Chapter 3 / **Example 20**

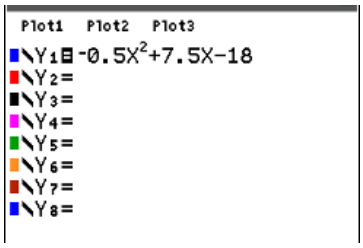
# Graphing quadratic functions

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.

Press [f1] [y=] to display the equation entry screen.

Type $-0.5x^2 + 7.5x - 18$ and press [enter] to enter the equation as $Y_1$.

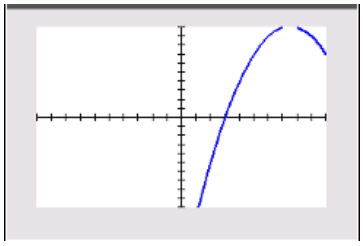



Press [f5] [graph] to display the graph screen

The GDC now displays the quadratic function:

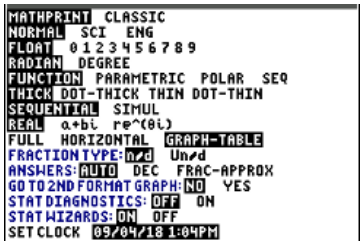
$Y_1 = -0.5x^2 + 7.5x - 18$

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



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

Press [mode]. Use the [◀] [▲] [▶] [▼] keys to place the cursor on GRAPH-TABLE in the Mode menu, and then press [enter] to highlight it.



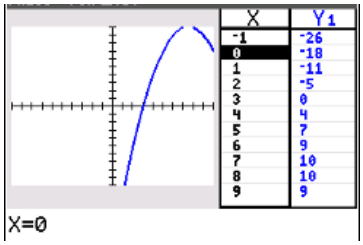

Press [f5] [graph].

A table of values is displayed alongside the graph.

Press [2nd] [f5] [table] to move the cursor into the table.

You can scroll through the table using [▲] and [▼] on the touchpad.

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



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

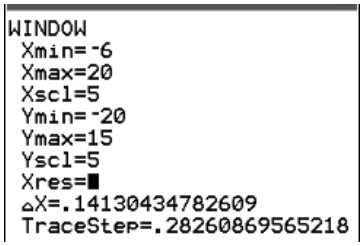
Press [mode] Use the [◄] [▲] [►] [▼] keys to place the cursor on FULL in the Mode menu, and then press [enter] to highlight it.

Press [f2] [window]

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

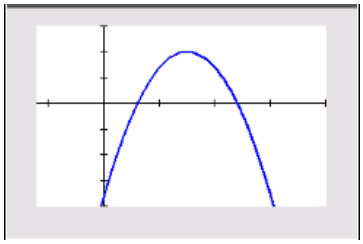
You can leave the last three items as they are.

Press [f5] [graph] when you have finished.




Hint: press [enter] after entering each value to move between the settings.

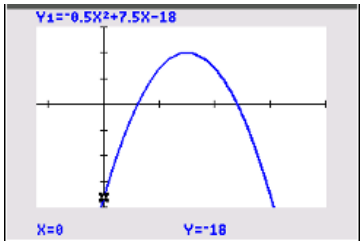
The GDC displays the quadratic curve in a suitable window.



To find the $y$-intercept press [2nd] [f4] [calc] 1:value

Press [0] [enter] to change the $x$-coordinate to 0.

The GDC displays the coordinates of the $y$-intercept.

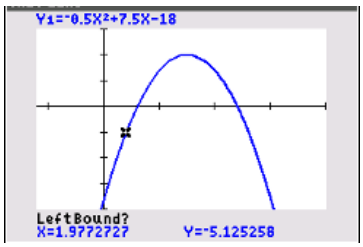



To find the zeros press [2nd] [f4] [calc] 2:zero

You will need to give the left and right bounds of the region that includes the zero.

The GDC shows a point on the curve and asks you to set the left bound. Move the point using [►] [◄] and choose a position to the left of the zero.

