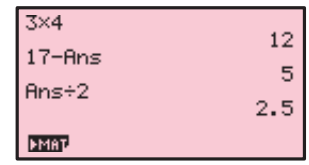
Casio fx-9860g

The variable **Ans** holds the most recent evaluated expression, and can be used in calculations by pressing SHIFT (−). For example, suppose you evaluate 3×4, and then wish to subtract this from 17. This can be done by pressing 17 − SHIFT (−) EXE.



If you start an expression with an operator such as +, −, etc, the previous answer Ans is automatically inserted ahead of the operator. For example, the previous answer can be halved simply by pressing ÷ 2 EXE.

If you wish to view the answer in fractional form, press F↔D.

RECALLING PREVIOUS EXPRESSIONS

Texas Instruments TI-83

The **ENTRY** function recalls previously evaluated expressions, and is used by pressing 2nd ENTER.

This function is useful if you wish to repeat a calculation with a minor change, or if you have made an error in typing.

Suppose you have evaluated $100 + \sqrt{132}$. If you now want to evaluate $100 + \sqrt{142}$, instead of retyping the command, it can be recalled by pressing 2nd ENTER.

The change can then be made by moving the cursor over the 3 and changing it to a 4, then pressing ENTER.

If you have made an error in your original calculation, and intended to calculate $1500 + \sqrt{132}$, again you can recall the previous command by pressing 2nd ENTER.

Move the cursor to the first 0.

You can insert the digit 5, rather than overwriting the 0, by pressing 2nd DEL 5 ENTER.

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Pressing the left cursor key allows you to edit the most recently evaluated expression, and is useful if you wish to repeat a calculation with a minor change, or if you have made an error in typing.

Suppose you have evaluated $100 + \sqrt{132}$.

If you now want to evaluate $100 + \sqrt{142}$, instead of retyping the command, it can be recalled by pressing the left cursor key.

Move the cursor between the 3 and the 2, then press DEL 4 to remove the 3 and change it to a 4. Press EXE to re-evaluate the expression.

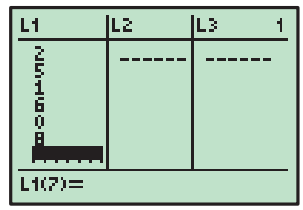
E LISTS

Lists are used for a number of purposes on the calculator. They enable us to enter sets of numbers, and we use them to generate number sequences using algebraic rules.

CREATING A LIST

Texas Instruments TI-83

Press STAT 1 to take you to the **list editor** screen.



To enter the data {2, 5, 1, 6, 0, 8} into **List1**, start by moving the cursor to the first entry of L_1. Press 2 ENTER 5 ENTER ..... and so on until all the data is entered.

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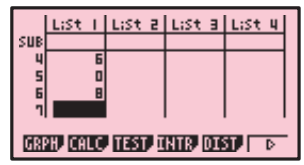
Selecting **STAT** from the Main Menu takes you to the **list editor** screen.



To enter the data {2, 5, 1, 6, 0, 8} into **List 1**, start by moving the cursor to the first entry of **List 1**. Press 2 EXE 5 EXE ..... and so on until all the data is entered.

DELETING LIST DATA

Texas Instruments TI-83

Pressing STAT **1** takes you to the **list editor** screen.

Move the cursor to the heading of the list you want to delete then press CLEAR ENTER.

Casio fx-9860g

Selecting **STAT** from the Main Menu takes you to the **list editor** screen.

Move the cursor to anywhere on the list you wish to delete, then press F6 **(▷)** F4 **(DEL-A)** F1 **(Yes)**.

REFERENCING LISTS

Texas Instruments TI-83

Lists can be referenced by using the secondary functions of the keypad numbers 1–6.

For example, suppose you want to add 2 to each element of **List1** and display the results in **List2**. To do this, move the cursor to the heading of L_2 and press 2nd 1 + 2 ENTER.

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Lists can be referenced using the List function, which is accessed by pressing SHIFT **1**.

For example, if you want to add 2 to each element of **List 1** and display the results in **List 2**, move the cursor to the heading of **List 2** and press SHIFT 1 **(List)** 1 + 2 EXE.

