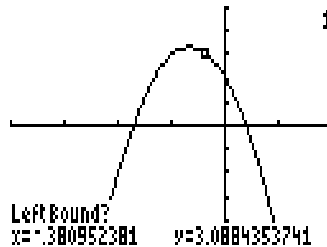
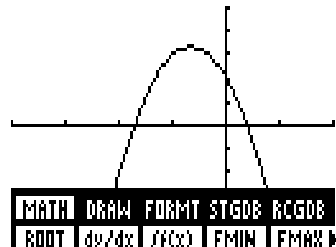
To see how **Maximum** works, graph $y = -3x^2 - 4x + 2$ with a window of $[-4, 2]$ by $[-5, 5]$. Since the leading coefficient -3 is negative, we know the graph of the parabola turns down, and thus, has a *maximum* value.

Press **Graph**, then **F1 y(x)=**, and clear any previous functions.

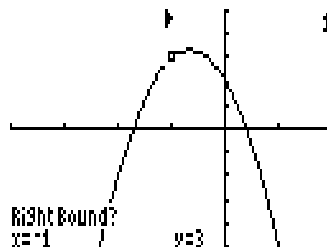
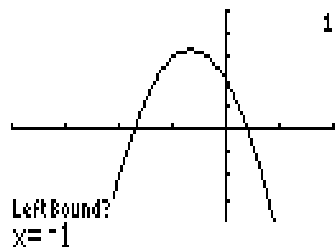
Enter the formula for y (left picture) and appropriate values for the window $[-4, 2]$ by $[-5, 5]$ (middle picture). Press **F5 Graph** (right picture).



To find the *maximum* value for this function, press **More** and **F1 Math** (left picture). Press **F5 FMax** to see the right picture.

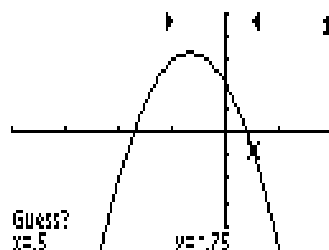
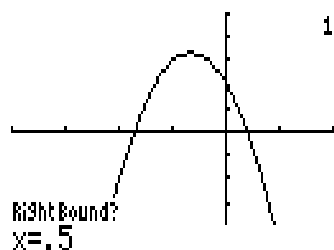


We have to indicate an interval surrounding the x -coordinate of the *maximum* value we need. We are asked for the *Left Bound*. Move the cursor to the left of the high point of the curve, or type in something like -1 (left picture) and press **Enter** (right picture).

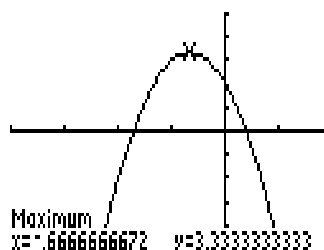


Notice the arrow above $x = -1$ indicating the leftmost endpoint of our interval.

For the *Right Bound*, move the cursor to the right of the high point, or type in, say .5 (left picture) and press **Enter** (right picture). Now we see the arrow for the rightmost endpoint of the interval.



We are asked to make a *Guess?*. Move the cursor closer to the high point, or just press **Enter**.



The *maximum* value, using two decimal places, is $y = 3.33$ when $x = -.67$.

The *Minimum* feature works in a similar fashion.