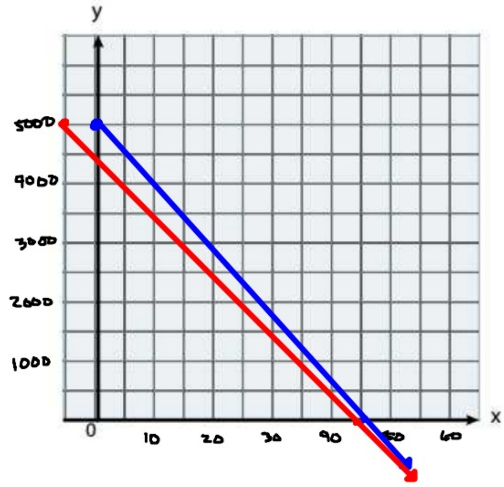
Name ______________________________

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?



$\frac{5000 \text{ ft}}{100 \text{ ft/s}}$ ↓ 50 s

$\frac{5000 \text{ ft}}{110}$ ↓ 45.46 s

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.**

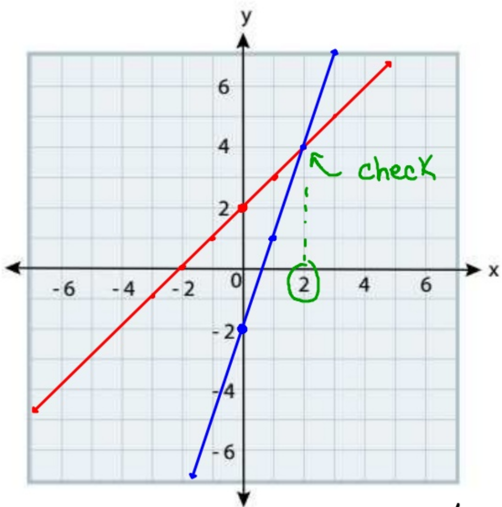
Essential Understanding

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. $y = x + 2$ ←
$y = 3x - 2$ ←

$y = x + 2$
$y = (2) + 2$
$y = 2 + 2$
$y = 4$



$y = 3x - 2$
$y = 3(2) - 2$
$y = 6 - 2$
$y = 4$

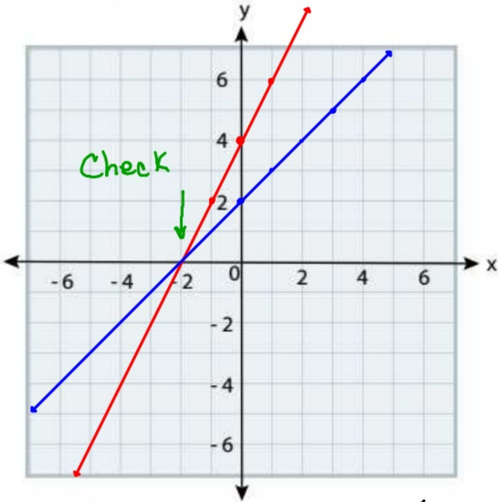
The solution to this system is $(2, 4)$

Your Turn to Work it Out

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

Use $x = -2$

$y = 2x + 4$
$y = 2(-2) + 4$
$y = -4 + 4$
$y = 0$

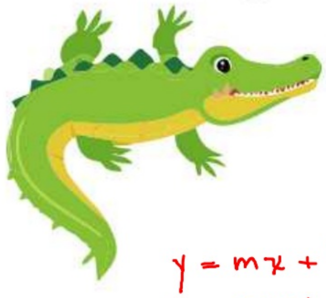


$y = x + 2$
$y = (-2) + 2$
$y = 0$

The solution for this system is $(-2, 0)$

Example #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?

