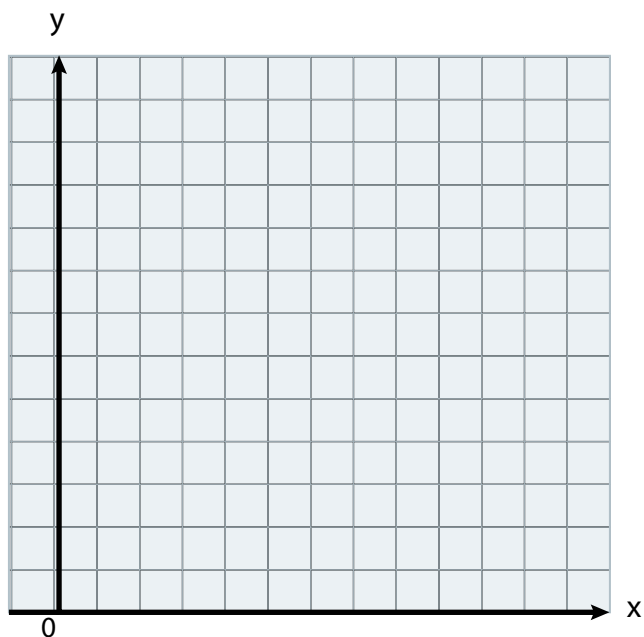## 6-1 ▸ Solving Systems by Graphing

OBJECTIVE: I can solve systems of equations by graphing to analyze special systems

🔥 Warm-Up

Two professional downhill skiers are racing at the speeds shown in the diagram. Skier 1 starts 5 s before Skier 2. The course is 5000 ft long. Will Skier 2 pass Skier 1? How do you know?

Skier 1
100 ft/s

Skier 2
110 ft/s

y

0   x

You can model the problem in the Warm Up with two linear equations. Two or more linear equations form a **system of linear equations**. Any ordered pair that makes all of the equations in a system true is a **solution of a system of linear equations.**

Essential Understanding You can use systems of linear equations to model problems. Systems of equations can be solved in more than one way. One method is to graph each equation and find the intersection point, if one exists.
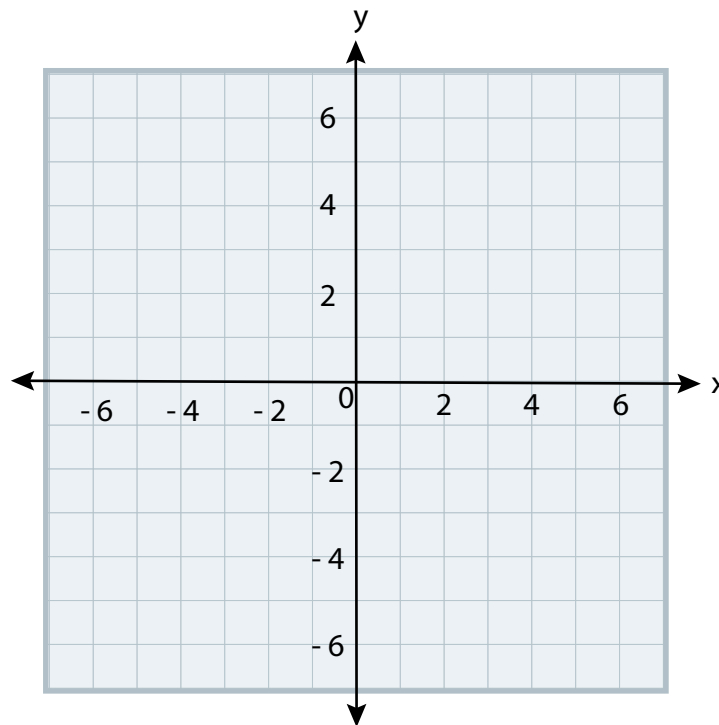
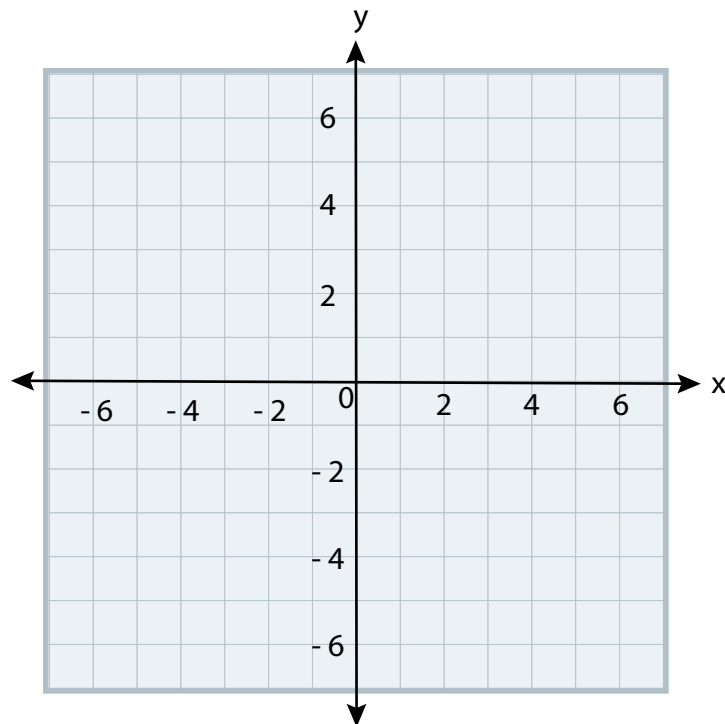**Example**

