TI-83/84 Plus Graphing Calculator Worksheet #2

The graphing calculator is set in the following WINDOW, MODE, and Y=, settings. Resetting your calculator brings it back to these original settings.

WINDOW

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

MODE

```
NORMAL SCI ENG
FLOAT 0123456789
RADIAN DEGREE
FUNC PAR POL SEQ
CONNECTED DOT
SEQUENTIAL SIMUL
REAL a+bi re^θi
FULL HORIZ G-T
SETCLOCK 10/22/07 1:07AM
```

Y=

```
Plot1 Plot2 Plot3
\Y1=
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

Note that all Plots are **NOT highlighted**. If any of them is highlighted, then use the arrow keys to go up / and right

Press **ENTER** to deselect

WINDOW Notation x: [x_{min}, x_{max}, x_{scl}] and y: [y_{min}, y_{max}, y_{scl}]

Original Setting x: [–10, 10, 1] and y: [–10, 10, 1]

Resetting Calculator to Factory Setting:

- when the user have used the calculator in various ways and it is difficult to go back to the original setting.
- when the user lend the calculator to others and they have messed up the original setting.
- this should be done before a test or after you lend the calculator to a friend

2nd **MEM "** **+**

```
MEMORY
1:About
2:Mem Mgmt/Del…
3:Clear Entries
4:ClrAllLists
5:Archive
6:UnArchive
7:Reset…
```

Select Option 7 **ENTER**

Select Option 1 **ENTER**

```
RAM ARCHIVE ALL
1:All RAM…
2:Defaults…
```

This will also delete all your entries like equations in Y= screen as well as data in the STATS screen

Adjusting WINDOW of a graph:

Sometimes, a graph needs to be set with a customize WINDOW. This is similar to setting the intervals and the ranges for both x- and y- axis.

Example 1: Graph $y = –2x^2 + 5x + 15$.

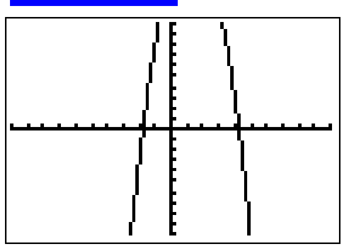
Y=

```
Plot1 Plot2 Plot3
\Y1= -2X²+5X+15
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

To enter negative sign, press (–)

To enter X, press **X,T,θ,n**

GRAPH

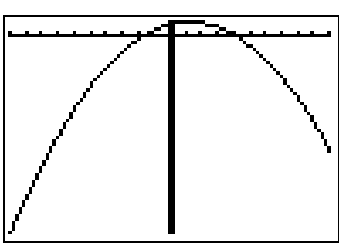


ZOOM

```
ZOOM MEMORY
4↑ZDecimal
5:ZSquare
6:ZStandard
7:ZTrig
8:ZInteger
9:ZoomStat
0:ZoomFit
```

Scroll down with (▼) and press **ENTER** or Select Option 0

Note: We use the subtraction button **–** between terms. Otherwise, we use (–) for negative signs.

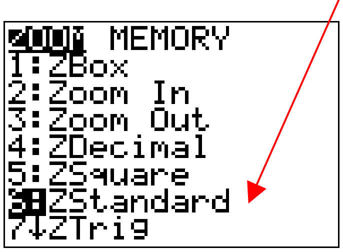


```
WINDOW
 Xmin=-10
 Xmax=10
 Xscl=1
 Ymin=-235
 Ymax=18.123585…
 Yscl=1
 Xres=1
```

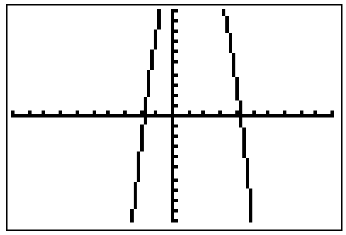
The ZoomFit option does not give a neat WINDOW setting, but it allows us to see the whole graph

To quickly reset the original WINDOW setting without resetting the entire calculator:

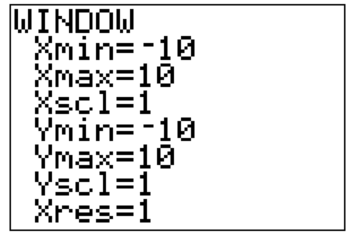
ZOOM



Scroll down with ▼ **and press** **ENTER** **or Select Option 6**



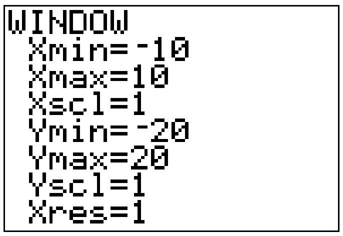
WINDOW



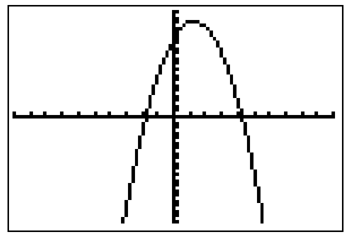
Note the WINDOW goes back to the original setting.

