

Chapter 6 / **Example 9**

Sketching cubic functions

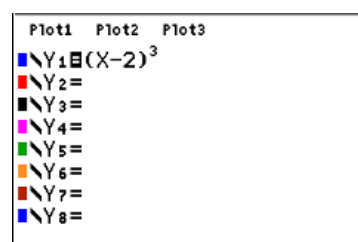
Sketch the graphs of $y = f(x)$ for the following functions.

a $f(x) = (x-2)^3$, $0 \leq x \leq 4$ **b** $f(x) = x^3 - 7x^2 + 4x - 12$, $-2 \leq x \leq 8$

On your sketch, label the coordinates of points where the graphs intersect the axes, and any local maximum or minimum points.

Press **[F1]** **[Y=]** to display the equation entry screen.

Type $(x-2)^3$ and press **[ENTER]** to enter the equation as Y_1 .



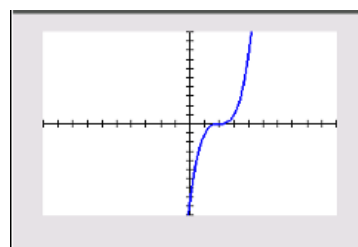
Press **[F5]** **[GRAPH]** to display the graph screen

The GDC now displays the cubic function:

$$Y_1 = (x-2)^3$$

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

There is no maximum or minimum point.

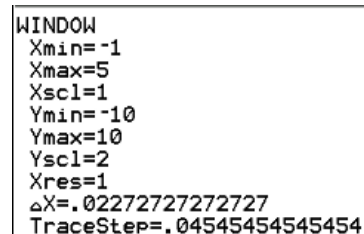


Change the window settings

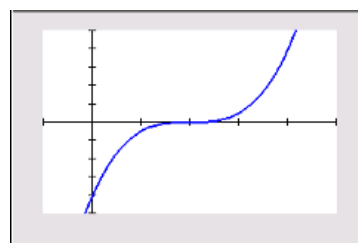
Press **[F2]** **[WINDOW]**

Set the axes to show $-1 \leq x \leq 5$ with a scale of 1 and $-10 \leq y \leq 10$ with a scale of 2.

Press **[F5]** **[GRAPH]** when you have finished.



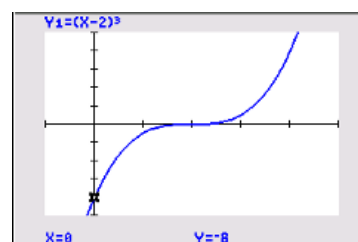
The GDC displays the graph in a suitable window.



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, $(0, -8)$.



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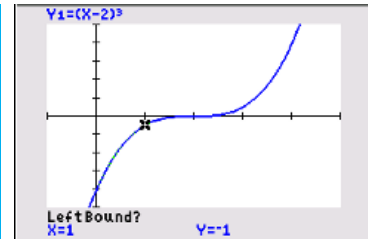
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To find the zero press $\boxed{2\text{nd}} \boxed{F4} \boxed{[CALC]} 2:\text{zero}$

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 $\boxed{\blacktriangleright}$ $\boxed{\blacktriangleleft}$ and choose a position to the left of the zero.

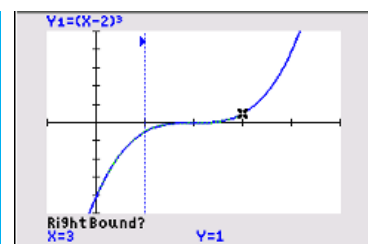
Press \boxed{ENTER} .



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

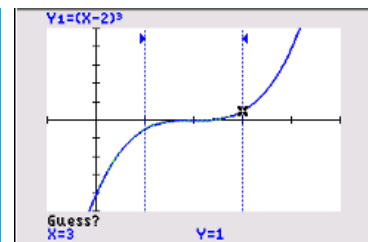
Move the point using $\boxed{\blacktriangleright}$ $\boxed{\blacktriangleleft}$ and choose a position to the right of the zero.

