

Chapter 6 / **Example 3****Problems involving quadratics**

A rectangular mirror has perimeter 260 cm.

- If the length of the mirror is x cm, find the height of the mirror in terms of x .
- Find an equation for the area of the mirror, A cm², in terms of x .
- Use your GDC to plot a graph of your equation for the area of the mirror, showing area A on the y -axis and length x on the x -axis. Choose a suitable domain and range.
- Find the coordinates of the points where the graph intersects the x -axis.
- State what these two values of x represent.
- Find the equation of the graph's line of symmetry.
- State what the equation of the line of symmetry tells you in this context.

height = $130 - x$, area = $x(130 - x)$.

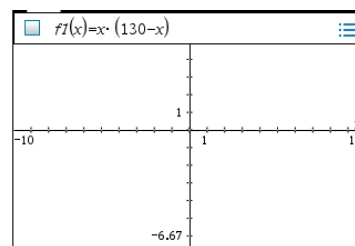
Open a new document and add a Graphs page.

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

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

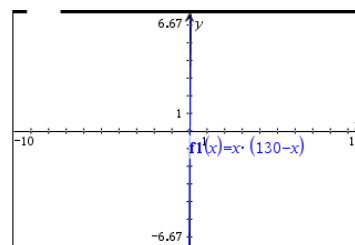
The default axes are $-10 \leq x \leq 10$ and $-6.67 \leq y \leq 6.67$.

Type $x \times (130 - x)$ and press **enter**.



The GDC displays the graph $f1(x) = x \cdot (130 - x)$ with the default axes.

There is not much to see with these axes.

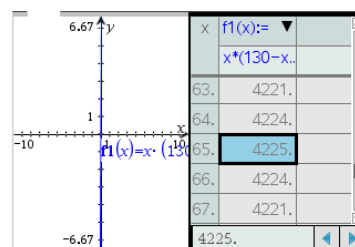


To get a better idea of the best window to view the graph in, it is helpful to use a table of values. Press **ctrl** **T**.

A table of values is displayed alongside the graph.

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

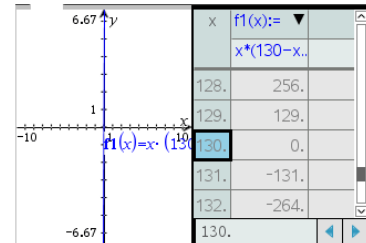
From the table, you can see that the maximum value of y is around 4225.



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Scrolling further you can see that the value of y remains positive for values of x up to 130.

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

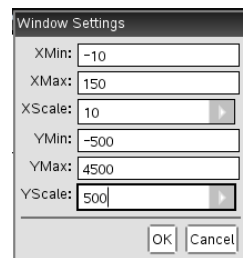


Use this information to choose suitable window settings to display the graph.

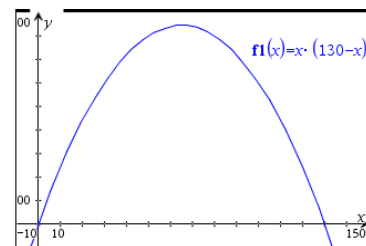
Press **menu** 4:Window/Zoom | 1:Window Settings...

Set the axes to show $-10 \leq x \leq 150$ with a scale of 10 and $-500 \leq y \leq 4500$ with a scale of 500.

Press **enter** when you have finished.



The GDC displays the quadratic curve in a suitable window.

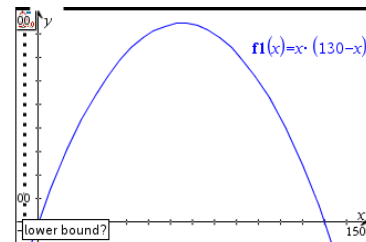


To find the zeros press **menu** 6:Analyse Graph | 1:Zero.

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.

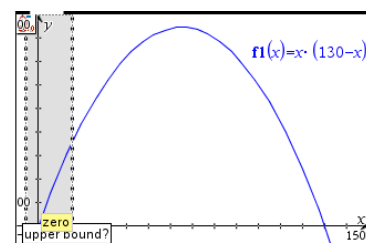


The GDC shows another line and asks you to set the upper bound.

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.



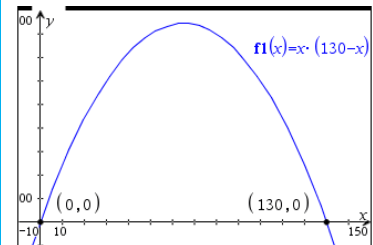
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Repeat for the second zero.

The GDC displays the zeros at $(0,0)$ and $(130,0)$.

x must lie between the values 0 and 130.

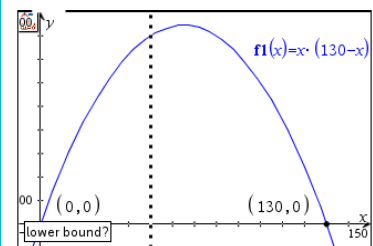


To find the vertex press **menu** 6:Analyse Graph | 3:Maximum.

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.

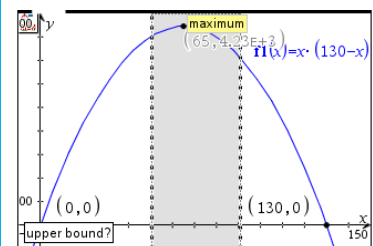


The GDC shows another line and asks you to set the upper bound.

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.

The vertex of the quadratic function is at $(65, 4225)$.

The axis of symmetry passes through the vertex.

The line of symmetry is $x = 65$.

