

Inequality Graphing for the TI-83 Plus

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- Shade the inequality intersection or union

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What is Inequality Graphing?

The Inequality Graphing application for the TI-83 Plus gives you new features for graphing equations and inequalities and evaluating the relationship between them. Using the Inequality Graphing application, you can

- enter inequalities using relation symbols
- graph inequalities and shade the union and intersection regions
- enter inequalities (vertical lines only) in an X=editor
- trace points of interest (such as intersections) between relations
- store (x,y) coordinate pairs to lists for viewing and optimizing functions for linear programming

Inequality Graphing is available in two different versions, English only and international. The international version contains the English version and also supports Dutch, French, German, Portuguese, and Spanish. To run Inequality Graphing in a language other than English, you must have the corresponding language localization application installed and running on your calculator. Language localization applications are available for download free of charge in TI's online store at epsstore.ti.com.

Where to Find Installation Instructions

You can find detailed instructions on installing Flash applications at education.ti.com/guides.

Getting Started

Getting Started is a fast-paced introduction that shows you some of the Inequality Graphing application's features.

Maximize profit, $P = 3X + 2Y$, for quantities of two products, X and Y , given the following constraints on materials and time:

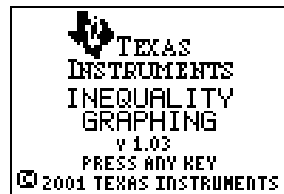
$$X \geq 0, Y \geq 0$$

$$Y + X \leq 10$$

$$3X + Y \leq 15$$

1. Press **[APPS]** to display the list of applications on your calculator.
2. Select **Inequal** (or **Inequalz** in the international version).

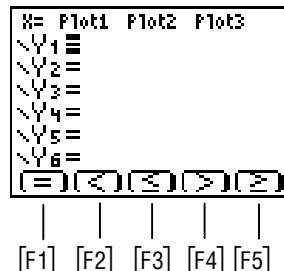
The Inequality Graphing splash screen is displayed.



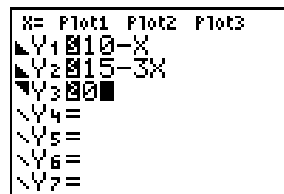
- Press any key. The **Y= Editor** screen is displayed.

Note that placing the cursor on = for any Y-variable displays the new relation symbols at the bottom of the screen.

Press **[ALPHA]** plus **[F1]** – **[F5]** to insert a relation symbol.



- Press **[ALPHA]** **[F3]** to select $\leq$.
- Move the cursor to the right of the relation symbol.
- Press **[1]** **[0]** **[=]** **[X,T,θ,n]** to store $10-x$ to **Y₁**.
- Enter the relations for **Y₂** and **Y₃**, as shown.



8. Move the cursor to **X=** (in the top left corner).

9. Press **ENTER** to access the X=editor.

10. Press **ALPHA** [F5] to select $\geq$.

11. Press **0** to store the value to **X₁**.

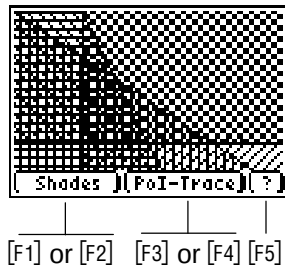
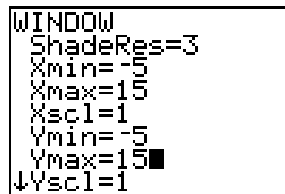
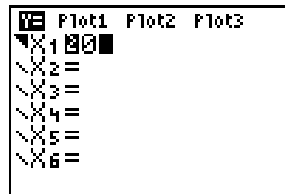
12. Press **WINDOW** to set up the graphing window.

13. Change the **Xmin**, **Xmax**, **Ymin**, and **Ymax** settings as shown.

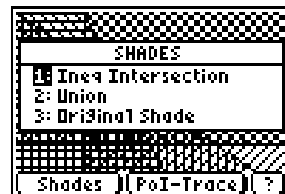
14. Press **GRAPH** to graph the selected **X_n** and **Y_n** variables.

Shades, Pol-Trace and ? (help) options display when the graph is drawn.

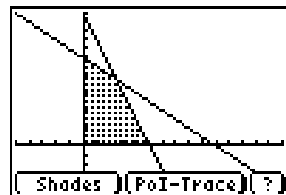
Press **ALPHA** plus [F1] – [F5] to select an option.



15. Press **[ALPHA]** **[F1]** to display the SHADES menu.

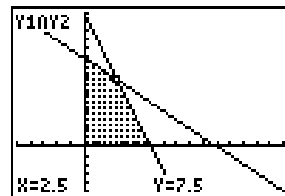


16. Select **1:Ineq Intersection**.
Inequality Graphing draws the graph again, shading the intersection region of the inequalities.