Casio models without the List function can do this by pressing OPTN F1 **(LIST)** F1 **(List)** 1 + 2 EXE.

NUMBER SEQUENCES

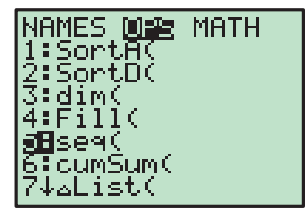
Texas Instruments TI-83

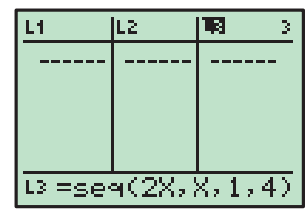
You can create a sequence of numbers defined by a certain rule using the *seq* command.

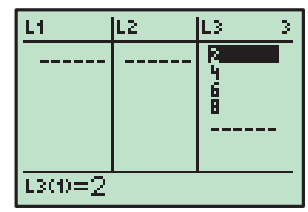
This command is accessed by pressing 2nd STAT ▶ to enter the **OPS** section of the List menu, then selecting **5:seq**.

For example, to store the sequence of even numbers from 2 to 8 in **List3**, move the cursor to the heading of **L3**, then press 2nd STAT ▶ **5** to enter the *seq* command, followed by 2 X,T,θ,*n* , X,T,θ,*n* , 1 , 4) ENTER.

This evaluates $2x$ for every value of x from 1 to 4.







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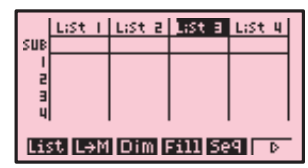
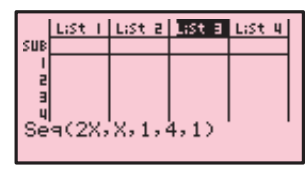
You can create a sequence of numbers defined by a certain rule using the *seq* command.

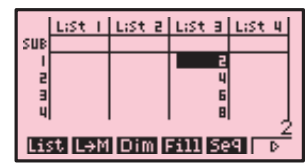
This command is accessed by pressing OPTN F1 **(LIST)** F5 **(Seq)**.

For example, to store the sequence of even numbers from 2 to 8 in **List 3**, move the cursor to the heading of **List 3**, then press OPTN F1 F5 to enter a sequence, followed by 2 X,θ,T , X,θ,T , 1 , 4 , 1) EXE.

This evaluates $2x$ for every value of x from 1 to 4 with an increment of 1.







F STATISTICAL GRAPHS

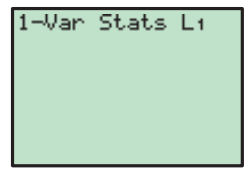
STATISTICS

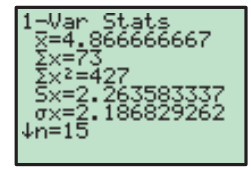
Your graphics calculator is a useful tool for analysing data and creating statistical graphs.

In this section we will produce descriptive statistics and graphs for the data set 5 2 3 3 6 4 5 3 7 5 7 1 8 9 5.

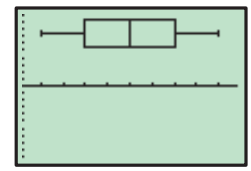
Texas Instruments TI-83

Enter the data set into **List1** using the instructions on page **18**. To obtain descriptive statistics of the data set, press STAT ▶ **1:1-Var Stats** 2nd **1 (L1)** ENTER .

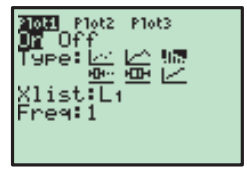


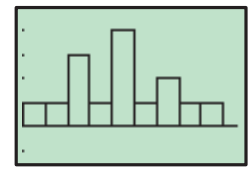


To obtain a boxplot of the data, press 2nd Y= **(STAT PLOT) 1** and set up **Statplot1** as shown. Press ZOOM **9:ZoomStat** to graph the boxplot with an appropriate window.



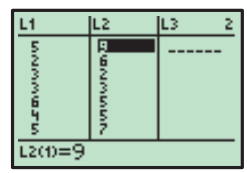
To obtain a vertical bar chart of the data, press 2nd Y= **1**, and change the type of graph to a vertical bar chart as shown. Press ZOOM **9:ZoomStat** to draw the bar chart. Press WINDOW and set the **Xscl** to 1, then GRAPH to redraw the bar chart.