Now, we try using a customize WINDOW setting to *x*: [–10, 10, 1] and *y*: [–20, 20, 1].

WINDOW



GRAPH



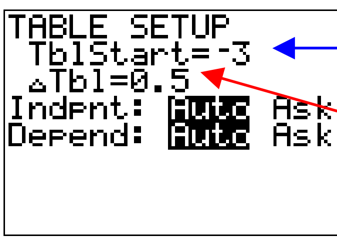
Note that now the graph fits nicely.

Example 2: Using the graph $y = -2x^2 + 5x + 15$ from the previous example,

a. Create a table of values starting at $x = -3$ with an increasing interval of 0.5.
b. Trace the graph and find the value of y when $x = 5$ from the graph.
c. What is the y-intercept of this graph?
d. Determine the x-intercepts.
e. Give the coordinates of where the maximum value of this graph occurs.
f. Solve $-2x^2 + 5x + 15 > 0$ and then solve $-2x^2 + 5x + 15 \leq 0$.

a. **<u>To create and customize a Table of Values</u>**:

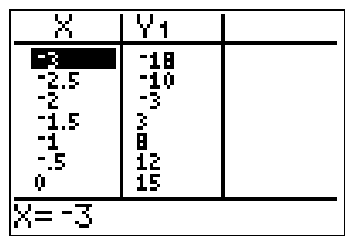
2nd **TBLSET** **WINDOW**



Set Table Start to –3

Set Table Interval to 0.5

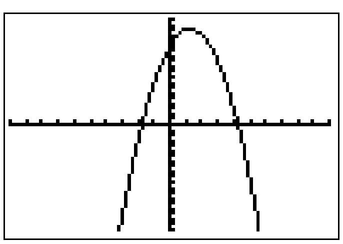
2nd **TABLE** **GRAPH**



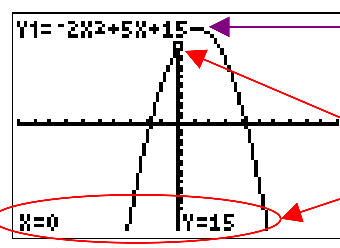
We may scroll up and down using ▲ ▼

b. **<u>To Trace along a Graph and find a Y-value from an X-value</u>**:

GRAPH

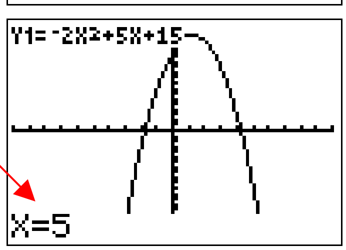


TRACE



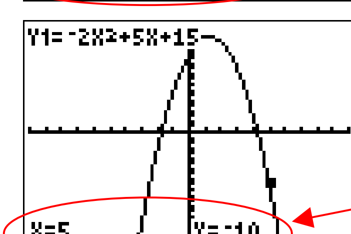
The equation is displayed on top.

Note the blinking cursor and the valued of the current x and y.



Enter 5 to input *x*-value

ENTER

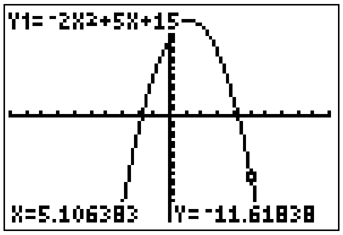


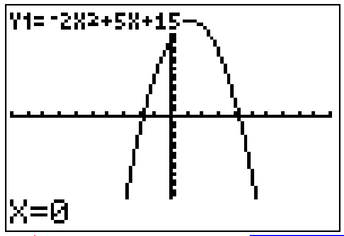
***y*-value of –10 is shown**

c. **<u>To find y-intercept, let $x = 0$</u>**

Note the y-intercept of a quadratic equation is its constant value after we manipulate it to $ax^2 + bx + c = 0$.