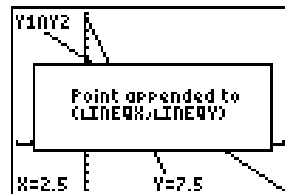
17. Press **[ALPHA]** **[F3]** to select the PoI-Trace option. The first point of interest is displayed.

The coordinates of the point of interest are displayed at the bottom of the screen. The X-variables and Y-variables that are a part of the intersection are displayed in the top left corner (in this case **Y₁** and **Y₂**).



Press **[↑]** or **[↓]** to move from one **X_n** or **Y_n** to the next. Press **[→]** or **[←]** to move from one point to another along the same **X_n** or **Y_n**.

18. Press **[STO▶]** to append the coordinates for the point at your cursor position to the lists **LINEQX** (x-coordinate) and **LINEQY** (y-coordinate).



19. Press any key to continue.
20. Find and store the remaining points that bound the shaded region.
21. Press **[STAT]**.
22. From the Edit menu, select **1:Edit**.

LINEQX	LINEQY	----- ?
2.5	7.5	
0	0	
0	10	
5	0	
-----	-----	
LINEQX()=2.5		

23. Insert a new list named PRFT.

24. Add the formula for maximum profit,
"3 * LINEQX + 2 * LINEQY":

Press **[ALPHA]** **["]** **[3]** **[x]** **[2nd]** **[LIST]**.

Scroll to LINEQX.

Press **[ENTER]** to select it.

Press **[+]** **[2]** **[x]** **[2nd]** **[LIST]**.

Scroll to LINEQY.

Press **[ENTER]** to select it.

Press **[ALPHA]** **["]**.

The highest value in PRFT provides the
corresponding x (**LINEQX**) and y (**LINEQY**)
values to maximize the profit.

LINEQX	LINEQY	PRFT	#
2.5	7.5	-----	
0	0		
0	10		
5	0		
-----	-----		
PRFT="3*LINEQX+2...			

LINEQX	LINEQY	PRFT	#
2.5	7.5	22.5	9
0	0	0	
0	10	20	
5	0	15	
-----	-----	-----	
PRFT(1) =22.5			

Starting and Quitting the Inequality Graphing Application

Note

To select a menu option, press the number or letter corresponding to the option or press  to highlight the option, then press **ENTER**.

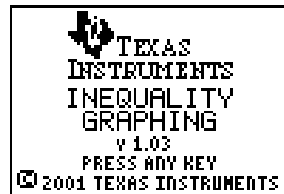
The Inequality Graphing application works only in function mode. If your calculator is not in function mode, the application changes the mode.

To run the Inequality Graphing application efficiently, your calculator should have at least 600 bytes of free RAM.

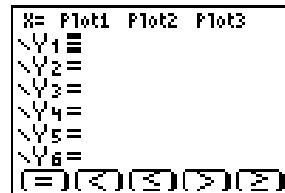
Note

Quitting the application does not delete it from your calculator. To delete the application, see [Deleting Inequality Graphing from the TI-83 Plus](#).

1. Press **APPS** to display the list of applications on your calculator.
2. Select **Inequal** (or **Inequalz** in the international version). The Inequality Graphing information screen is displayed.



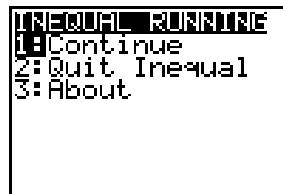
3. Press any key. The **Y= Editor** screen is displayed with the cursor on the = for **Y₁**.



If the Inequality Graphing application is already running on your calculator, the above screens will not be displayed when you select **Inequal** (or **Inequalz** in the international version) from the **Applications** menu. Instead, the following screen is displayed, giving you options to quit the application or to continue (leave it running).

Select one of the following options:

Choose	To
1:Continue	Leave the Inequality Graphing application active
2:Quit Inequal	Deactivate the Inequality Graphing application
3:About	View the About screen that displays the application name and version number



A Word About AppVars

The Inequality Graphing application creates two application variables (AppVars) when you run it. These AppVars are used to store data specific to this application and to make graphing faster.

- INEQVAR requires 237 bytes of free RAM. The Inequality Graphing application requires INEQVAR to function correctly. If your calculator does not have at least 237 bytes of free RAM, you cannot run the Inequality Graphing application.
- POILIST requires 317 bytes of free RAM. The Inequality Graphing application does not require POILIST to function correctly. However, if your calculator does not have an additional 317 bytes of free RAM so that POILIST can be created, performance will be much slower.

INEQVAR and POILIST are automatically deleted from the calculator's memory when you quit Inequality Graphing normally (from the Quit menu option). If Inequality Graphing is forced to quit by the system, (for example, if you delete the application manually, or if you transfer files while the application is running and the calculator is defragmented) the AppVars remain on the calculator, but are no longer active.