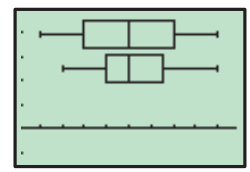




We will now enter a second set of data, and compare it to the first.

Enter the data set 9 6 2 3 5 5 7 5 6 7 6 3 4 4 5 8 4 into **List2**, press 2nd Y= **1**, and change the type of graph back to a boxplot as shown. Move the cursor to the top of the screen and select **Plot2**. Set up **Statplot2** in the same manner, except set the **XList** to **L2**. Press ZOOM **9:ZoomStat** to draw the side-by-side boxplots.





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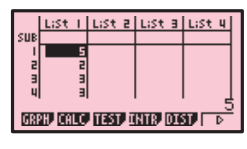
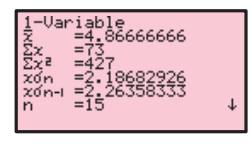
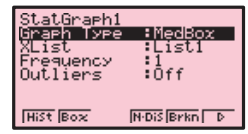
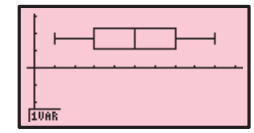
Enter the data into **List 1** using the instructions on page **18**. To obtain the descriptive statistics, press F6 **(▷)** until the **GRPH** icon is in the bottom left corner of the screen, then press F2 **(CALC)** F1 **(1VAR)**.





To obtain a boxplot of the data, press EXIT EXIT F1 **(GRPH)** F6 **(SET)**, and set up **StatGraph 1** as shown. Press EXIT F1 **(GPH1)** to draw the boxplot.

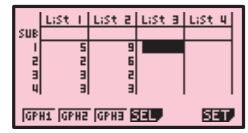


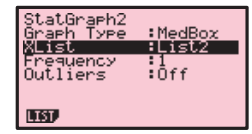


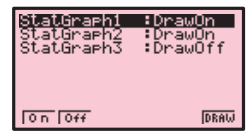
To obtain a vertical bar chart of the data, press EXIT F6 **(SET)** F2 **(GPH 2)**, and set up **StatGraph 2** as shown. Press EXIT F2 **(GPH 2)** to draw the bar chart (set Start to 0, and Width to 1).

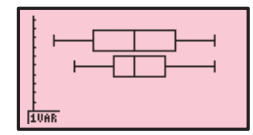
We will now enter a second set of data, and compare it to the first.

Enter the data set 9 6 2 3 5 5 7 5 6 7 6 3 4 4 5 8 4 into **List 2**, then press F6 **(SET)** F2 **(GPH2)** and set up **StatGraph 2** to draw a boxplot of this data set as shown. Press EXIT F4 **(SEL)**, and turn on both **StatGraph 1** and **StatGraph 2**. Press F6 **(DRAW)** to draw the side-by-side boxplots.







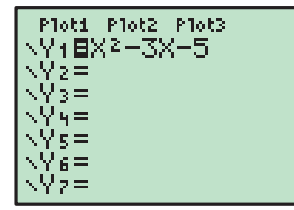


G WORKING WITH FUNCTIONS

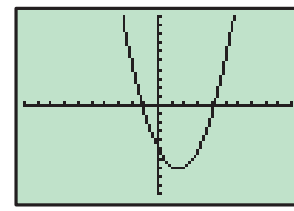
GRAPHING FUNCTIONS

Texas Instruments TI-83

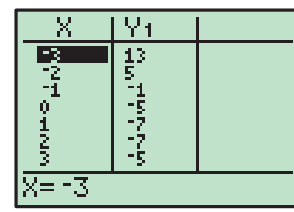
Pressing Y= selects the **Y=** editor, where you can store functions to graph. Delete any unwanted functions by scrolling down to the function and pressing CLEAR.



To graph the function $y = x^2 - 3x - 5$, move the cursor to **Y1**, and press X,T,θ,n x^2 − 3 X,T,θ,n − 5 ENTER. This stores the function into **Y1**. Press GRAPH to draw a graph of the function.



