Chapter 4 / **Example 26**

Finding extrema graphically

The GDC can be used to confirm the position and nature of turning points.

If $f(x)=1-4x^2+2x^4$:

a Find any turning points.

b Determine the nature of the points and justify your answers.

c State the intervals in which the function increases/decreases.

d Confirm your answers graphically, and state whether the points found in **a** are local or global extrema.

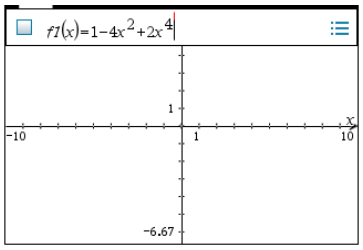
Open a new document and add a Graphs page.

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

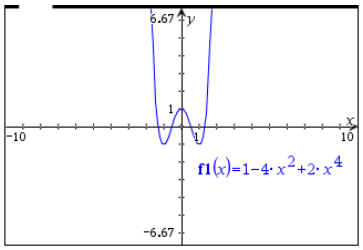
The default graph type is function, so '$f1(x)=$' is displayed.

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

Type $1-4x^2+2x^4$ and press enter.



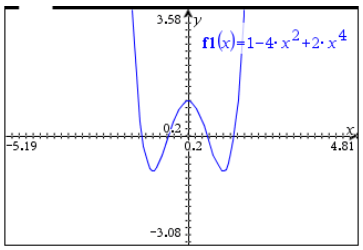
The GDC displays the graph $f1(x)=1-4x^2+2x^4$ with the default axes.



To view the extrema better press menu 4:Window/Zoom | 3:Zoom - In.

Position the centre for zooming at the origin using the touchpad and click the touchpad.

Press esc to exit zoom mode.

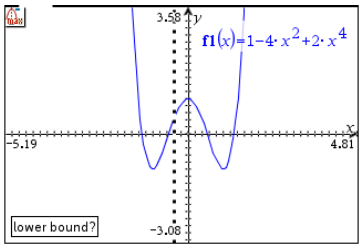


To find the maximum press menu 6:Analyse Graph | 3:Maximum

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

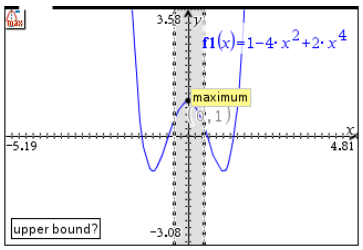
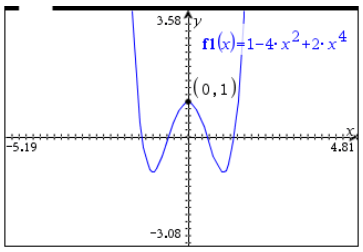
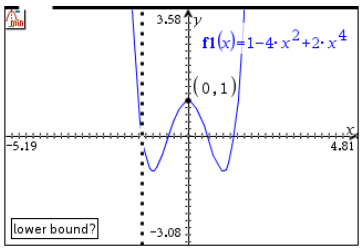
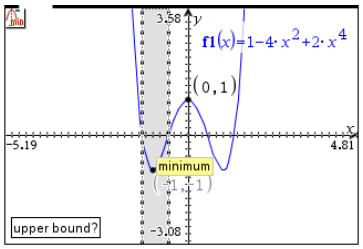
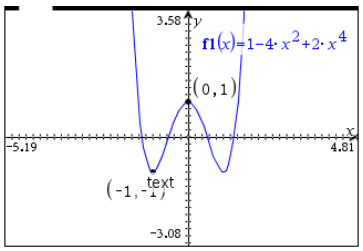
The GDC shows a line and asks you to set the lower bound. Move the line using the touchpad and choose a position to the left of the maximum.

Click the touchpad.



Chapter 4 / **Example 26**

Finding extrema graphically

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 maximum. When the region contains the maximum, the calculator will display the word 'maximum' in a box. Click the touchpad.	
The GDC displays the local maximum point at $(0,1)$.	
To find the first minimum press menu 6:Analyse Graph | 2: Minimum. You will need to give the lower and upper bounds of the region that includes the minimum. 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 minimum. 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 minimum. When the region contains the minimum, the calculator will display the word 'minimum' in a box. Click the touchpad.	
The GDC displays the minimum at $(-1,-1)$.	

Chapter 4 / **Example 26**

Finding extrema graphically

Repeat for the second minimum.

The GDC displays the minimum at $(1, -1)$.

From the graph,

f is increasing for $x \in]-1, 0[\cup]1, \infty[$.

f is decreasing for $x \in]-1, 0[\cup]1, \infty[$.