Academic Support Center

Using the TI-83/84+ Graphing Calculator
PART II

Using the Graphing Calculator
(TI-83+ or TI-84+)

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Entering Linear Equations using ==Y=== key

To graph an equation on the TI-83 & TI-84, the equation must be in Y= form.
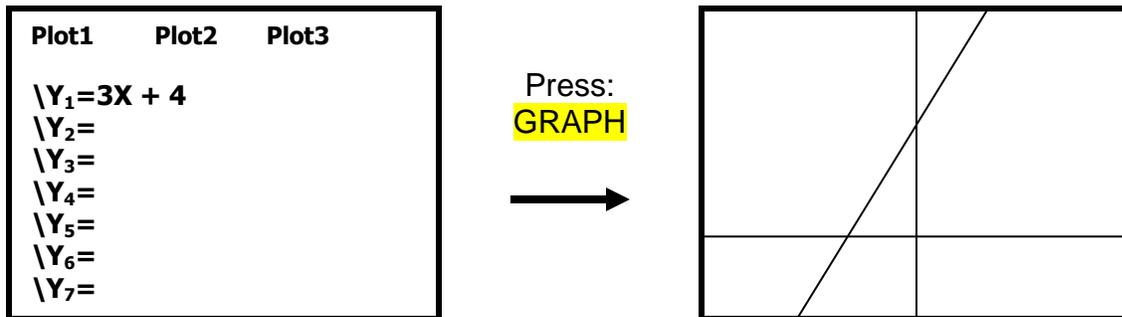Once the equation is in the proper form, the equation can be graphed easily.

EXAMPLE
   Graph y=3x+4 on your calculator

PRESS: ==Y===   and then enter equation.
PRESS: ==ZOOM==   ==6== (Standard)

…and then you'll have your graph!

<table>
<tr><td>

Plot1   **Plot2**   **Plot3**

$\backslash Y_1 = 3X + 4$
$\backslash Y_2 =$
$\backslash Y_3 =$
$\backslash Y_4 =$
$\backslash Y_5 =$
$\backslash Y_6 =$
$\backslash Y_7 =$

</td><td>

Press:
==GRAPH==

→

</td><td>

</td></tr>
</table>

EXAMPLE
   Graph 2x+4y= 8 on your calculator

Solving for Y produces the equation y= -½ x + 2, so that is what needs to be
entered on the Y= screen.

This may take some practice, but ultimately using the graphing utility will help you
greatly!

==WINDOW== and ==ZOOM==: what do they mean and how do I use them?

The ==WINDOW== key, allows you to zoom in and out on your graph. It's similar to a
camera lens. For convenience, there are several fixed ==ZOOM== functions, as well as
the ==WINDOW== key, which allows you to set your own X and Y parameters.

Press: WINDOW
Your screen should look like this →

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

This screen allows you to set maximum and minimum values on your axes. The *Xscl* and *Yscl* key sets the way the calculator counts each axis. The window above is set from [-10, 10] on the x-axis, counted off by 1 and the y-axis is set from [-10, 10], counted off by 1, which is known as the **standard window.** Press the GRAPH key to see the axes.

In order to see how the zoom functions manipulate the window, let's enter the equation $y=x^2 + 4x - 4$ into the calculator in the Y= screen.

ZOOM- Standard
PRESS: ZOOM 6
This sets your window from -10 to 10 on both the X and Y axis. Many of the graphs you encounter in this course will fit into this window.

ZOOM- In
Press: ZOOM   2   ENTER
If the graph is small and hard to see in the standard window, you may want to try to zoom in. This will shrink the window and make your graph seem bigger.

ZOOM- Out
Press: ZOOM   3   ENTER
If the graph is too large for the window, and you cannot see all that you're looking for, try zooming out. This will make the window larger, and the graph will appear smaller.

***__NOTE__: You can zoom in and out as many times as necessary to view your graph.

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Using the <mark>TRACE</mark> key to Evaluate

One way to evaluate a graph at a specific point is to use the <mark>TRACE</mark> key.
EXAMPLE
  Evaluate y=3x-8 for x = 2

PRESS: <mark>Y=</mark>
Enter the equation.

PRESS: <mark>ZOOM</mark> 6
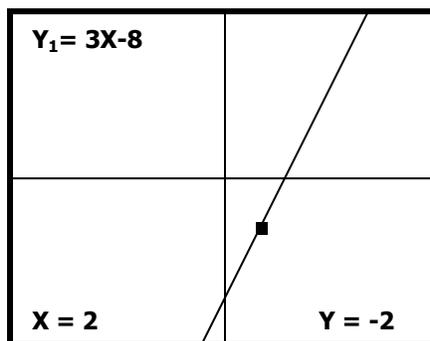View graph in standard window.