To view a table of values for the function, press 2nd GRAPH **(TABLE)**. The starting point and interval of the table values can be adjusted by pressing 2nd WINDOW **(TBLSET)**.



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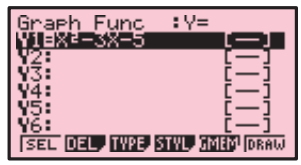
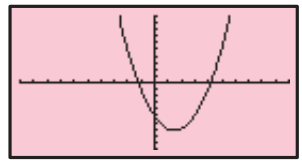
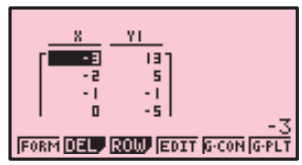


Selecting **GRAPH** from the Main Menu takes you to the Graph Function screen, where you can store functions to graph. Delete any unwanted functions by scrolling down to the function and pressing DEL F1 **(Yes)**.

To graph the function $y = x^2 - 3x - 5$, move the cursor to **Y1** and press X,θ,T x^2 − 3 X,θ,T − 5 EXE. This stores the function into **Y1**. Press F6 **(DRAW)** to draw a graph of the function.



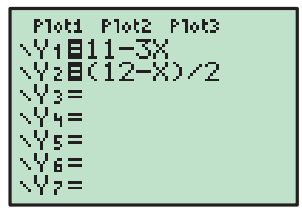
To view a table of values for the function, press MENU and select **TABLE**. The function is stored in **Y1**, but not selected. Press F1 **(SEL)** to select the function, and F6 **(TABL)** to view the table. You can adjust the table settings by pressing EXIT and then F5 **(SET)** from the Table Function screen.



FINDING POINTS OF INTERSECTION

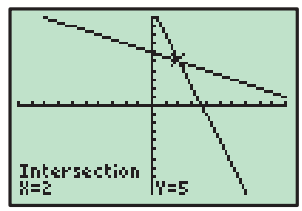
It is often useful to find the points of intersection of two graphs, for instance, when you are trying to solve simultaneous equations.

Texas Instruments TI-83



We can solve $y = 11 - 3x$ and $y = \dfrac{12 - x}{2}$ simultaneously by finding the point of intersection of these two lines. Press Y=, then store $11 - 3x$ into **Y1** and $\dfrac{12 - x}{2}$ into **Y2**. Press GRAPH to draw a graph of the functions.

To find their point of intersection, press 2nd TRACE **(CALC)** **5**, which selects **5:intersect**. Press ENTER twice to specify the functions **Y1** and **Y2** as the functions you want to find the intersection of, then use the arrow keys to move the cursor close to the point of intersection and press ENTER once more.



The solution $x = 2$, $y = 5$ is given.

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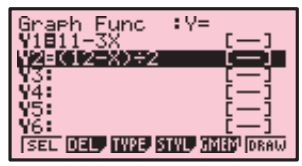
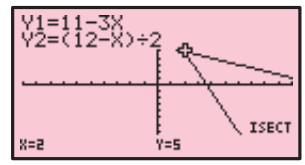


We can solve $y = 11 - 3x$ and $y = \dfrac{12 - x}{2}$ simultaneously by finding the point of intersection of these two lines. Select **GRAPH** from the Main Menu, then store $11 - 3x$ into **Y1** and $\dfrac{12 - x}{2}$ into **Y2**. Press F6 **(DRAW)** to draw a graph of the functions.

To find their point of intersection, press F5 **(G-Solv)** F5 **(ISCT)**. The solution $x = 2,\ y = 5$ is given.



Note: If there is more than one point of intersection, the remaining points of intersection can be found by pressing ▶.

SOLVING $f(x) = 0$

In the special case when you wish to solve an equation of the form $f(x) = 0$, this can be done by graphing $y = f(x)$ and then finding when this graph cuts the x-axis.

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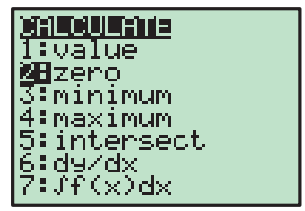
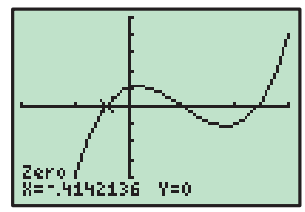
To solve $x^3 - 3x^2 + x + 1 = 0$, press Y= and store $x^3 - 3x^2 + x + 1$ into **Y1**. Press GRAPH to draw the graph.