Y= Editor and X= Editor

When you place the cursor over the equality symbol on the Y= editor, you immediately see some of the features the Inequality Graphing application offers. A set of relation options is displayed across the bottom of the screen. You can use any inequality symbol ($>$, $<$, $\geq$, $\leq$) as well as the equality symbol. *(These options are displayed only when the cursor is over the relation symbol.)*

The Inequality Graphing application has an X=editor to complement the Y=editor. You access it from the Y=editor and you can move between the two editors as much as you like. A highlighted X= or Y= in the top left corner of the screen reminds you that you defined and selected equations or inequalities on the other editor.

On the X= editor, an expression must evaluate to a real number. You can use any constant function of X to define vertical lines, whether they are equations or inequalities.

Relation Symbols

To change a relation symbol, place the cursor on the symbol for that Y_n or X_n and use the keystrokes below to select the appropriate symbol.

Relation Symbol	Keystrokes
	<code>[ALPHA] [F1]</code>
	<code>[ALPHA] [F2]</code>
	<code>[ALPHA] [F3]</code>
	<code>[ALPHA] [F4]</code>
	<code>[ALPHA] [F5]</code>

Graph Styles

In the Y=editor, the graph style for inequalities corresponds to the inequality and automatically changes when you select the symbol. You cannot change this graph style. The graph style for equations remains unchanged. You can change the graph style to one of the seven standard TI-83 Plus options: $\setminus$, ∇ , ∇ , $\sqcup$, $\emptyset$, $\emptyset$, or $\cdot$.

In the X=editor, all graph styles are automatically selected and cannot be changed. Inequalities have a graph style that corresponds to the inequality; equations have the thin line graph style (↖).

Note When you quit the Inequality Graphing application normally, all inequality graph styles are changed to the thin line graph style (↖).

Inequality Graph Style	Relation Symbol	Definition	Result
	$<$	Less than	Graph is shaded below the line, but the line is not included in the solution, so it appears “dotted”
	$\leq$	Less than or equal to	Graph is shaded below the line and the line is included in the solution
	$>$	Greater than	Graph is shaded above the line, but the line is not included in the solution, so it appears “dotted”
	$\geq$	Greater than or equal to	Graph is shaded above the line and the line is included in the solution

Defining an Inequality or Equation

To define an inequality or equation in the Y=editor or X=editor, select the relation symbol, move the cursor to the right, and enter the inequality or equation. You do not have to change the relation symbol *before* you type the inequality or equation.

*Notice that when a Y_n or X_n is defined, it is automatically selected to be included in the graph. To select or deselect a Y_n or X_n , place the cursor on the relation symbol and press **ENTER**.*

Example: Define the following in the Y= editor:

$$Y_1 \leq 2X + 4$$

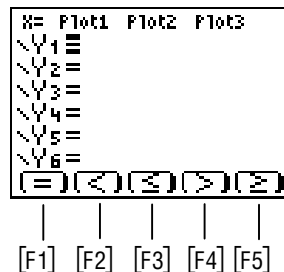
$$Y_2 \geq -5X$$

$$Y_3 > 0$$

1. Place the cursor on the = symbol for Y_1 .

The cursor is automatically placed over the = symbol for Y_1 when you first access the Y= editor. The relation symbol displays only when the cursor is on a relation symbol.

Press **ALPHA** plus [F1] – [F5] to insert a relation symbol.



2. Press $\boxed{\text{ALPHA}} \boxed{[F3]}$ to change $=$ to $\leq$.
3. Move the cursor to the right of the relation symbol.
4. Press $\boxed{2} \boxed{X,T,\theta,n} \boxed{+} \boxed{4}$ to store $2x+4$ to Y_1 .
5. Move the cursor to the next Y-variable and enter the remaining inequalities, as shown.

```

X= Plot1 Plot2 Plot3
Y1 2X+4
Y2 -5X
Y3 0
Y4 =
Y5 =
Y6 =
Y7 =

```

Example: Define the following in the X=editor:
 $x_1 \geq 0$

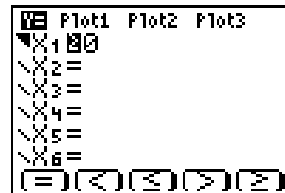
1. Move the cursor to the $X=$ symbol in the top left corner of the screen.

```

X= Plot1 Plot2 Plot3
Y1 2X+4
Y2 -5X
Y3 0
Y4 =
Y5 =
Y6 =
Y7 =

```

2. Press **ENTER** to display the X=editor screen. The cursor is automatically placed on the = symbol for X_1 .
3. Press **ALPHA** **[F5]** to change = to $\geq$.
4. Move the cursor to the right of the relation symbol.
5. Press **0** to store the value to X_1 .