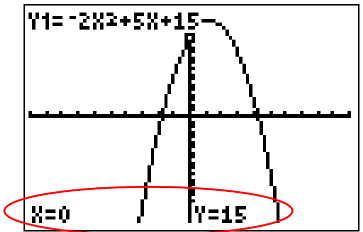
TRACE





Enter 0 to input x-value

ENTER



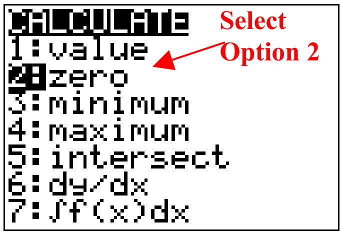
y-value of –15 is shown

d. **<u>To find x-intercept, let $y = 0$</u>**: This means using the ZERO function.

2nd

CALC

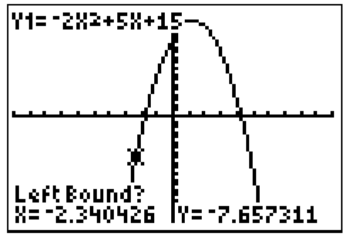
TRACE



Select Option 2

Use and take the cursor to the left of the first x-intercept.

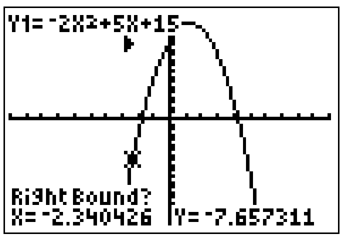
ENTER



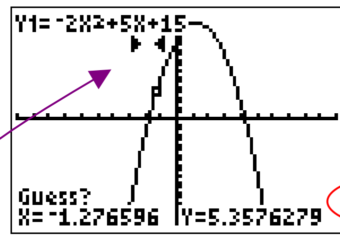
Zero = x-intercept = Solution = Root

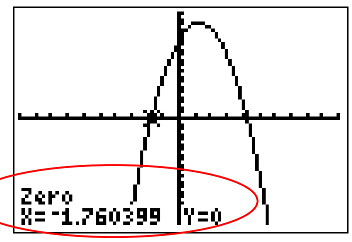
Use and take the cursor to the right of the first x-intercept.

ENTER



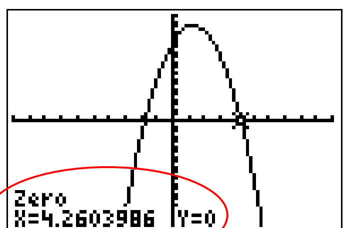
Press **ENTER** again.





Note the two little triangles that appear. They indicate the calculator will find the x-intercept within that range.

Do the same steps for the second x-intercept.



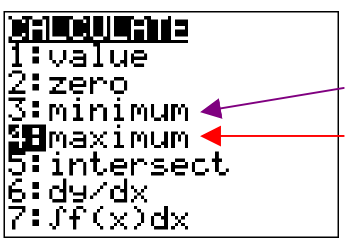
Because the original quadratic equation, $y = -2x^2 + 5x + 15$, is not factorable, these **<u>solutions are the decimal equivalents of the roots found from the quadratic formula</u>**. However, ***<u>we prefer the exact values</u>*** from the quadratic formula to their decimal equivalents.

e. **<u>To find the coordinates of the Maximum (or the Minimum) of a Graph</u>**:

2nd

CALC

TRACE

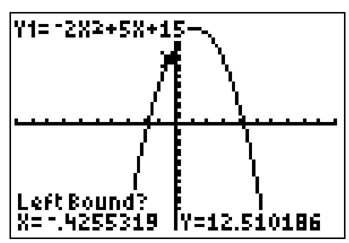


Select Option 3 for Minimum

Select Option 4 for Maximum

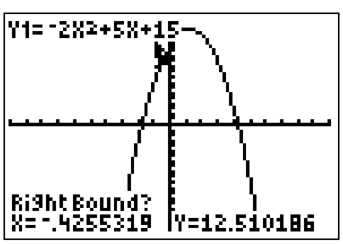
Use and take the cursor to the left of the Maximum point

ENTER

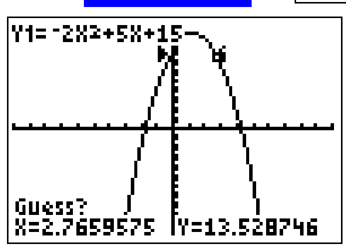


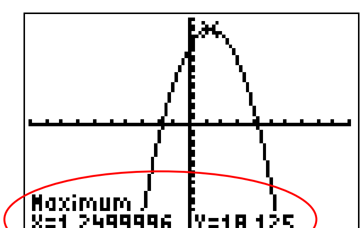
Use and take the cursor to the right of the Maximum point.