When the region contains the zero, Press \boxed{ENTER} .

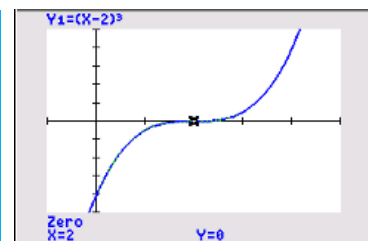


The GDC requires an initial guess for the position of the zero. Choose the default position.

Press \boxed{ENTER} .



The GDC displays a zero at $(2, 0)$.



Press $\boxed{2\text{nd}} \boxed{F5} \boxed{[TABLE]}$.

Use the $\boxed{\blacktriangleup}$ $\boxed{\blacktriangledown}$ keys to scroll through the table.

Take some more points from the table and plot the graph.

X	Y1			
-1	-27			
0	-8			
1	-1			
2	0			
3	1			
4	8			
5	27			
6	64			
7	125			
8	216			
9	343			

X = -1

Press $\boxed{F1} \boxed{Y=}$ to display the equation entry screen.

Type $x^3 - 7x^2 + 4x - 12$ and press \boxed{ENTER} to enter the equation as Y_1 .

Plot1	Plot2	Plot3
$\blacksquare Y_1 = X^3 - 7X^2 + 4X - 12$		
$\blacksquare Y_2 =$		
$\blacksquare Y_3 =$		
$\blacksquare Y_4 =$		
$\blacksquare Y_5 =$		
$\blacksquare Y_6 =$		
$\blacksquare Y_7 =$		
$\blacksquare Y_8 =$		

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Press **[2nd]** **[F5]** **[TABLE]**.

Use the **[▲]** **[▼]** keys to scroll through the table.

From the table, suitable axes will be $-2 \leq x \leq 8$ and $-60 \leq y \leq 90$.

X	Y1			
-2	-56			
-1	-24			
0	-12			
1	-14			
2	-24			
3	-36			
4	-44			
5	-42			
6	-24			
7	16			
8	84			

X=8

Press **[F2]** **[WINDOW]**

Set the axes above with a x-scale of 1 and a y-scale of 20.

You can leave the last three items as they are.

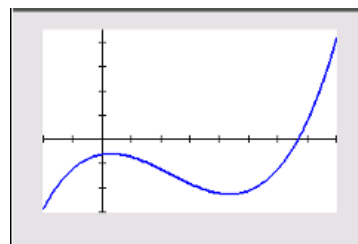
Press **[F5]** **[GRAPH]** when you have finished.

```

WINDOW
Xmin=-2
Xmax=8
Xscl=1
Ymin=-60
Ymax=90
Yscl=20
Xres=1
ΔX=.0378787878787878
TraceStep=.0757575757575757

```

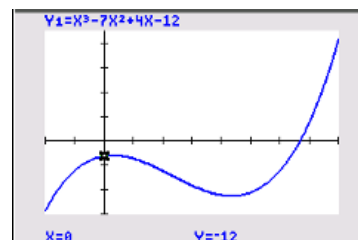
The GDC displays the cubic curve in a suitable window.



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, $(0, -12)$.

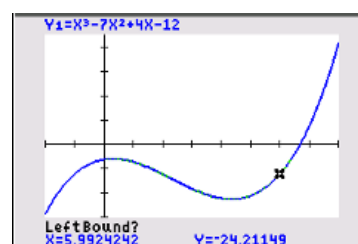


To find the zero press **[2nd]** **[F4]** **[CALC]** 2:zero

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.

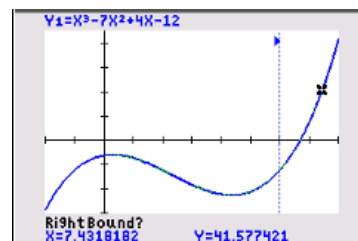
Press **[ENTER]**.



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]**.

