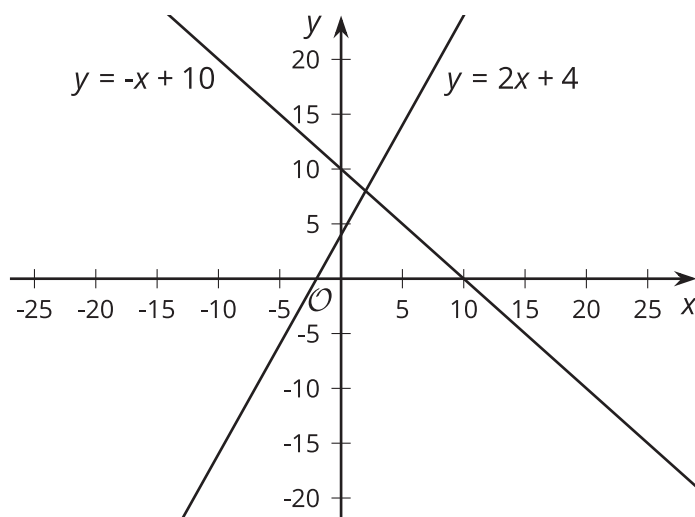




# Solving Systems of Equations

Let's solve systems of equations.

## 13.1 Ask about This Graph



## 13.2 Matching Graphs to Systems

Here are three **systems of equations**. Find the solution to each system.

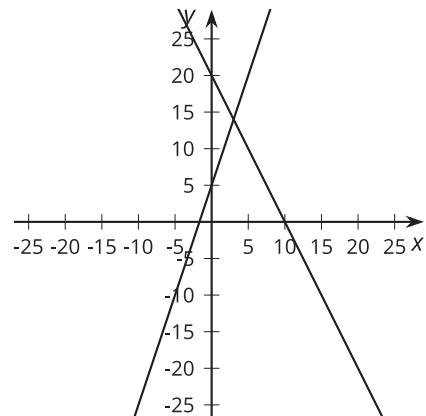
$$\begin{cases} y = 3x + 5 \\ y = -2x + 20 \end{cases}$$

$$\begin{cases} y = 2x - 10 \\ y = 4x - 1 \end{cases}$$

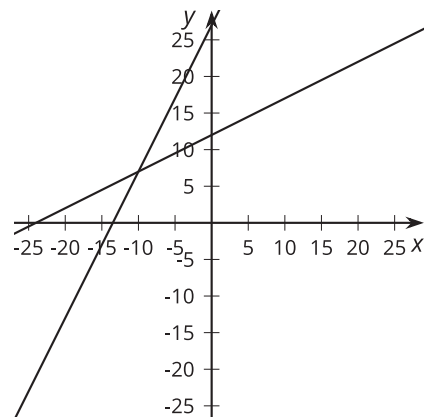
$$\begin{cases} y = 0.5x + 12 \\ y = 2x + 27 \end{cases}$$

Match each graph to one of the systems of equations, then use the graphs to check that your solutions are reasonable.

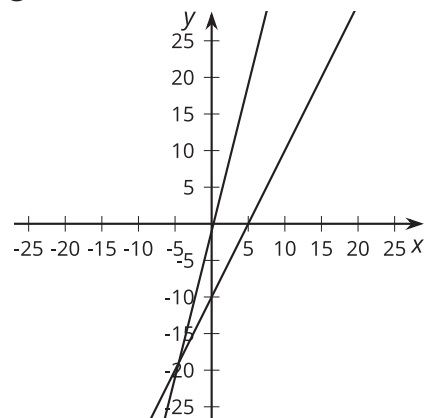
**A**



**B**



**C**



## 13.3 Different Types of Systems

Your teacher will give you a page with some systems of equations.

1. Graph each system of equations carefully on the provided coordinate plane.
2. Describe what the graph of a system of equations looks like when it has
  - a. 1 solution.
  - b. 0 solutions.
  - c. Infinitely many solutions.

### Are you ready for more?

The graphs of the equations  $Ax + By = 15$  and  $Ax - By = 9$  intersect at  $(2, 1)$ . Find  $A$  and  $B$ . Show or explain your reasoning.

## Lesson 13 Summary

Sometimes it is easier to solve a system of equations without having to graph the equations and look for an intersection point. In general, whenever we are solving a system of equations written as

$$\begin{cases} y = [\text{some stuff}] \\ y = [\text{some other stuff}] \end{cases}$$

we know that we are looking for a pair of values  $(x, y)$  that makes both equations true. In particular, we know that the value for  $y$  will be the same in both equations. That means that

$$[\text{some stuff}] = [\text{some other stuff}]$$

For example, look at this system of equations:

$$\begin{cases} y = 2x + 6 \\ y = -3x - 4 \end{cases}$$

Since the  $y$  value of the solution is the same in both equations, then we know that:

$$2x + 6 = -3x - 4$$

We can solve this equation for  $x$ :

$$2x + 6 = -3x - 4$$

$$5x + 6 = -4$$

$$5x = -10$$

$$x = -2$$

add  $3x$  to each side

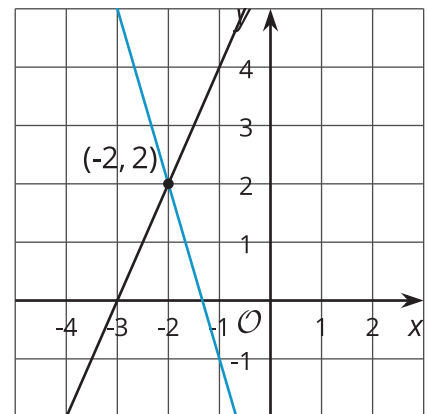
subtract 6 from each side

divide each side by 5

But this is only half of what we are looking for: we know the value for  $x$ , but we need the corresponding value for  $y$ .

Since both equations have the same  $y$  value, we can use either equation to find the  $y$ -value:  $2(-2) + 6$  or  $y = -3(-2) - 4$ .

In both cases, we find that  $y = 2$ . So the solution to the system is  $(-2, 2)$ . We can verify this by graphing both equations in the coordinate plane.



In general, a system of linear equations can have:

- No solutions. In this case, the lines that correspond to each equation never intersect. They have the same slope and different  $y$ -intercepts.
- Exactly one solution. The lines that correspond to each equation intersect in exactly one point. They have different slopes.
- An infinite number of solutions. The graphs of the two equations are the same line! They have the same slope and the same  $y$ -intercept.