

Chapter 3 / **Example 35****Solving polynomial inequalities**

Given the polynomials  $f(x) = 3x^3 + 2x^2 - 3$  and  $g(x) = x^3 - x^2 + 3x - 1$ , find all the values of  $x$  such that  $f(x) \geq g(x)$  by using a graphical method on a calculator.

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

Type  $3x^3 + 2x^2 - 3$  and press **EXE** to enter the first equation as Y1.

Type  $x^3 - x^2 + 3x - 1$  and press **EXE** to enter the second equation as Y2.

Graph Func : Y=  
Y1 =  $3x^3 + 2x^2 - 3$  [—]  
Y2 =  $x^3 - x^2 + 3x - 1$  [—]  
Y3 : [—]  
Y4 : [—]  
Y5 : [—]  
Y6 : [—]  
[SELECT] [DELETE] [TYPE] [TOOL] [MODIFY] [DRAW]

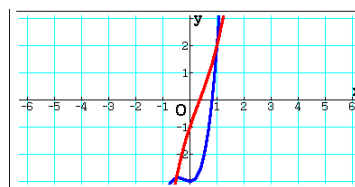
Press **F6** DRAW to display the graph screen

The GDC now displays the curve and the straight-line:

$$Y1 = 3x^3 + 2x^2 - 3$$

$$Y2 = x^3 - x^2 + 3x - 1$$

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



Choose suitable window settings to display the graphs.

Press **F3** V-WIN.

Set the axes to show  $-3 \leq x \leq 3$  with a scale of 1 and  $-24 \leq y \leq 8$  with a scale of 4.

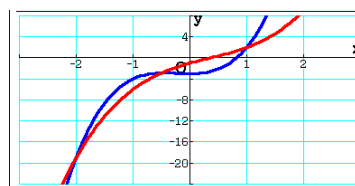
You can leave the other items as they are.

Press **EXIT** when you have finished.

View Window  
Xmin : -3  
max : 3  
scale : 1  
dot : 0.01587301  
Ymin : -24  
max : 8  
[INITIAL] [TRIG] [STANDARD] [V-WIN] [SQUARE]

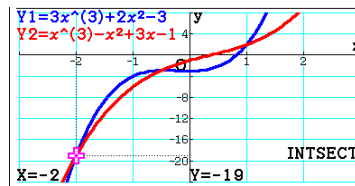
Press **F6** DRAW to display the graph screen

The GDC now displays the curves in a suitable window.



To find the intersections press **F5** G-SOLVE and then press **F5** INTERSECT.

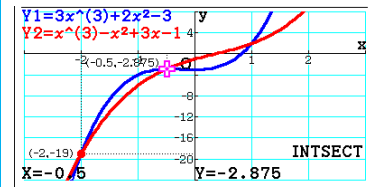
The GDC shows the first intersection.



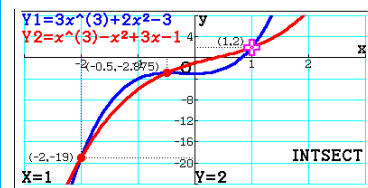
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Press **EXE** to display the coordinates.

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



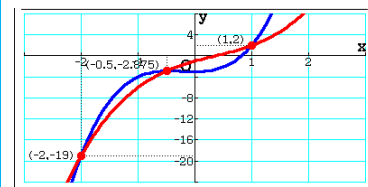
Press **▶** to move to the next zero and press **EXE** to display its coordinates.



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

The GDC displays the intersections at  $(-2, -19)$ ,  $(-0.5, -2.88)$  and  $(1, 2)$ .

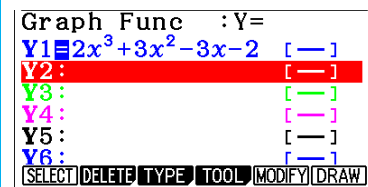
$$x \in \left[-\infty, \frac{1}{3}\right] \cup \left[2, \frac{5}{2}\right]$$



Alternatively, rewrite  $3x^3 + 2x^2 - 3 \geq x^3 - x^2 + 3x - 1$  as  $2x^3 + 3x^2 - 3x - 2 \geq 0$

Press **EXIT** to return to the equation entry screen and delete the two functions using **F2** DELETE.

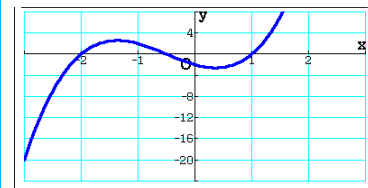
Type  $2x^3 + 3x^2 - 3x - 2$  and press **EXE** to enter the first equation as Y1.



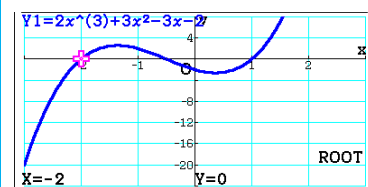
Press **F6** DRAW to display the graph screen

The GDC now displays the curve  $Y1 = 2x^3 + 3x^2 - 3x - 2$

The axes are  $-3 \leq x \leq 3$  and  $-24 \leq y \leq 8$ .



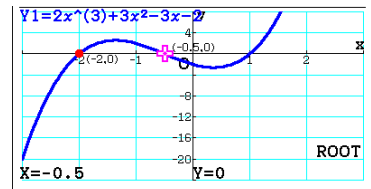
To find the zeros press **F5** G-SOLVE and then press **F1** ROOT. The GDC shows the first zero.



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Press **EXE** to display the coordinates.

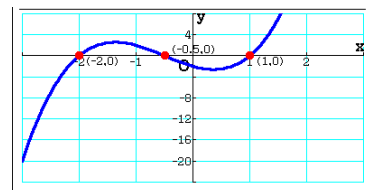
Press **▶** to move to the next zero and press **EXE** to display its coordinates.



Press **▶** to move to the next zero 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 zeros at  $(-2, 0)$ ,  $(-0.5, 0)$  and  $(1, 0)$ .



$$x \in \left[-\infty, \frac{1}{3}\right] \cup \left[2, \frac{5}{2}\right]$$