PRESS: <mark>TRACE</mark>
Enter the number you wish to evaluate for

PRESS: <mark>ENTER</mark>
The bottom of the screen will show the corresponding y value.

Your calculator should look like this:

$Y_1 = 3X-8$

X = 2   Y = -2

 So, at x = 2, y = -2 is the solution.

Solving Quadratic Equations using <mark>ZERO</mark> function

The graphing calculator allows us to solve quadratic equations without factoring!
In order to do this you must use the option called <mark>ZERO</mark> in the <mark>2</mark>[nd] <mark>TRACE</mark> Menu.

EXAMPLE
  Solve: $y = x^2 + 5x - 6$

PRESS: Y=
Enter the equation

PRESS: ZOOM   6
View the window, is it appropriate? If not, zoom in or out.

PRESS: 2nd   CALC (above TRACE)   2(for ZERO)

***This next step can get a little tricky, but with practice it will become more
   natural. Follow the parabola from left to right (just like you would draw it).

Use the ◄   and ►   keys to move the cursor through the graph.

***This just moves the cursor either left or right and does not have anything to do
   with the cursor being above or below the x-axis.

For Left Bound - Move the cursor to the left of the x-intercept point.
                Press ENTER
For Right Bound - Move the cursor to the right of the x-intercept point.
                Press ENTER
The calculator will now ask for a Guess - just press ENTER

Record the result. In this case it is (-6,0).

Now, we must repeat the steps for the 2nd intercept.

For Left Bound - Move the cursor to the left of the x-intercept point.
                Press ENTER
For Right Bound - Move the cursor to the right of the x-intercept point.
                Press ENTER
The calculator will now ask for a Guess - just press ENTER

Record the result. In this case it is (1,0).
So, the solutions are x= - 6 and 1

Solving Quadratic Equations using a ==TABLE==

Graph your function by using the appropriate window size by

zooming in ==ZOOM== ==2== ==ENTER== *or zooming out* ==ZOOM== ==3== ==ENTER==

Now set up your table by pressing ==2nd== followed by ==WINDOW==
(*Always choose the same value of X min. Tblstart = "value of x-min". Make sure ΔTbl=1)

Now press ==2nd== followed by ==GRAPH==

Under Y_1 scroll down until you get a value of **0**

The x value will be your first answer. Repeat these steps as many times as necessary to see all other x-intercepts on your graph.

EXAMPLE
Solve: $y = x^2 + 5x - 6$

PRESS: ==Y===
Enter the equation

PRESS: ==ZOOM== ==6==
View the window, is it appropriate? If not, zoom in or out.
From the graph you will know how many x-intercepts you have. In this example there are 2 x-intercepts, therefore you should have 2 answers.

PRESS: ==WINDOW==
Copy the value of Xmin
Xmin = -10

PRESS: ==2nd== ==WINDOW==
Set up the table:
TblStart = -10
ΔTbl=1

PRESS: ==2nd== ==GRAPH==

View the table. Under **Y₁** scroll down until you get a value of **0**, copy the X value which is X = -6. Since we have 2 solutions, therefore keep scrolling down under **Y₁** until you get to the second **0**, copy the X value which is X = 1.

So, the solutions are x= - 6 and 1
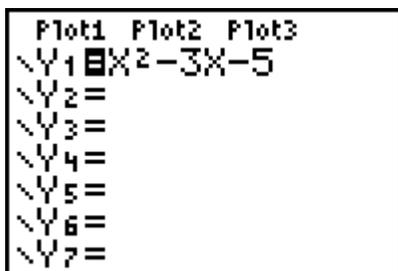
Maximum and Minimum value of a Quadratic Equation

In this section, you will be instructed step-by-step to find the maximum or the minimum point of a quadratic equation.
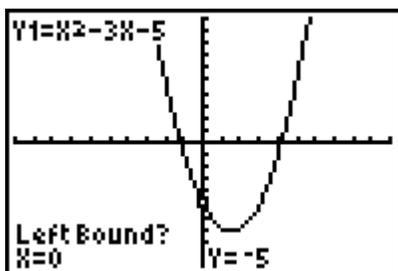
EXAMPLE

Determine the maximum or the minimum value of the function:
$f(x) = x^2 - 3x - 5$ and where it occurs.

