

You have studied linear functions and monomials. Some functions can be defined by the sums of monomials. One function that can be defined this way is a cubic function. A **cubic equation** has the form  $ax^3 + bx^2 + cx + d = 0$ , where  $a \neq 0$ . All cubic equations have at least one but no more than three real roots. You can use a Sharp EL-9900C graphing calculator to graph cubic functions.

### ACTIVITY

Solve  $x^3 - 6x^2 + 3x + 10 = 0$  by graphing.

**Step 1** Enter the related function in the  $Y=$  list after the calculator memory is cleared.

**KEYSTROKES:**  $2\text{ndF}$  [OPTION] [ALPHA] [E] 2 [CL] [ENTER]  $Y=$   $X/\theta/T/n$   $a^b$  3  $\blacktriangleright$   $-$  6  
 $X/\theta/T/n$   $x^2$   $+$  3  $X/\theta/T/n$   $+$  10 [ENTER]

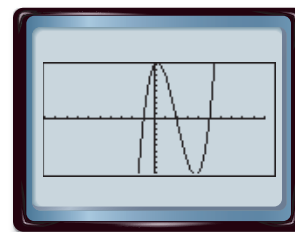
**Step 2** Graph the function in the standard viewing window.

**KEYSTROKES:** [ZOOM] 5

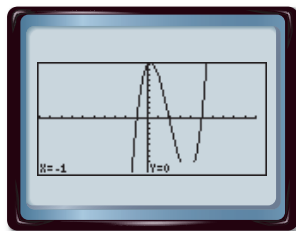
**Step 3** Find the zeros of the function by determining where the graph crosses the  $x$ -axis. Notice that this graph crosses the  $x$ -axis three times. Therefore, there are 3 real solutions for the equation.

**KEYSTROKES:**  $2\text{ndF}$  [CALC] 5: X\_Incpt

The cursor will be on the first intersection point.



$[-10, 10]$  scl: 1 by  $[-10, 10]$  scl: 1



One root is  $x = -1$ .

**Step 4** Repeat Step 3 for each additional root.

The solutions for  $x^3 - 6x^2 + 3x + 10 = 0$  are  $x = -1, 2,$  and  $5$ .

### Exercises

Solve each equation by graphing.

1.  $x^3 - 4x^2 - 9x + 36 = 0$

2.  $x^3 - 6x^2 - 6x - 7 = 0$

3.  $x^3 + x^2 + x - 3 = 0$

4.  $x^3 - 5x^2 - 2x + 24 = 0$