

## Chapter 6 / Example 3

## Problems involving quadratics

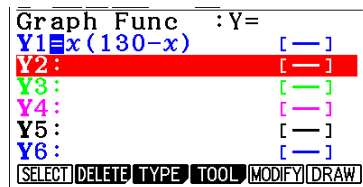
A rectangular mirror has perimeter 260 cm.

- 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,  $A$  cm<sup>2</sup>, 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 =  $x(130 - x)$ .

Press **MENU** 5 **GRAPH** to display the equation entry screen.

Type  $x(130 - x)$  and press **EXE** to enter the equation as Y1.



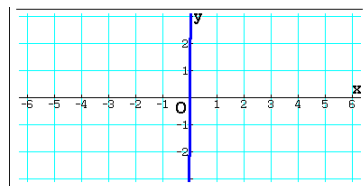
Press **F6** DRAW to display the graph screen

The GDC now displays the quadratic function:

$$Y1 = x(130 - x)$$

The default axes are  $-6.3 \leq x \leq 6.3$  and  $-3.1 \leq y \leq 3.1$ .

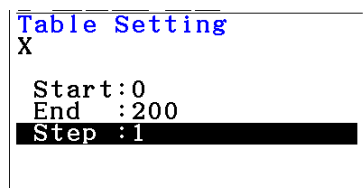
There is not much to see with these axes.



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

Press **MENU** 7 **TABLE**. Press **F5** SET and change the settings so that the table starts from 0 and ends at 200.

Press **EXIT**.



Press **F6** TABLE.

A table of values is displayed.

You can scroll through the table using **▲** and **▼** to get an idea of the ranges of values you will need to use for  $x$  and  $y$  to display the curve.

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

X	Y1
64	4224
65	4225
66	4224
67	4221

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

X	Y1
129	129
130	0
131	-131
132	-264

131

FORMULA DELETE ROW EDIT GPH-CON GPH-PLT

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

Press **MENU** 5 **GRAPH** **II**

Press **SHIFT** **F3** V-WIN.

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.

You can leave the other items as they are.

Press **EXIT** when you have finished.

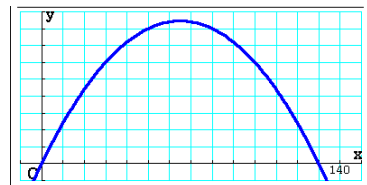
View Window

Xmin : -10  
max : 150  
scale : 10  
dot : 0.42328042  
Ymin : -500  
max : 4500

INITIAL TRIG STANDARD V-WIN SQUARE

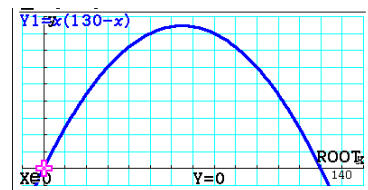
Press **F6** DRAW to display the graph screen.

The GDC displays the quadratic curve in a suitable window.



To find the  $x$ -intercepts or roots press **F5** G-SOLVE and then press **F1** ROOT.

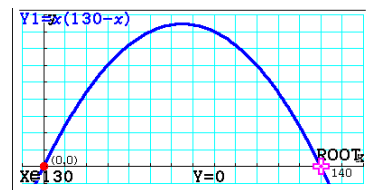
The GDC shows the first root.



Press **EXE** to display the coordinates.

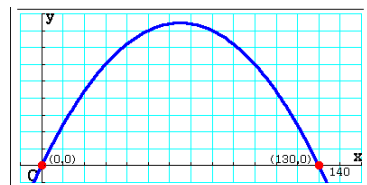
Press **▶** to move to the next root and press **EXE** to display its coordinates.

Press **EXIT** to leave G-Solv mode and **F6** DRAW to display the graph screen again.



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

$x$  must lie between the values 0 and 130.



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To find the vertex press **F5** G-SOLVE and then press **F2** MAX.  
Press **EXE** to display the coordinates.

Press **EXIT** to leave G-Solv mode and **F6** DRAW to display the graph screen again.

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

The axis of symmetry passes through the vertex.

The line of symmetry is  $x = 65$ .