1. PRESS: Y= and enter the equation into **Y₁**

```
Plot1  Plot2  Plot3
\Y1◻X2-3X-5
\Y2=
\Y3=
\Y4=
\Y5=
\Y6=
\Y7=
```

2. PRESS: GRAPH to see a full picture of the graph. Make sure that you see the turning point. If you can not see the turning point, zoom in or out.

```
Y1=X2-3X-5



Left Bound?
X=0              Y= -5
```

3. From the graph, find if there is a minimum value or a maximum value. If the graph is concave up(opens up), then there is a minimum value. If the graph

is concave down, then there is a maximum value. In this example, there is a minimum value. To find the minimum value:
PRESS 2nd Trace to activate the CALC menu.

```
CALCULATE
1:value
2:zero
3:minimum
4:maximum
5:intersect
6:dy/dx
7:∫f(x)dx
```
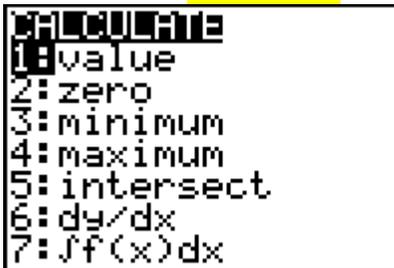
4. PRESS: **3** for **minimum**. If you have a maximum value, you have to PRESS: **4** for **maximum**.
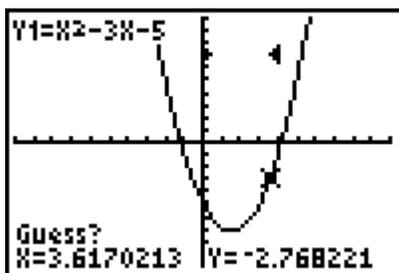
```
Y1=X²-3X-5




Left Bound?
X=0          Y=-5
```
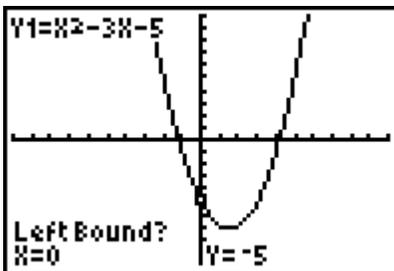
5. The calculator will say **Left Bound**? Use the arrow keys to move the cursor to any point left of the minimum point. Press the ENTER key.

```
Y1=X²-3X-5




Left Bound?
X=.42553191  Y=-6.095518
```
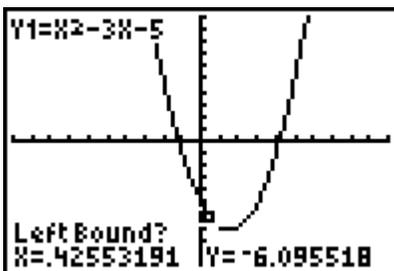
6. The calculator will say **Right Bound**? Move the cursor to any point to the right of the minimum point. Press the ENTER key.

```
Y1=X²-3X-5




Right Bound?
X=3.6170213  Y=-2.768221
```

9
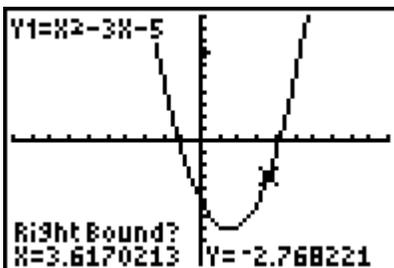
7. The calculator will say **Guess**? Press the <mark>ENTER</mark> key one last time.

```
Y1=X2-3X-5

           ◄

Guess?
X=3.6170213  Y=-2.768221
```

8. The coordinates of the minimum point are displayed at the bottom of the screen. In this example, the minimum value of Y is -7.25 and the minimum value occurs when X is 1.5.

```
Minimum
X=1.5         Y=-7.25
```
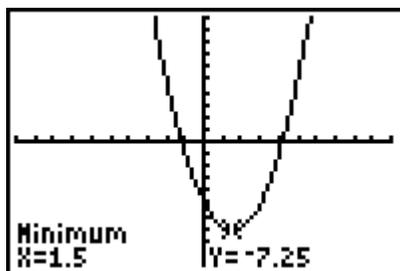
9. Your final answer is: X = 1.5   Y = -7.5, which means that there is a minimum value of -7.5 at x=1.5.

