

Chapter 3 / **Example 20**

Graphing quadratic functions

This example includes the techniques of finding a suitable window to display the function and using the GDC to find its key features.

The quadratic function $f(x) = -0.5x^2 + 7.5x - 18$ is said to be in general form. Use technology to plot the graph of $f(x) = -0.5x^2 + 7.5x - 18$ and then sketch this on paper. Your sketch should show the general correct shape of the graph, with key features labeled. Also state the domain and range of this function.

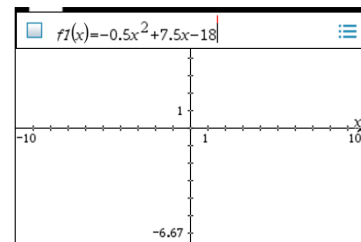
Open a new document and add a Graphs page.

The entry line is displayed at the top of the work area.

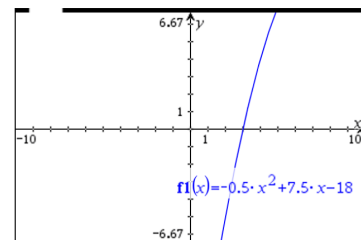
The default graph type is function, so 'f1(x)= ' is displayed.

The default axes are $-10 \leq x \leq 10$ and $-6.67 \leq y \leq 6.67$.

Type $-0.5x^2 + 7.5x - 18$ and press **enter**.

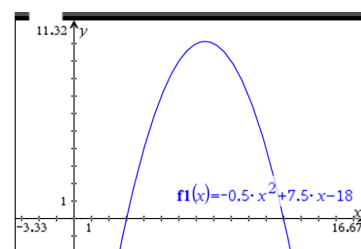


The GDC displays the graph $f1(x) = -0.5x^2 + 7.5x - 18$ with the default axes.



Click and hold the touchpad somewhere on the white area of the screen. You should see the cursor change to ✎ . Drag the axes. This is called panning.

When you have a better view of the curve, click the touchpad again (or press **esc**).

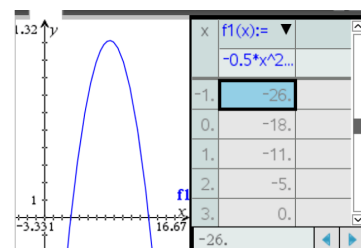


To get a better idea of the best window to view the graph in, it is helpful to use a table of values. Press **ctrl** **T**.

A table of values is displayed alongside the graph.

You can scroll through the table using \blacktriangle and \blacktriangledown on the touchpad.

From the table, you can see that the graph can see that the curve will cross the y-axis at $(0, -18)$.



Chapter 3 / **Example 20**

Graphing quadratic functions

Use this information to choose suitable window settings to display the graph.

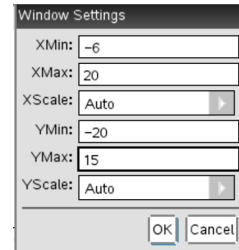
Press **ctrl** **T** again to remove the table.

Press **menu** 4:Window/Zoom | 1:Window Settings...

Set the axes to show $-6 \leq x \leq 20$ and $-20 \leq y \leq 15$

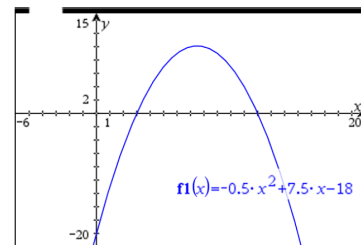
You can leave the scales set to Auto.

Press **enter** when you have finished.



Hint: use the **tab** key to move between the settings.

The GDC displays the quadratic curve in a suitable window.

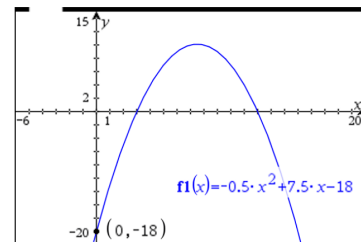


To find the y-intercept press **menu** 5:Trace | 1:Graph Trace

Press **0** **enter** to change the x coordinate to 0.

Press **enter** again and then press **esc** to leave the graph trace mode.

The GDC displays the coordinates of the y-intercept.

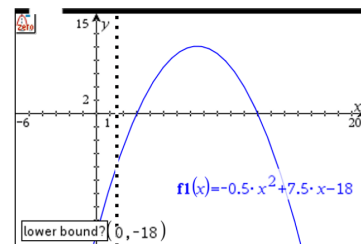


To find the zeros press **menu** 6:Analyse Graph | 1:Zero

You will need to give the lower and upper bounds of the region that includes the zero.