Graphing

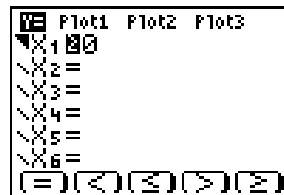
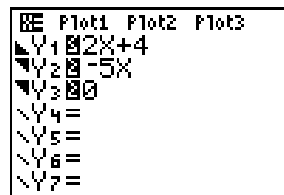
The Inequality Graphing application graphs the selected inequalities and/or equations from the Y=editor first, then it graphs the selected inequalities and/or equations from the X=editor. When the graphs are displayed, three options appear at the bottom of the screen: **Shades**, **Pol-Trace**, and **? (Help)**. These options are additional features of the Inequality Graphing application and are discussed later in this section.

Note

WINDOW, **TRACE**, **ZOOM**, and **2nd** **[CALC]** work the same in Inequality Graphing as in normal graphing.

1. Check the Y=editor and the X=editor to be sure that the relations you want to include on the graph are selected.

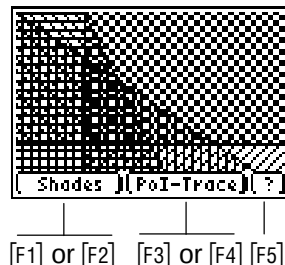
Place the cursor on the relation symbol and press **ENTER** to select or deselect a **Y_n** or **X_n**.



- Press **[GRAPH]** to graph the selected relations.

Shades, Pol-Trace and ? (help) options display when the graph is drawn.

Press **[ALPHA]** plus **[F1]** – **[F5]** to select an option.



Shading the Inequality Intersection or Union

Now that the selected inequalities and/or equations are graphed, you can further view their relationship to each other by displaying their inequality intersection or union. The graphs of all of the relations remain on the screen and their intersection or union regions are shaded.

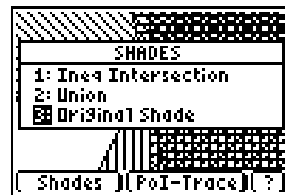
The new graph is not intended to exactly represent the intersection or union solution, but to help you visualize the solution.

If you have selected a graph style for a Y-variable on the Y=editor (when the relation symbol is =), it may not be displayed when you graph the intersection or union of the relations. The following table shows what happens to each of the graph styles.

Graph style	Definition	What happens when you graph intersection and union
	Thin line	Unchanged
	Thick line	Converted to thin line
	Shade below	Converted to thin line and warning message displayed: Above or Below not supported
	Shade above	Converted to thin line and warning message displayed: Above or Below not supported
	Trace	Unchanged
	Trace with trailing line	Unchanged
	Dotted line	Unchanged

1. Press **[ALPHA]** **[F1]** to display the Shades menu.

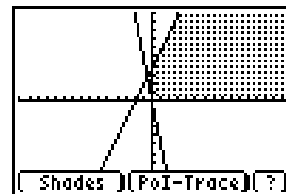
The default option selected in this menu corresponds to the type of shading that was displayed before you selected the Shades feature.



2. The following graphing options are available:

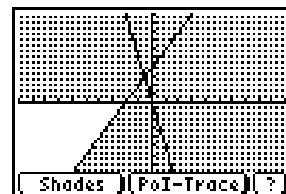
**1:Ineq
Intersection**

Shades the intersection of the selected inequalities



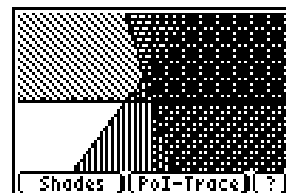
2:Union

Shades the union of the selected inequalities and/or equations



**3:Original
Shade**

Displays the original graph of all of the selected inequalities and/or equations



Note

You can pause/resume or stop drawing the graph at any time:

Press **[ENTER]** to pause/resume drawing.

Press **[ON]** to stop drawing.

Press **[GRAPH]** to redraw the graph..

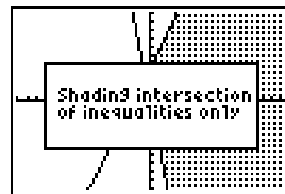
Note

When Shades, Pol-Trace, and ? (Help) are displayed on the screen, you can hide them and display them again:

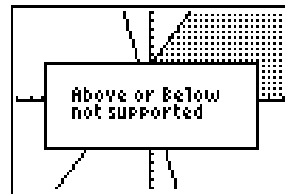
Press **ENTER** to hide the options.

Press **GRAPH** to display the options.

When you shade the intersection of a graph that includes both inequalities and equations, a dialog box displays to remind you that the application is only shading the intersections of the inequalities.