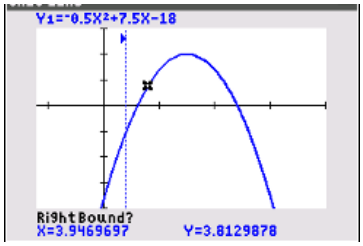
Press [enter].




The GDC shows a line where you have set the left bound and a point on the curve.

Move the point using [►] [◄] and choose a position to the right of the zero.

When the region contains the zero, Press [enter].



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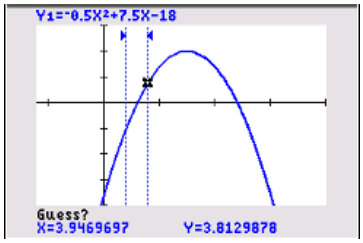
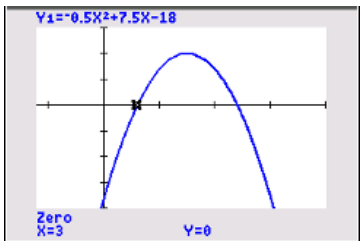
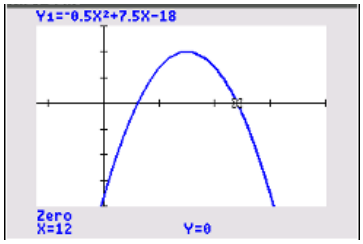
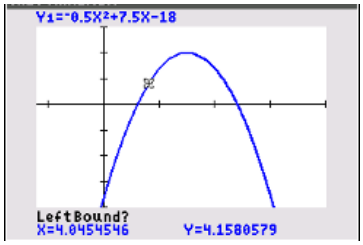
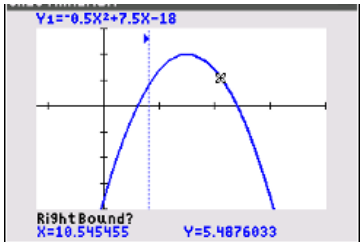
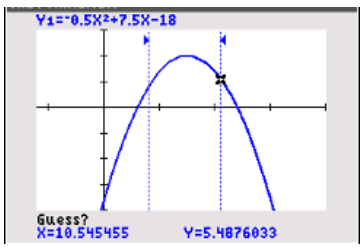
| | |
|---|---|
| The GDC requires an initial guess for the position of the zero. Choose the default position.<br>Press enter. |  |
| The GDC displays a zero at $(3,0)$. |  |
| Repeat for the second zero.<br>The GDC displays a zero at $(12,0)$. |  |
| To find the vertex press 2nd [f4] [calc] 4:maximum<br>You will need to give the left and right bounds of the region that includes the vertex.<br>The GDC shows point on the curve and asks you to set the left bound. Move the point using ▶ ◀ and choose a position to the left of the vertex.<br>Press ENTER. |  |
| The GDC shows a line where you have set the left bound and a point on the curve.<br>Move the point using ▶ ◀ and choose a position to the right of the vertex.<br>When the region contains the vertex, Press ENTER. |  |
| The GDC requires an initial guess for the position of the zero. Choose the default position.<br>Press ENTER. |  |

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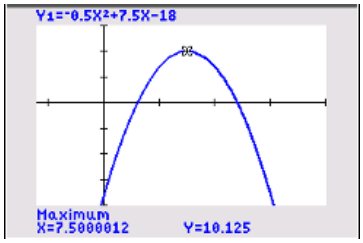
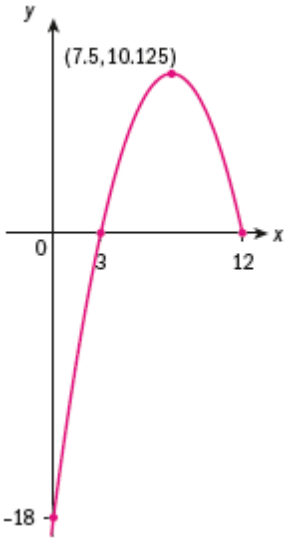
The GDC displays the vertex.

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




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

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