The GDC shows a line and asks you to set the lower bound. Move the line using the touchpad and choose a position to the left of the zero.

Click the touchpad.

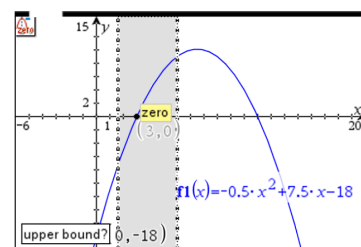


The GDC shows another line and asks you to set the upper bound.

Use the touchpad to move the line so that the region between the lower and upper bounds contains the zero.

When the region contains the zero, the calculator will display the word 'zero' in a box.

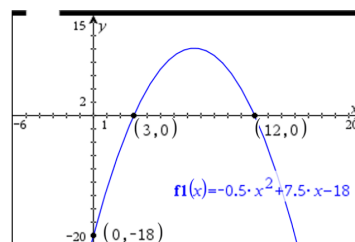
Click the touchpad.



Chapter 3 / **Example 20****Graphing quadratic functions**

Repeat for the second zero.

The GDC displays the zeros at $(3,0)$ and $(12,0)$.

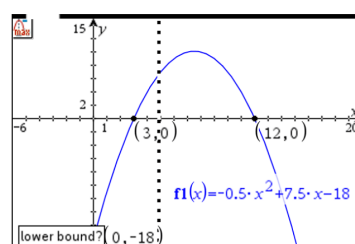


To find the vertex press **menu** 6:Analyse Graph | 3:Maximum

You will need to give the lower and upper bounds of the region that includes the vertex.

The GDC shows a line and asks you to set the lower bound. Move the line using the touchpad and choose a position to the left of the vertex.

Click the touchpad.

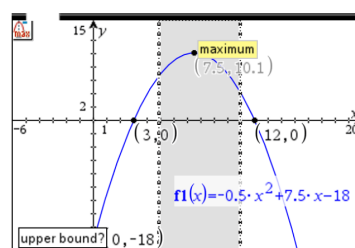


The GDC shows another line and asks you to set the upper bound.

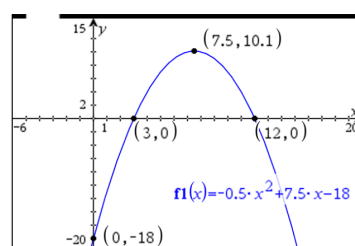
Use the touchpad to move the line so that the region between the lower and upper bounds contains the vertex.

When the region contains the zero, the calculator will display the word 'maximum' in a box.

Click the touchpad.



The GDC displays the vertex. However, you might want to have greater precision for the values of the coordinates.



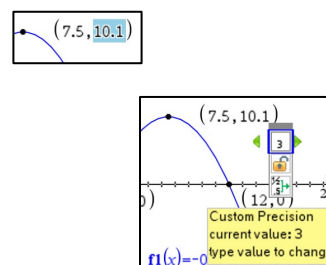
To change the precision of a displayed value, click on the number with the touchpad so that it is highlighted in blue.

Press **ctrl** **menu** (ⓘ) 2:Attributes

Use the **►** key or press **4** **enter** to change the precision from 3 to 4.

Press **enter**.

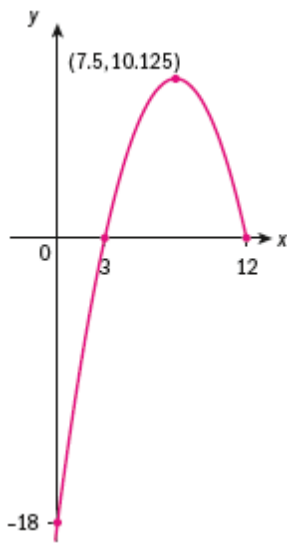
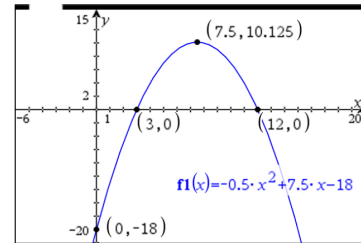
The values you enter here will depend on what the default settings are on your GDC. These may also be in significant figures or decimal places.



Chapter 3 / **Example 20****Graphing quadratic functions**

The GDC displays the vertex to 3dp.

The vertex of the quadratic function is at $(7.5, 10.125)$



Domain of f is $\{x \in \mathbb{R}\}$.

Range of f is $\{y \in \mathbb{R} \mid y \leq 10.125\}$.