ENTER



Press **ENTER** again.

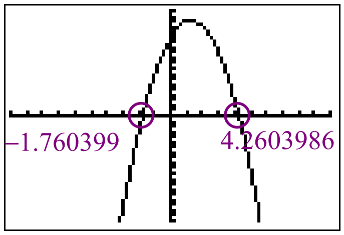




f. <u>**Solve Inequalities from Graphing**</u>: ($-2x^2 + 5x + 15 > 0$) and ($-2x^2 + 5x + 15 \le 0$)

GRAPH

x: [−10, 10, 1]
and
y: [−20, 20, 1]



when $y > 0$
(positive y-values)

when $y = 0$
(all y-values of x-axis = 0)

when $y > 0$
(negative y-values)

$$x\text{-intercepts} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-(5) \pm \sqrt{(5)^2 - 4(-2)(15)}}{2(-2)} = \frac{-5 \pm \sqrt{145}}{-4} = \frac{5 \pm \sqrt{145}}{4}$$

$$x = \frac{5 - \sqrt{145}}{4} \approx -1.760399 \qquad x = \frac{5 + \sqrt{145}}{4} \approx 4.2603986$$

For $-2x^2 + 5x + 15 > 0$, it is the same as when $y > 0$.

Approx Solution: $-1.760399 < x < 4.2603986$

Exact Solution: $\frac{5 - \sqrt{145}}{4} < x < \frac{5 + \sqrt{145}}{4}$

For $-2x^2 + 5x + 15 \le 0$, it is the same as when $y \le 0$.

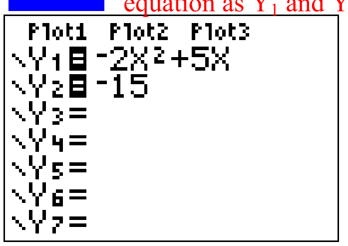
Approx Solution: $x \le -1.760399$ or $x \ge 4.2603986$

Exact Solution: $x \le \frac{5 - \sqrt{145}}{4}$ or $x \ge \frac{5 + \sqrt{145}}{4}$

Example 3: Solve $-2x^2 + 5x = -15$ using the INTERSECT function.

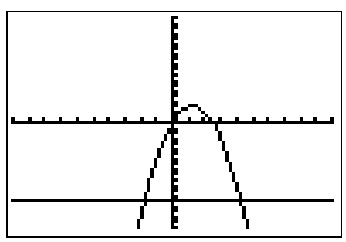
<u>**Using the INTERSECT function**</u>:

Y= Enter the two sides of the equation as Y_1 and Y_2



GRAPH

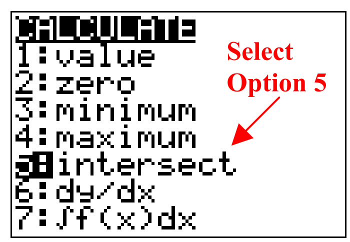
x: [−10, 10, 1]
and
y: [−20, 20, 1]



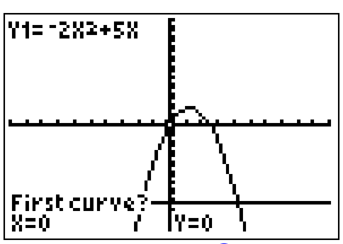
2nd

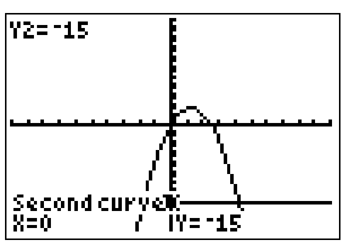
CALC

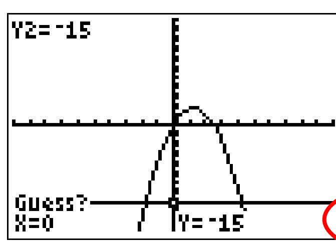
TRACE

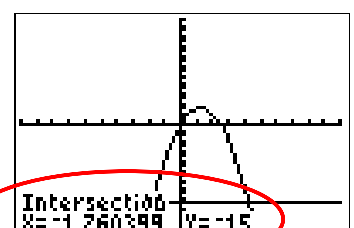


Select Option 5



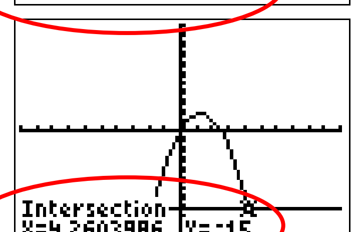






Take cursor close to the first intersecting point

ENTER **ENTER** **ENTER**



Note that solutions for the equation, $-2x^2 + 5x = -15$, are the same as the zeros for $y = -2x^2 + 5x + 15$.