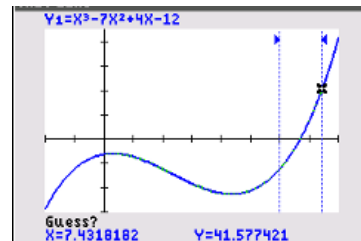


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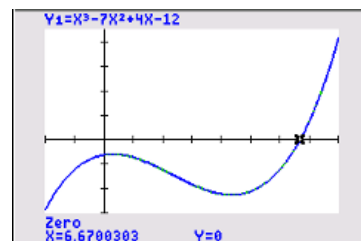
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The GDC requires an initial guess for the position of the zero. Choose the default position.

Press **ENTER**.



The GDC displays a zero at $(6.67, 0)$.

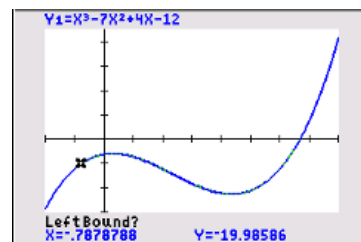


To find the maximum press **2nd** **[F4]** **[CALC]** 4:maximum

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

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 maximum.

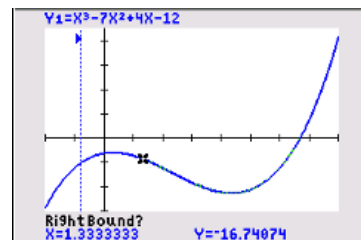
Press **ENTER**.



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

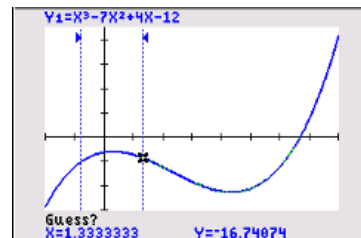
Move the point using **▶** **◀** and choose a position to the right of the maximum.

When the region contains the maximum, Press **ENTER**.



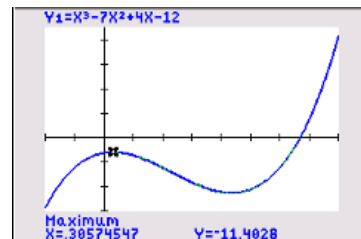
The GDC requires an initial guess for the position of the maximum. Choose the default position.

Press **ENTER**.



The GDC displays the maximum.

The maximum of the cubic function is at $(0.306, -11.4)$.



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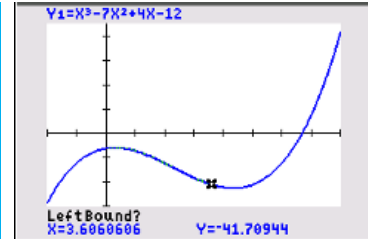
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To find the minimum press $\boxed{2\text{nd}} \boxed{f4} \boxed{[CALC]} 3:\text{minimum}$

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

The GDC shows a point on the curve and asks you to set the left bound. Move the point using $\boxed{\blacktriangleright}$ $\boxed{\blacktriangleleft}$ and choose a position to the left of the minimum.

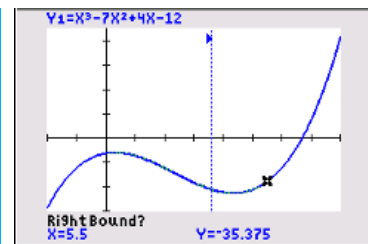
Press \boxed{ENTER} .



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

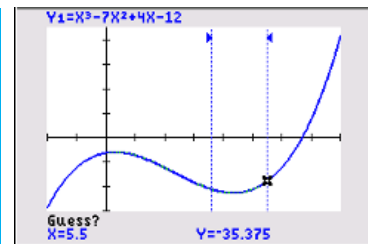
Move the point using $\boxed{\blacktriangleright}$ $\boxed{\blacktriangleleft}$ and choose a position to the right of the minimum.

When the region contains the turning point, Press \boxed{ENTER} .



The GDC requires an initial guess for the position of the minimum. Choose the default position.

Press \boxed{ENTER} .



The GDC displays the minimum.

The minimum of the cubic function is at $(4.36, -44.7)$.

The four points found should be sufficient to sketch the curve.