Solving Systems of Equations using INTERSECT

Your graphing calculator can be used to solve systems of equations, provided you first solve each equation for y. Their solution can then be calculated using the **INTERSECT** option in the **CALC** menu.

EXAMPLE

Solve the following system of equations:

Y=2x+6

2x+y=4

1. In order to solve this system, the second equation must be solved for y. Subtracting 2x from each side produces the equation y = -2x + 4.

2. PRESS: <mark>Y=</mark> and enter the first equation in Y_1 and the second in Y_2.

```
Plot1      Plot2      Plot3

\Y₁=2x + 6
\Y₂=-2x + 4
\Y₃=
\Y₄=
\Y₅=
\Y₆=
\Y₇=
```

3. PRESS: <mark>ZOOM</mark>   <mark>6</mark> and check to make sure you have an appropriate window.
4. To find the solution, PRESS: <mark>2ⁿᵈ</mark>   <mark>CALC</mark>   <mark>5</mark> (INTERSECT)
5. The calculator will say *first curve?* Move the cursor until it is on top of the intersection point. PRESS: <mark>ENTER</mark>
6. The calculator will say *second curve?* Move the cursor until it is on top of the intersection point. PRESS: <mark>ENTER</mark>
7. PRESS: <mark>ENTER</mark> when the calculator says *guess?*
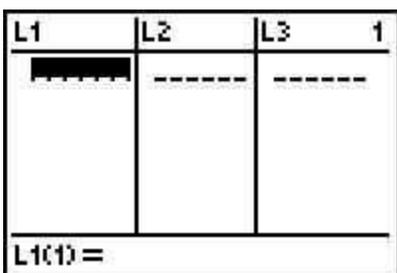8. Record the intersection point. In this case it is $(-^1/_2, 5)$.

```
Intersection
X=-.5              Y=5
```
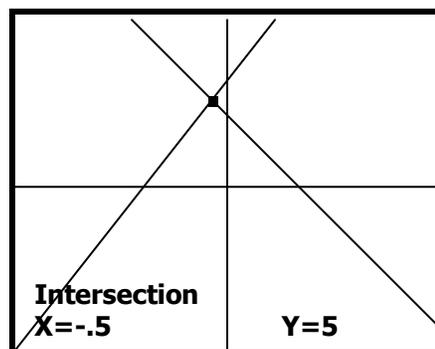
Plotting Points

1. PRESS STAT

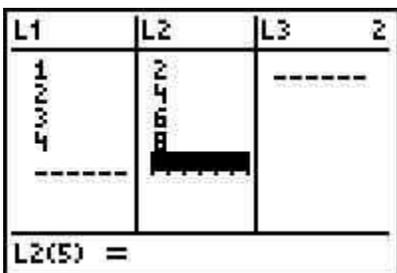2. PRESS: ENTER or 1 to see the EDIT screen

3. If there is data, clear it by highlighting **L1**, Press CLEAR and hit ENTER. Repeat this step to clear all the data in the other lists.

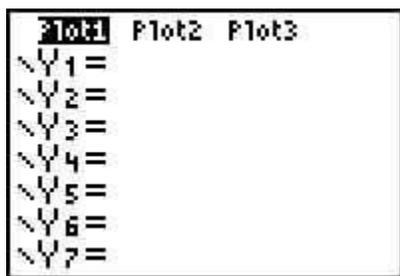****Do not press* DEL.

4. ENTER: x-values in **L1** and y-values in **L2**. Make sure to press ENTER after each number.
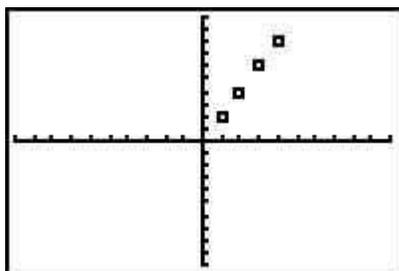

5. PRESS: Y=

6. HIGHLIGHT: **Plot1** and Press ENTER. Make sure that **Plot1** is highlighted.

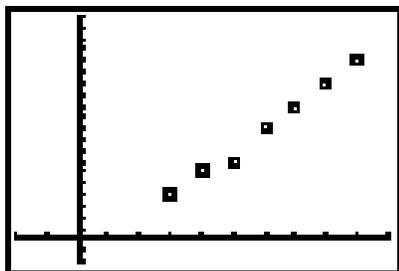7. PRESS: ZOOM **9**, the window will display all the points that you entered.