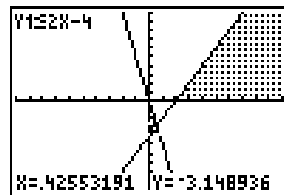


If you graph an equation with the shade style set to shade above (▴) or below (▾) the equation, the shading will not be displayed when you shade the inequality intersection or union. Use the relation symbols ($<$, $\leq$, $>$, $\geq$) to ensure that all inequalities are shaded properly.



Exploring Graphs with TRACE

You can use the TI-83 Plus **TRACE** feature to move the cursor from one plotted point to the next along a relation. Because the Inequality Graphing application is running, the Y_n displayed in the top left corner includes the relation symbol.



See section 3–18 in the TI-83 Plus guidebook education.ti.com/guides for detailed information about the **TRACE** feature.

Exploring Graphs with Pol-Trace (Point of Interest Trace)

When you select Pol-Trace, the Inequality Graphing application displays the points of interest (“intersections” of all lines, dotted or solid). Use the arrow keys to move from one Y_n or X_n to another and from one point of interest to another on the same Y_n or X_n as detailed below. *If an X-coordinate lies outside of the window range (Xmin and Xmax), that point of interest will not be found.*

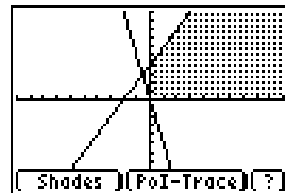
The **X** and **Y** coordinates for the intersection are displayed at the bottom of the screen. The **X_n** and **Y_n** values for the intersection are displayed in the top left corner. The intersection symbol is used when both relations are represented by solid lines (i.e., **Y1 $\cap$ Y2**). For points of interest where the relation is represented by a dotted line, the **X_n** and **Y_n** values are separated by a comma (i.e., **Y1, Y2**).

The Pol-Trace feature was designed for linear functions. It may not find all points of interest for non-linear functions. See [Exploring Non-linear Functions](#) to learn how to find these points of interest.

Note

If one or more Y-variables contains a list, you will not be able to trace points of interest for the graph.

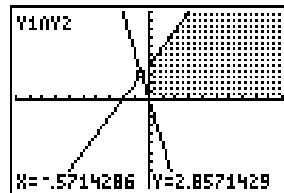
Press **[ALPHA]** **[F3]** to trace points of interest.
The first point of interest is displayed.



Note

At any time, you can press **[ON]** to stop the solver.

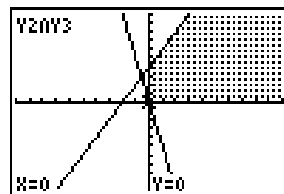
The X and Y coordinates are displayed at the bottom of the screen. The top left corner shows that the point lies at the intersection of Y_1 and Y_2 .



1. Press $\blacktriangleright$ or $\blacktriangleleft$ to move to the next point of interest on the same Y_n or X_n .

—or—

Press $\blacktriangleup$ or $\blacktriangledown$ to move to a point of interest on another Y_n or X_n .



Press $\boxed{\text{CLEAR}}$ to exit the Pol-Trace mode.

Exploring Non-linear Functions with Pol-Trace

When a non-linear function intersects another function or relation, only one point of interest can be calculated. If that point is not the one you want, you can find the other point using one of the following methods.

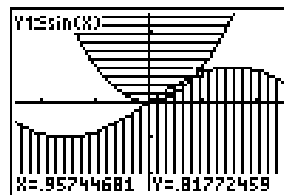
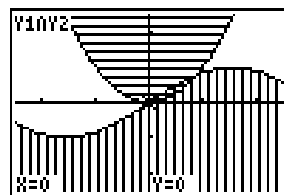
The following examples use these relations:

$$Y_1 \leq \sin x$$

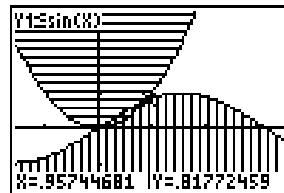
$$Y_2 \geq x^2$$

Method 1

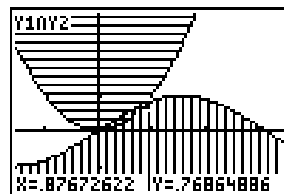
1. Press **[ALPHA]** **[F3]** to activate the Pol-Trace mode. Coordinates for the first point of interest are displayed.
2. Press **[TRACE]**. You are no longer in Pol-Trace mode.
3. Move the cursor close to the other point of interest.



- Press **[ENTER]**. The window shifts and the graph is redrawn.