#1 Solving a System of Equations by Graphing

What is the solution of the system? Use a graph.
$$y = x + 2$$
$$y = 3x - 2$$

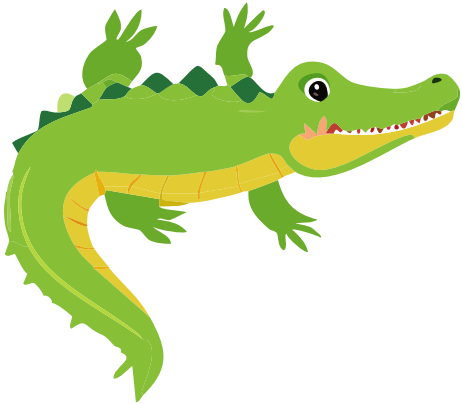1. What is the solution of the system? Use a graph. $y = 2x + 4$
$y = x + 2$

#2 Writing a System of Equations

Biology Scientists studied the weights of two alligators over a period of 12 months. The initial weight and growth rate of each alligator are shown below. After how many months did the alligators weigh the same amount?

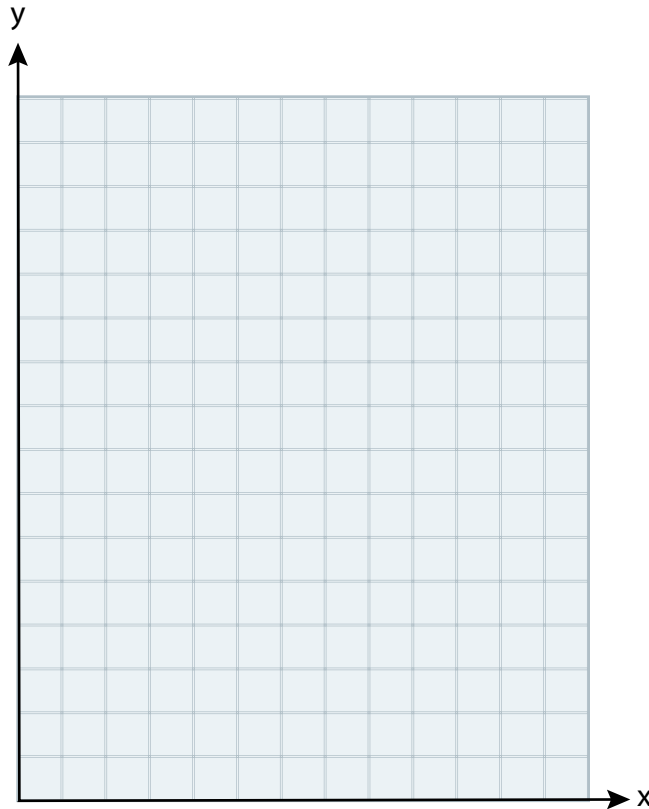| ALLIGATOR 1 |
|:---:|
| Initial Weight: 4 lb |
| Rate of Growth: |
| 1.5 lb per month |