_ _ .. _ _ .. _ _ _ .. _ _ _ .. _ _ _ .. _ _ _ .. _ _ .. _ _

Linear Regression

1. Enter data into **L1** and **L2**. (See previous section: Plotting points).

2. PRESS: STAT and highlight CALC by moving the cursor to the right.

```
EDIT CALC TESTS
1:1-Var Stats
2:2-Var Stats
3:Med-Med
4:LinReg(ax+b)
5:QuadReg
6:CubicReg
7↓QuartReg
```

3. CHOOSE: **4:LinReg(ax+b)** and hit ENTER to find the best fit line equation for the data points that you entered.

```
LinReg(ax+b) ▮
```
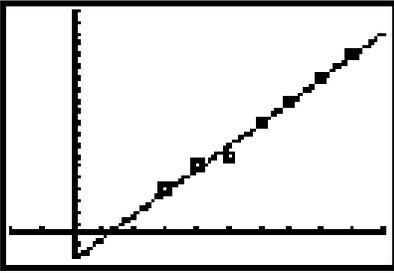
4. PRESS: ENTER again to have your line equation.

```
LinReg
 y=ax+b
 a=2.035714286
 b=-2.357142857
 r²=.9929706601
 r=.9964791318
```

The Line equation is **y = 2.035714286x – 2.357142857** which is in the form **y = ax+b**

5. To copy the model equation into Y= so that you could graph the equation, GO TO: Y= and clear **Y₁**.

6. PRESS: **VARS** key

7. PRESS: **5:Statistics**

8. Move the cursor to the right to highlight **EQ.**

9. PRESS: <mark>ENTER</mark> and the model is placed into Y_1.

10. PRESS: GRAPH to see the graph of your model with the data points.

- -

Trigonometry: Converting Angles

The calculator can convert angles in Degree, Minutes, and Seconds (D°M'S") notation to decimal degree form and vice-versa.

Converting from (D°M'S") Notation to Decimal Degree Form:
EXAMPLE
Convert 5°42'30" to decimal degree form.

1. PRESS: MODE. Make sure that **Degree** is highlighted. If not highlighted, move to Degree and press ENTER.
2. Return to the main screen. Enter the number of degrees first, in this case 5. Then PRESS 2nd APPS (ANGLE) and PRESS **1** for the degrees symbol.

5°

3. Enter the amount of minutes next, 42 in this example. Then PRESS 2nd APPS (ANGLE) and PRESS 2 for the minutes symbol.

```
5°42′
```

4. Enter the amount of seconds next, in this example, 30. Then Press ALPHA and Press + (the addition sign) for the seconds symbol.

```
5°42′ 30″
```

5. PRESS ENTER.

```
5°42′ 30″
                5.708333333
```
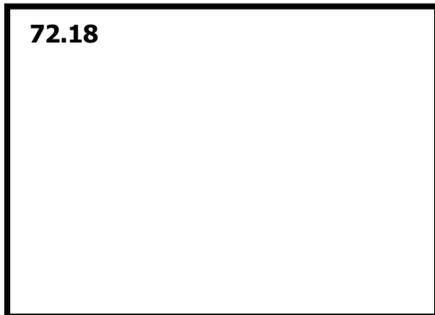
6. Round to the nearest hundredth of a degree. Your Answer is: 5°42'30"= 5.71°.

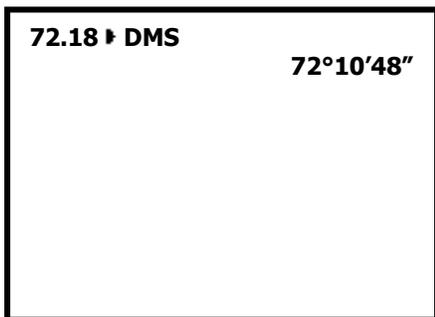**Converting Decimal Degree From to (D°M'S") Notation:**
EXAMPLE
Convert 72.18° to D°M'S" notation.

1. PRESS: <mark>MODE</mark>. Make sure that **Degree** is highlighted. If not highlighted, move to Degree and press <mark>ENTER</mark>.

2. To convert decimal degree form to D°M'S" form, we enter 72.18 into the main screen.

```
72.18
```

3. PRESS <mark>2nd</mark> <mark>APPS</mark> (ANGLE) and PRESS **4** for DMS. Then PRESS <mark>ENTER</mark>.

```
72.18 ▶ DMS
                72°10'48"
```

4. Your Final Answer is: 72.18°= 72°10'48"