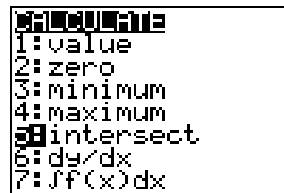
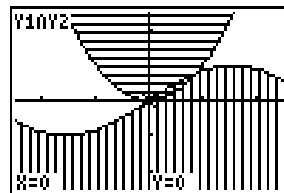


- Press **[ALPHA]** **[F4]** to return to Pol-Trace mode. The exact coordinates of the point of interest are displayed.



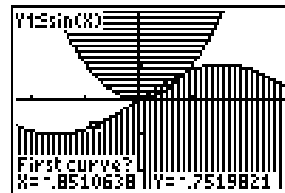
Method 2

- Press **[ALPHA]** **[F3]** to activate the Pol-Trace mode. Coordinates for the point of interest are displayed.
- Press **[2nd]** **[CALC]** to display the **CALCULATE** screen.
- Select **5:intersect**.

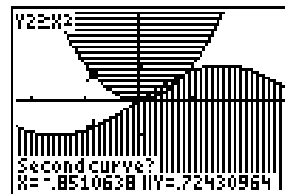


4. The cursor moves to a point on one of the curves and displays **First curve?** If want to find an intersection point on this curve, press **ENTER**.

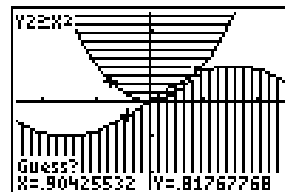
If you do not want to find an intersection point on this curve, move the cursor to the correct curve and press **ENTER**.



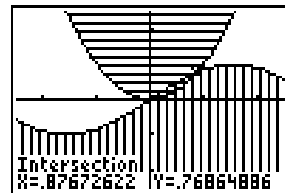
5. Repeat step 3 for the second curve.



6. Now the screen displays **Guess?** Move the cursor as close to the intersection point as you can and press **ENTER**.



The exact intersection point that is closest to where you placed the cursor is displayed.



Graph of intersection (zoomed in)



Storing Coordinates of Points

You can store coordinates of points to lists so that you can use them in evaluations. The points are automatically stored in **LINEQX** (for x-values) and **LINEQY** (for y-values). If these lists already exist, new values are appended to the existing lists. (As explained later in this section, you can press **[ALPHA]** **[CLEAR]** to clear all values from **LINEQX** and **LINEQY**.)

LINEQX and **LINEQY** are placed in the calculator's list editor, unless the list editor is full.

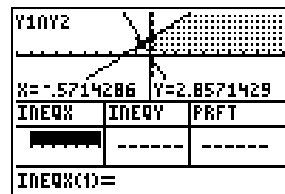
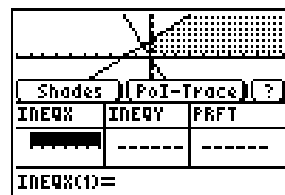
Storing points is not limited to the Pol-Trace mode or to points of interest. If you can see the cursor on the screen, you can store any point. You can also manually add values to **LINEQX** and **LINEQY**, although there is one specific limitation: *both lists must contain only real numbers*.

Both lists must contain the same number of elements for Inequality Graphing to store points to them.

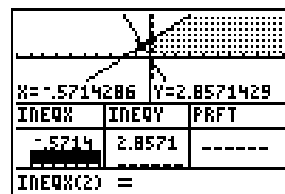
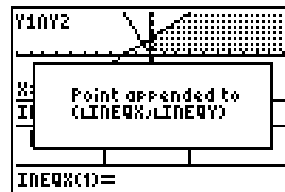
The following example shows both the graph and the stat list editor. The calculator mode is set to **Horiz** (horizontal split screen).

1. Press **[ALPHA]** **[F3]** to select Pol-Trace.

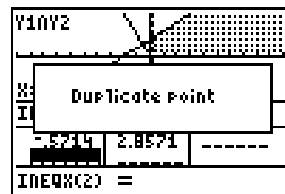
The first point found is displayed.



- Press **STO►** to store the coordinates to **LINEQX** and **LINEQY**.

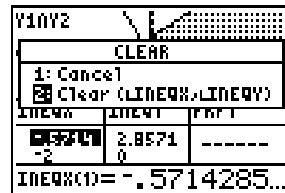


If (**LINEQX**, **LINEQY**) already contains the point you want to store, a message displays. Press any key to clear the message.



To clear all elements from **LINEQX** and **LINEQY**

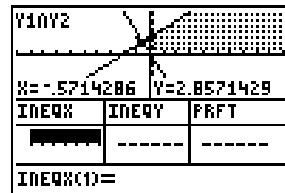
- Press **ALPHA** **CLEAR**.
- Select 2: Clear (**LINEQX**, **LINEQY**).