ALLIGATOR 2
Initial Weight: 6 lb
Rate of Growth:
1 lb per month
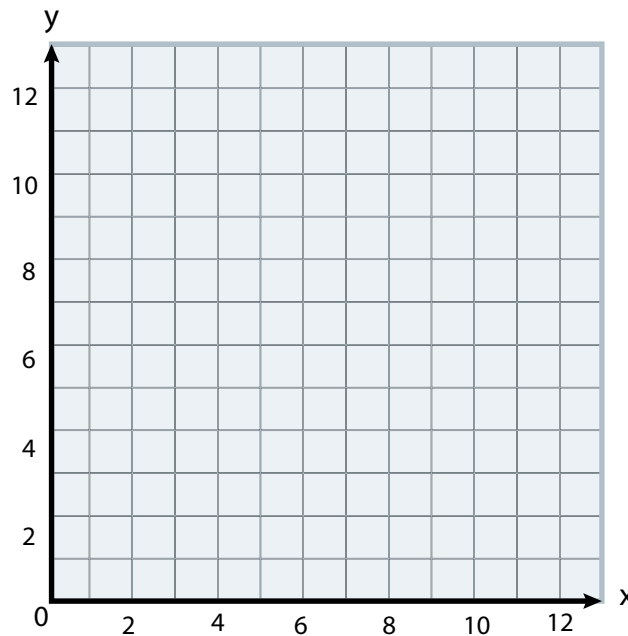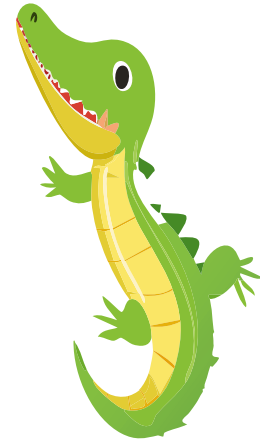
2. One satellite radio service charges $10 per month plus an activation fee of $20. A second service charges $11 per month plus an activation fee of $15. In what month was the cost of the service the same?
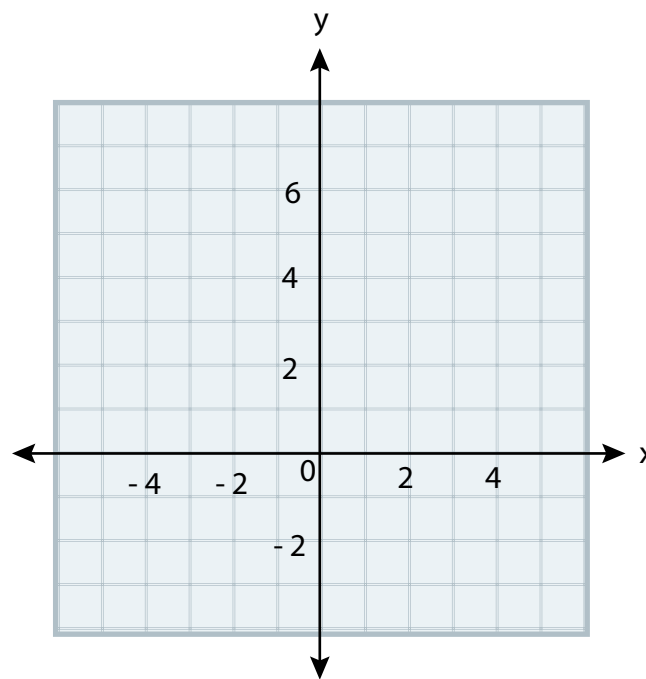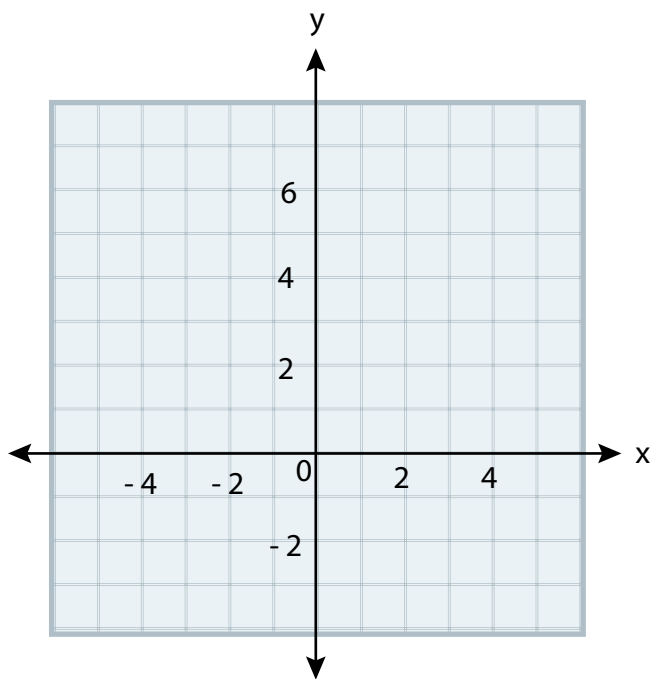
#3 Systems With Infinitely Many Solutions or No Solution

