



**COMMON CORE**

**Systems of Equations**  
In this extension, you will

- solve linear equations by graphing a system of linear equations.

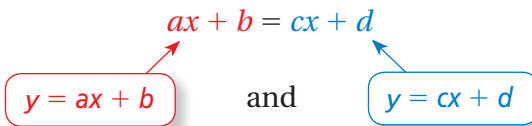
Learning Standards

- 8.EE.8a
- 8.EE.8b
- 8.EE.8c
- A.CED.3
- A.REI.6

**Key Idea**

**Solving Equations Using Graphs**

**Step 1:** To solve the equation  $ax + b = cx + d$ , write two linear equations.

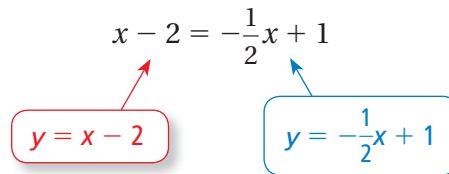


**Step 2:** Graph the system of linear equations. The  $x$ -value of the solution of the system of linear equations is the solution of the equation  $ax + b = cx + d$ .

**EXAMPLE 1 Solving an Equation Using a Graph**

Solve  $x - 2 = -\frac{1}{2}x + 1$  using a graph. Check your solution.

**Step 1:** Write a system of linear equations using each side of the equation.



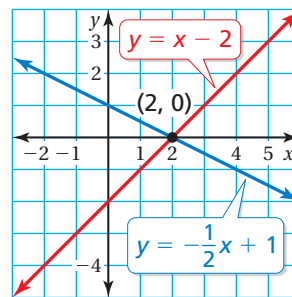
**Step 2:** Graph the system.

$$y = x - 2$$

$$y = -\frac{1}{2}x + 1$$

The graphs intersect at  $(2, 0)$ .

So, the solution of the equation is  $x = 2$ .



**Check**

$$x - 2 = -\frac{1}{2}x + 1$$

$$2 - 2 \stackrel{?}{=} -\frac{1}{2}(2) + 1$$

$$0 = 0 \quad \checkmark$$

**Practice**

Use a graph to solve the equation. Check your solution.

1.  $2x + 3 = 4$

2.  $2x = x - 3$

3.  $3x + 1 = 3x + 2$

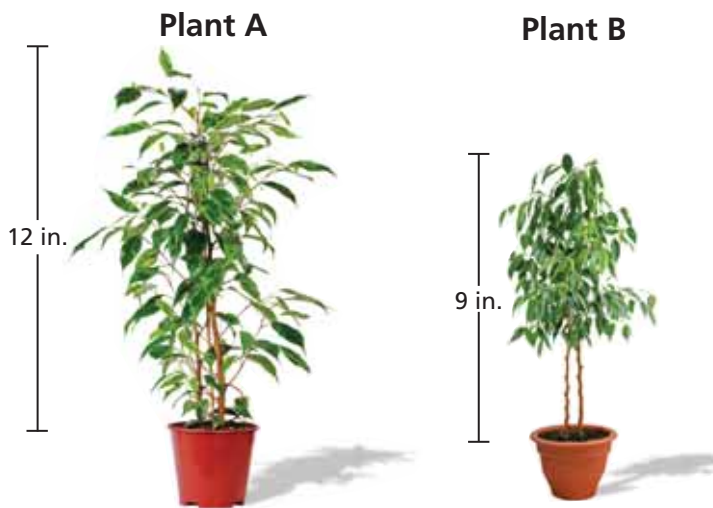
4.  $\frac{1}{3}x = x + 8$

5.  $1.5x + 2 = 11 - 3x$

6.  $3 - 2x = -2x + 3$

7. **STRUCTURE** Write an equation with variables on both sides that has no solution. How can you change the equation so that it has infinitely many solutions?

## EXAMPLE 2 Real-Life Application



Plant A grows 0.6 inch per month. Plant B grows twice as fast.

- Use the model to write an equation.
- After how many months  $x$  are the plants the same height?

$$\begin{array}{|c|} \hline \text{Growth} \\ \hline \text{rate} \\ \hline \end{array} \cdot \begin{array}{|c|} \hline \text{Months,} \\ \hline x \\ \hline \end{array} + \begin{array}{|c|} \hline \text{Original} \\ \hline \text{height} \\ \hline \end{array} = \begin{array}{|c|} \hline \text{Growth} \\ \hline \text{rate} \\ \hline \end{array} \cdot \begin{array}{|c|} \hline \text{Months,} \\ \hline x \\ \hline \end{array} + \begin{array}{|c|} \hline \text{Original} \\ \hline \text{height} \\ \hline \end{array}$$

- The equation is  $0.6x + 12 = 1.2x + 9$ .
- Write a system of linear equations using each side of the equation. Then use a graphing calculator to graph the system.

### Study Tip

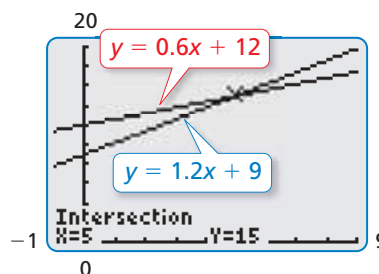
You can check your answer algebraically as in Section 1.3.

$$\begin{aligned} 0.6x + 12 &= 1.2x + 9 \\ 12 &= 0.6x + 9 \\ 3 &= 0.6x \\ 5 &= x \end{aligned}$$

$$0.6x + 12 = 1.2x + 9$$

$$y = 0.6x + 12$$

$$y = 1.2x + 9$$



The solution of the system is  $(5, 15)$ .

- ❖ So, the plants are both 15 inches tall after 5 months.

## Practice

Use a graph to solve the equation. Check your solution.

8.  $6x - 2 = x + 11$

9.  $\frac{4}{3}x - 1 = \frac{2}{3}x + 6$

10.  $1.75x = 2.25x + 10.25$

11. **WHAT IF?** In Example 2, the growth rate of Plant A is 0.5 inch per month. After how many months  $x$  are the plants the same height?