Do the same steps for the second intersecting point.

Exercise Questions

1. Graph $y = x^2 + 6x - 16$. Adjust the WINDOW to properly fit the graph.
   a. Trace the graph and find the value of y when $x = -7$ from the graph.
   b. What is the y-intercept of this graph? How is the answer compared to the constant of the equation?
   c. Determine the x-intercepts. How are they compared to solving the equation by factoring?
   d. Give the coordinates of where the minimum value of this graph occurs.
   e. Solve $x^2 + 6x - 16 \geq 0$.
   f. Solve $x^2 + 6x - 16 < 0$.

2. Solve all real solutions $x^3 + 3x^2 - 7x = 15$ to two decimal place by graphing $y = x^3 + 3x^2 - 7x - 15$ and determine its zeros. Adjust WINDOW accordingly.
   a. Why is find the zeros of $y = x^3 + 3x^2 - 7x - 15$ the same as solving the equation $x^3 + 3x^2 - 7x = 15$?
   b. Solve the equation, $x^3 + 3x^2 - 7x = 15$, again by using the intersect function of the calculator.
   c. Give the coordinates (to the two decimal place) where the minimum value of this graph occurs.
   d. Solve $x^3 + 3x^2 - 7x - 15 < 0$.

3. A number people were shipwrecked on an island. The population of the island slowly grew for 20 years until a passing boat rescued the people. The population on the island can be modeled by the formula, $P = 200(1.1)^t$, where P is the number of years on the island and t is the years that they have been shipwrecked.
   a. Why is $0 \leq x \leq 20$ an appropriate x range for your window?
   b. What is an appropriate y range? How will ZOOMFit set a good range for you after you have put in the x range (we used this on the last worksheet)?
   c. How many people were originally shipwrecked? What time is this?
   d. What is the population after 5 years? 18 years?
   e. When is the population 300? When is it 1000?

Answers

1a. When $x = -7$, $y = -9$.
1b. y-int $= -16$. The y-int of the graph is the constant of the equation because all x terms becomes 0 (as we set $x = 0$ to find y-intercept).
1c. x-intercepts are -8 and 2. They are the same if we solve the equation by factoring.
1d. Minimum at coordinates $(-3, -25)$
1e. $x^2 + 6x - 16 \geq 0$ when $x \leq -8$ or $x \geq 2$.
1f. $x^2 + 6x - 16 < 0$ when $-8 < x < 2$.

2. $x = -3.80$, $x = -1.62$, $x = 2.43$
2a. Finding zeros of $y = x^3 + 3x^2 - 7x - 15$ is the same as solving the equation $x^3 + 3x^2 - 7x = 15$ because we essential let the equation equals to 0 and when $y = 0$, we are solving for the x-intercepts (or zeros of the graph).
2b. Letting $Y_1 = x^3 + 3x^2 - 7x$ and $Y_2 = 15$ will give intersecting points at $x = -3.80$, $x = -1.62$, $x = 2.43$.
2c. The relative minimum occurs at $(0.83, -18.17)$. As the graph goes infinitely towards negative y, moving towards the left, we can see there is no absolute minimum.
2d. $x^3 + 3x^2 - 7x - 15 < 0$ when $x < -3.80$ or $-1.62 < x < 2.43$

3a. It is because we cannot have negative time values and it is stated in the question that the population grew for 20 years. Hence, it is appropriate to set time to $0 \leq t \leq 20$.
3b. The ZOOMFit Function uses the range y: [200, 1345.49999, 1]. We can modify WINDOW by customizing the y range as y: [0, 1400, 100]
3c. There were originally 200 people shipwrecked. This can be found because when $t = 0$, $P = 200$.
3d. When $t = 5$ years, $P = 322$ people. When $t = 18$ years, $P = 1111$ people
3e. $P = 300$ people when $t = 4.26$ years. $P = 1000$ people when $t = 16.89$ years