What is the solution of each system? Use a graph.

A $2y - x = 2$

$y = \dfrac{1}{2}x + 1$
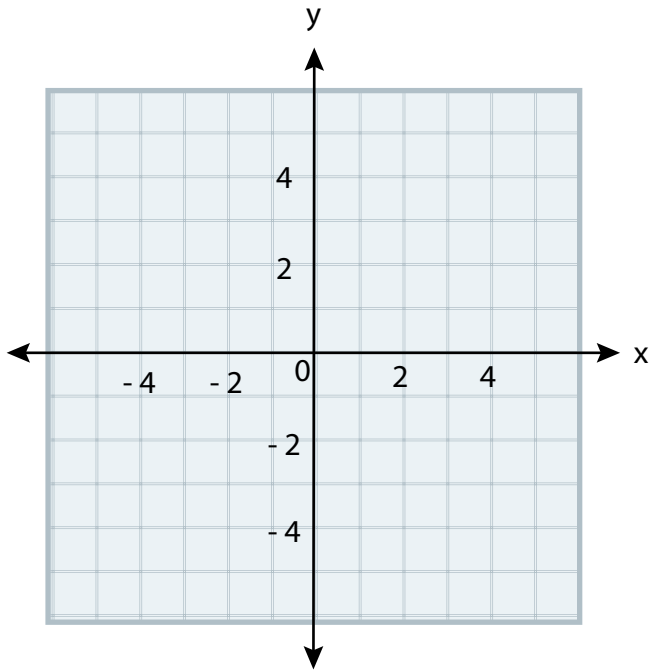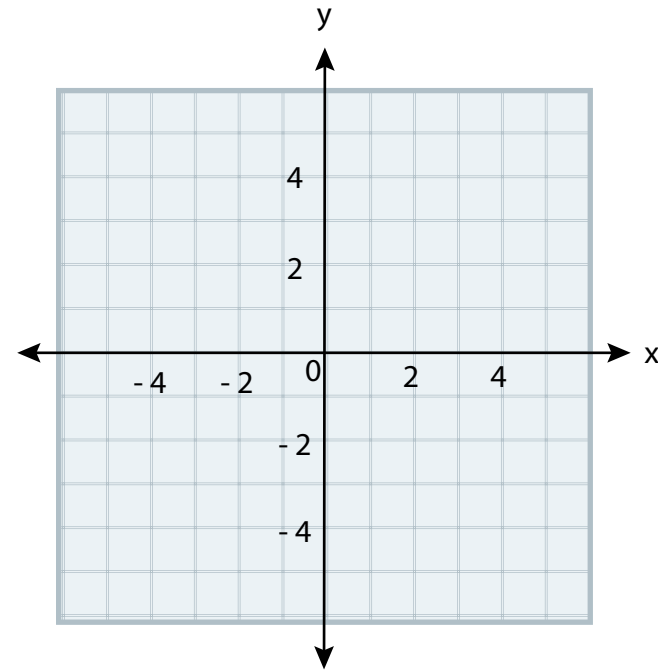
B $y = 2x + 2$

$y = 2x - 1$

3. What is the solution of each system in parts (a) and (b)? Use a graph. Describe the number of solutions.
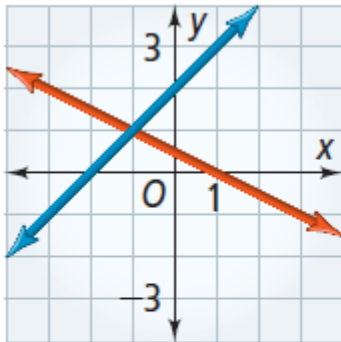
A $y = -x - 3$
$y = -x + 5$

