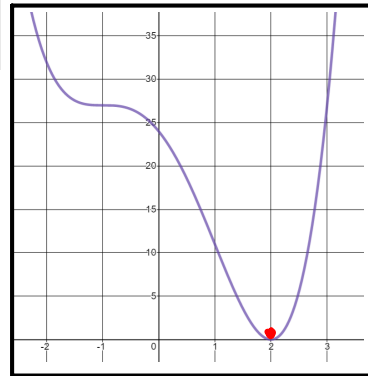


Lets speed up this process!

If the degree of a polynomial function or equation is 4 or higher, it is often necessary to find more than one linear factor by synthetic division.

One way to speed up the process of finding the first zero is to graph the function. Any x -intercept is a zero.



EXAMPLE 5 Solving a Polynomial Equation

Solve: $x^4 - 6x^2 - 8x + 24 = 0$.

From the graph... $x = 2$ (mult. 2)

$$\begin{array}{r|rrrrr} 2 & 1 & 0 & -6 & -8 & 24 \\ & & 2 & 4 & -4 & -24 \\ \hline & 1 & 2 & -2 & -12 & 0 \end{array}$$

$$\begin{array}{r|rrrr} 2 & 1 & 2 & -2 & -12 & 0 \\ & & 2 & 8 & 12 & \\ \hline & 1 & 4 & 6 & 0 & \end{array}$$

$$x^2 + 4x + 6 = 0$$

Use quadratic formula...

$$x = -2 \pm i\sqrt{2} \text{ and } x = 2 \text{ (mult. 2)}$$

Great easy graphing tool:

www.desmos.com/calculator

or

Download on Apple App Store or GooglePlay

Check Point

Find all zeros of $x^4 + x^3 + 7x^2 + 9x - 18 = 0$

From the graph... $x = -2$ and 1

$$\begin{array}{r|rrrrr} 1 & 1 & 1 & 7 & 9 & -18 \\ & & 1 & 2 & 9 & 18 \\ \hline & 1 & 2 & 9 & 18 & 0 \end{array}$$

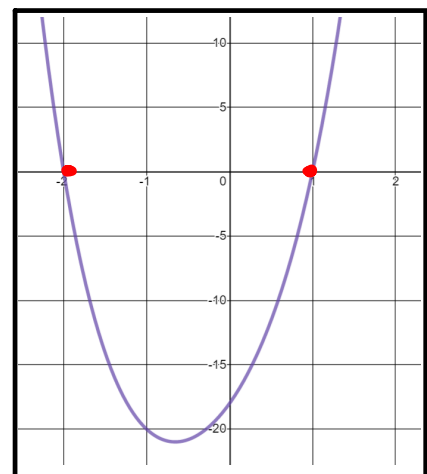
$$\begin{array}{r|rrrr} -2 & 1 & 2 & 9 & 18 & 0 \\ & & -2 & 0 & -18 & \\ \hline & 1 & 0 & 9 & 0 & \end{array}$$

$$x^2 + 9 = 0$$

Solve,
 $\sqrt{x^2} = \sqrt{-9}$

$$x = \pm 3i$$

$$x = -2 \text{ and } 1$$



✓ Check Point

Find all zeros of $f(x) = x^3 - 2x^2 - x - 6$

$$\begin{array}{r|rrrr} 3 & 1 & -2 & -1 & -6 \\ & & 3 & 3 & 6 \\ \hline & 1 & 1 & 2 & 0 \end{array} \checkmark$$

$$x^2 + x + 2 = 0$$

$$x = \frac{-1 \pm \sqrt{1^2 - 4(1)(2)}}{2(1)}$$

$$x = \frac{-1 \pm \sqrt{-7}}{2}, \quad \boxed{x = \frac{-1 \pm i\sqrt{7}}{2}} \text{ and } \boxed{x = 3}$$