Pressing **[ALPHA]** **[CLEAR]** changes the lists in the following ways:

- Changes them to real lists if they previously contained complex numbers
- Detaches any formulas attached to the lists

Pressing **[ALPHA]** **[CLEAR]** does not delete the lists from the calculator, but deletes all of the elements in the lists.



Getting Help

The Inequality Graphing application has a help feature for the graph mode. This help feature is only displayed on the graphed screen.

1. Press **[ALPHA]** **[F5]** to select ? (help)
2. The following help options are available:

Pressing

[STOP]

Does This

Appends the point of interest coordinates to the list pair (INEQX, INEQY)

[ALPHA] **[CLEAR]**

Clears all elements in the list pair (INEQX, INEQY)

[ALPHA] **[F1]**

—or—

[ALPHA] **[F2]**

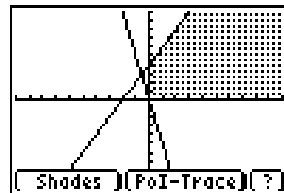
Displays the SHADES dialog box

[ALPHA] **[F3]**

—or—

[ALPHA] **[F4]**

Accesses the point of interest trace mode



STOP APPENDS(X,Y) to list pair (LINEQX,LINEQY)

ALPHA ADD:
CLEAR Clears list pair (LINEQX,LINEQY),
F1,F2 Shades options,
F3,F4 Traces Points of Interest

Window Settings

The Inequality Graphing application adds a new shading resolution variable to the Window settings called ShadeRes.

ShadeRes determines how far apart the shading lines are when the graph is drawn. Valid values are 3–8, with 3 making the shading lines closest together and 8 making them farthest apart. The default value for ShadeRes is 3.

```
WINDOW
ShadeRes=3
Xmin=-5
Xmax=15
Xscl=1
Ymin=-5
Ymax=15
↓Yscl=1
```

FnOn (Function On) and FnOff (Function Off) Commands

You can select or deselect all X-variables and Y-variables using the **FnOn** or **FnOff** command:

1. Press **[2nd]** **[CATALOG]**.
2. Select **FnOn** to select all X-variables and Y-variables.
—or—
Select **FnOff** to deselect X-variables and Y-variables.

You can also select or deselect individual Y-variables (you cannot select or deselect individual X-variables):

1. Press **[2nd]** **[CATALOG]**.
2. Select **FnOn** or **FnOff**.
3. Press **[VARS]**.
4. Select Y-VARS.
5. Select **1: Function**.
6. Select the Y-variable to turn on.
7. Press **[ENTER]**.

System Integration

The Inequality Graphing application is integrated in to the system except in the following situation:

When you access the Y-variables from outside the Y=editor, such as in the table editor or the home screen, they are treated as equations rather than inequalities.

Example:

In the Inequality Graphing application Y=editor,

$$Y_1 \geq 2X+4$$

On the home screen,

$$3 * Y_1 = 72$$

(where $x=10$ due to the default **Xmax** Window setting)

Deleting Inequality Graphing from the TI-83 Plus

To delete the application from your calculator:

1. Press $\boxed{2\text{nd}}$ $\boxed{[\text{MEM}]}$.
2. Select **2:Mem Mgmt/Del...**
3. Use $\boxed{\nabla}$ or $\boxed{\blacktriangle}$ to select **A:Apps...**
4. Use $\boxed{\nabla}$ or $\boxed{\blacktriangle}$ to select **Inequal**.
5. Press $\boxed{\text{DEL}}$.
6. Select **2:Yes**.
7. Press $\boxed{2\text{nd}}$ $\boxed{[\text{QUIT}]}$ to defragment the calculator.
8. Press $\boxed{2\text{nd}}$ $\boxed{[\text{MEM}]}$.
9. Select **2:Mem Mgmt/Del...**
10. Use $\boxed{\nabla}$ or $\boxed{\blacktriangle}$ to select **B:AppVars...**
11. Use $\boxed{\nabla}$ or $\boxed{\blacktriangle}$ to select **INEQVAR**.
12. Press $\boxed{\text{DEL}}$.
13. Use $\boxed{\nabla}$ or $\boxed{\blacktriangle}$ to select **POILIST**.
14. Press $\boxed{\text{DEL}}$.

Inequality Graphing Warning and Error Messages

Inequality Graphing Warning Messages

Message	Description
Duplicate point	You have selected coordinates to store to LINEQX and LINEQY that have already been stored.
List Editor full	The list editor already contains the maximum of 20 lists. LINEQX and LINEQY will be stored on your calculator, but will not appear in the list editor.
List mismatch	LINEQX and LINEQY contain different numbers of elements. Select one of the following options: 1:Cancel STO► to cancel storing the points. 2:Clear (INEQX , INEQY to delete all elements from LINEQX and LINEQY and store the selected point coordinates.
(LINEQX , LINEQY) must be real lists	LINEQX or LINEQY (or both) are complex lists. Press [ALPHA] [CLEAR] to clear the lists so that you can store the selected point coordinates.
(LINEQX , LINEQY) already full	The lists LINEQX and LINEQY contain 999 elements. Delete some elements or clear the lists so that you can store the selected point coordinates.