B $y = 3x - 3$
$3y = 9x - 9$

Key Concept: Systems of Linear Equations

One solution

Infinitely many solutions
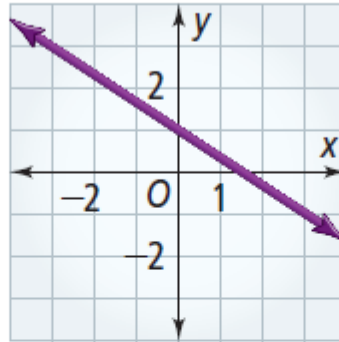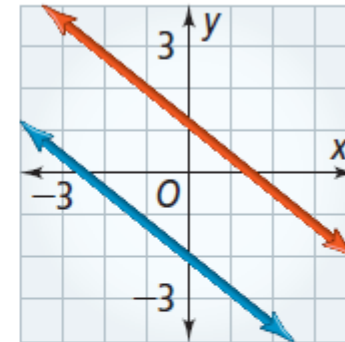
No solution

The lines intersect at one point. The lines have different slopes. The equations are consistent and independent.

The lines are the same. The lines have the same slope and y-intercept. The equations are consistent and dependent.

The lines are parallel. The lines have the same slope and different y-intercepts. The equations are inconsistent.
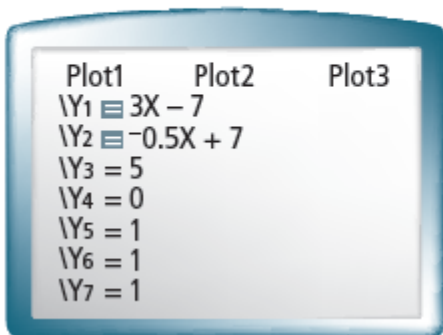
Concept Understanding

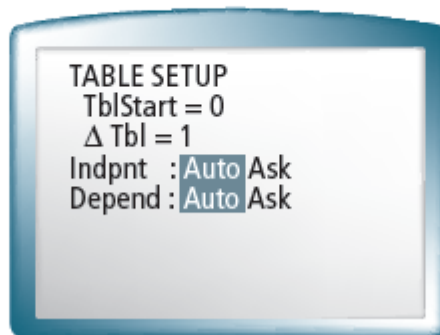Solve the system using a table.

$$y = 3x - 7$$
$$y = -0.5x + 7$$

Step 1

Enter the equations in the (y=) screen.

```
 Plot1      Plot2      Plot3
\Y₁ ▤ 3X − 7
\Y₂ ▤ −0.5X + 7
\Y₃ = 5
\Y₄ = 0
\Y₅ = 1
\Y₆ = 1
\Y₇ = 1
```

Step 2

Use the (tblset) function. Set TblStart to 0 and △Tbl to 1.

```
TABLE SETUP
  TblStart = 0
  △ Tbl = 1
 Indpnt  : Auto Ask
 Depend : Auto Ask
```

Step 3

Press (table) to show the table on the screen.

X	Y₁	Y₂
0	−7	7
1	−4	6.5
2	−1	6
3	2	5.5
4	5	5
5	8	4.5
6	11	4

X=0

1. Which x-value gives the same value for **Y₁** and **Y₂**?

2. What ordered pair is the solution of the system?

Solve the system using a graph.

$$y = -5x + 6$$
$$y = -x - 2$$

Step 1 Enter the equations in the [Y=] screen.

Step 2 Graph the equations. Use a standard graphing window.

Step 3 Use the **calc** [CALC F4 / TRACE] feature. Choose **INTERSECT** to find the point where the lines intersect.

3. Copy and complete: The lines intersect at (_?_ , _?_), so this point is the solution of the system.

4. How can you use the graph to find the solution of the equation $-5x + 6 = -x - 2$?

Exercises

Use a table and a graph to solve each system. Sketch your graph.

5. $y = 5x - 3$
$\quad y = 3x + 1$

6. $y = 2x - 13$
$\quad y = x - 9$

7. $2x - y = 1.5$
$\quad y = -12x - 1.5$

8. How can you use the graph of a system to find the solution of the equation $5x - 3 = 3x + 1$?