To find where this function first cuts the x-axis, press 2nd TRACE **(CALC) 2**, which selects **2:zero**. Move the cursor to the left of the first zero and press ENTER, then move the cursor to the right of the first zero and press ENTER. Finally, move the cursor close to the first zero and press ENTER once more. The solution $x \approx -0.414$ is given.



Repeat this process to find the remaining solutions $x = 1$ and $x \approx 2.41$.

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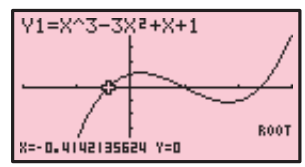
To solve $x^3 - 3x^2 + x + 1 = 0$, select **GRAPH** from the Main Menu and store $x^3 - 3x^2 + x + 1$ into **Y1**. Press F6 **(DRAW)** to draw the graph.



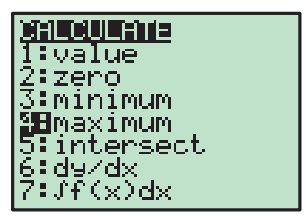
To find where this function cuts the x-axis, press F5 **(G-Solv)** F1 **(ROOT)**. The first solution $x \approx -0.414$ is given.

Press ▶ to find the remaining solutions $x = 1$ and $x \approx 2.41$.

TURNING POINTS

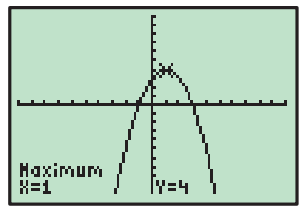
Texas Instruments TI-83

To find the turning point (vertex) of $y = -x^2 + 2x + 3$, press Y= and store $-x^2 + 2x + 3$ into **Y1**. Press GRAPH to draw the graph.



From the graph, it is clear that the vertex is a maximum, so press 2nd TRACE **(CALC) 4** to select **4:maximum**.

Move the cursor to the left of the vertex and press ENTER, then move the cursor to the right of the vertex and press ENTER. Finally, move the cursor close to the vertex and press ENTER once more. The vertex is $(1, 4)$.



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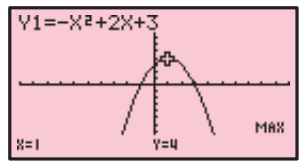
To find the turning point (vertex) of $y = -x^2 + 2x + 3$, select **GRAPH** from the Main Menu and store $-x^2 + 2x + 3$ into **Y1**. Press F6 **(DRAW)** to draw the graph.

From the graph, it is clear that the vertex is a maximum, so to find the vertex press F5 **(G-Solv)** F2 **(MAX)**.

The vertex is $(1, 4)$.



ADJUSTING THE VIEWING WINDOW

When graphing functions it is important that you are able to view all the important features of the graph. As a general rule it is best to start with a large viewing window to make sure all the features of the graph are visible. You can then make the window smaller if necessary.

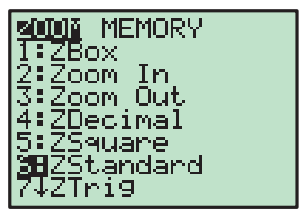
Texas Instruments TI-83

Some useful commands for adjusting the viewing window include:

ZOOM **0:ZoomFit** : This command scales the y-axis to fit the minimum and maximum values of the displayed graph within the current x-axis range.

ZOOM **6:ZStandard** : This command returns the viewing window to the default setting of $-10 \leqslant x \leqslant 10, \quad -10 \leqslant y \leqslant 10$.

If neither of these commands are helpful, the viewing window can be adjusted manually by pressing WINDOW and setting the minimum and maximum values for the x and y axes.



Casio fx-9860g

The viewing window can be adjusted by pressing SHIFT F3 **(V-Window)**. You can manually set the minimum and maximum values of the x and y axes, or press F3 **(STD)** to obtain the standard viewing window $-10 \leqslant x \leqslant 10$, $-10 \leqslant y \leqslant 10$.