Message	Description
No points found in this window	One of the following situations exist: • There are no points of interest (“intersection” points) at all. • The points of interest exist outside of the current window. Press WINDOW and change Xmin and/or Xmax to change the current window. • The solver is not able to find the points of interest for non-linear relations. See Exploring Non-linear Functions with Pol-Trace for details on how to find these points of interest.
Pol not available for lists	The Pol-Trace feature is not available when one or more of the Y-variables contains a list.
Shading intersection of inequalities only	One or more of the selected X-variables and Y-variables is an equation. The Inequality Graphing application shows the intersections of the inequalities even though equations are graphed.
Need at least two inequalities	At least two inequalities must be defined and selected in order to shade the inequality intersection.
Need at least two relations	At least two relations (equations or inequalities) must be defined and selected to shade the union.

Inequality Graphing Error Messages

Message	Description
ERR: MEMORY 600 Bytes Free RAM Needed 1: Quit Inequal	The calculator does not have enough free RAM to create the INEQVAR AppVar. Delete some items to free at least 600 bytes of RAM.
Conflicting APPS 1: Quit Inequal 2: Quit Apps listed below	One or more applications that are currently running use the same resources as the Inequality Graphing application. To run the Inequality Graphing application, you must quit the conflicting application(s).
ERR: INEQVAR 1:Overwrite 2:Quit Inequal	An AppVar named INEQVAR already exists, but it is not related to this application. Select one of the following options: 1:Overwrite to overwrite the current AppVar. 2:Quit Inequal to quit the application. Inequality Graphing will not run without the correct version of INEQVAR. You must either rename the existing AppVar or let Inequality Graphing overwrite it.
ERR: Data Type 1: Quit 2: Goto	An X-variable (in the X=editor) evaluates to a number that is not real. Select one of the following options: 1: Quit to restore the previous value for that X-variable. 2: Goto to change the X-variable so that it evaluates to a real number.

Message	Description
ERR: Divide by 0 1:Quit 2:Goto	You have entered an expression on the Y=Editor or X=Editor that is divided by zero. Select one of the following options: 1:Quit to restore the previous value for that X-variable. 2:Goto to change the expression so that it evaluates to a real number.

Error Recovery Instructions

Low Battery Condition

Do not attempt a Flash download if the low-battery message appears on the calculator. Low battery indication is shown on the initial screen. If you receive this error during an installation, change the batteries before trying again.

Archive Full

This error occurs when the TI-83 Plus does not have sufficient memory to store the application. You must delete an application and/or archived variables from the TI-83 Plus in order to make room for another application. You can back up an application to your computer by using the **Link > Receive Flash Software** menu in TI-GGRAPH LINK™ for the TI-83 Plus. Once saved, you can reload it to the TI-83 Plus later using the **Link > Send Flash Software** menu in TI-GGRAPH LINK.

Communication Error

This error indicates the Flash Installer is unable to communicate with the TI-83 Plus. The problem is usually associated with the TI-GGRAPH LINK cable and its connection to the TI-83 Plus and/or to the computer. Make sure the cable is firmly pushed in to the calculator and the computer.

If this does not correct the problem, try a different TI-GGRAPH LINK cable and reboot your computer. If you continue to get this error, please contact [TI-Cares™](#) Customer Support for assistance.

Validation Error

Either this calculator does not have a certificate to run the application, or electrical interference caused a link to fail. Try to install the application again. If you continue to receive this error, contact [TI-Cares](#).

Checksum Error

The Flash installer was not able to verify that the application was fully installed. Exit the installer and try to install the application again. If this problem persists, contact [TI-Cares](#).

Other Errors

See pages B-6 through B-10 in the TI-83 Plus guidebook education.ti.com/guides for information about the specific error or contact [TI-Cares](#).

Miscellaneous

Verify Maintenance Upgrade Version and Serial Number

1. Press **2nd** **[MEM]**.
2. Select **1:ABOUT**.

The version number has the format **x.yy**. The serial number appears on the line beneath the product ID number.

Check Amount of Flash Application Free Space

1. Press **2nd** **[MEM]**.
2. Select **2:MEM MGMT/DEL...**

The English only version of Inequality Graphing requires at least 16,535 bytes of ARC FREE to load the application. The international version requires 33,070 bytes of ARC FREE to load the application. For more information about memory and memory management, refer to the TI-83 Plus guidebook.

The TI-83 Plus Guidebook is available in electronic format at education.ti.com/guides.

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