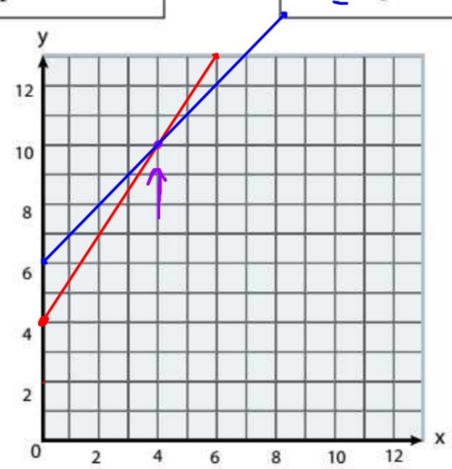


ALLIGATOR 1
Initial Weight: 4 lb
Rate of Growth:
1.5 lb per month

ALLIGATOR 2
Initial Weight: 6 lb
Rate of Growth:
1 lb per month

$y = mx + b$
$y = mx + 4$
$y = 1.5x + 4$

$y = (1.5)(4) + 4$
$y = 10$



$y = mx + b$
$y = mx + 6$
$y = x + 6$

$y = 4 + 6$
$y = 10$

The alligators will weigh the same amount on the 10th month

Your Turn to Work it Out

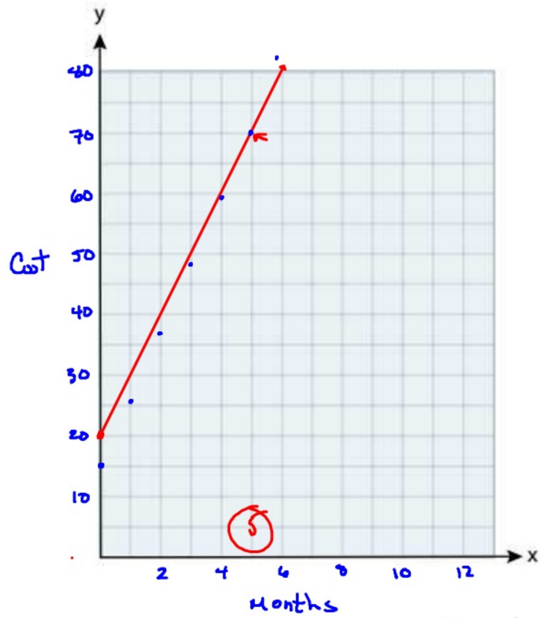
2. One satellite radio service charges $10 per month plus an activation fee of $20. A second service charges $11 per month plus an activation fee of $15. In what month was the cost of the service the same?

$y = 10x + 20$

$y = 10(5) + 20$

$y = 50 + 20$

$y = 70$



$y = 11x + 15$

$y = 11(5) + 15$

$y = 55 + 15$

$y = 70$

the solution to the system is the both with cost $70 at 5 months

$(5, 70)$

Example #3 Systems With Infinitely Many Solutions or No Solution

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

A $2y - x = 2$ → slope int form

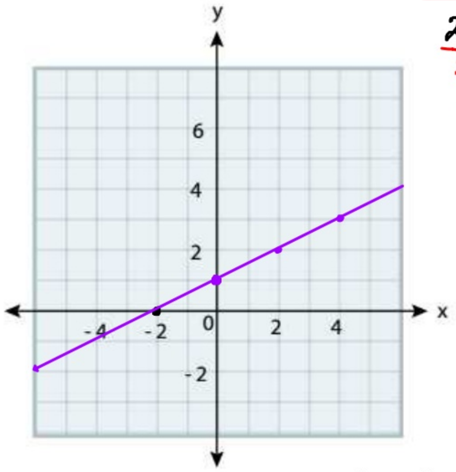
→ $y = \frac{1}{2}x + 1$ ←

$2y - x = 2$

$+x \quad +x$

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

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



these graphs have infinitely many solutions.

They have the same slope

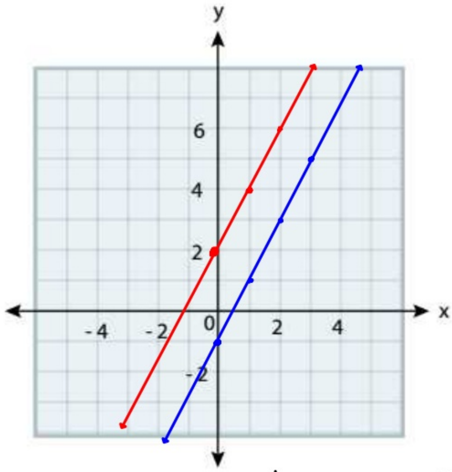
They have the same y-intercept

B $y = 2x + 2$ ←

$y = 2x - 1$ ←

same slope

- difference y-intercept



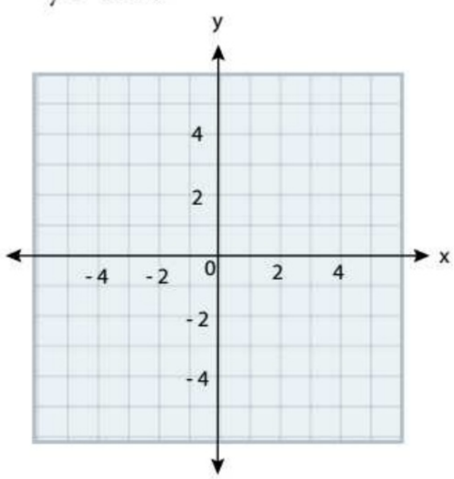
These graph have no solutions

they have the same slope, so they are parallel to each other and will not intersect.

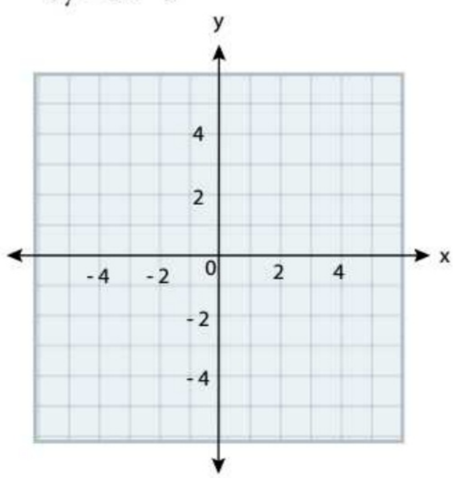
Your Turn to Work it Out

3. What is the solution of each system in parts (a) and (b)? Use a graph. Describe the number of solutions.

A $y = -x - 3$
$y = -x + 5$



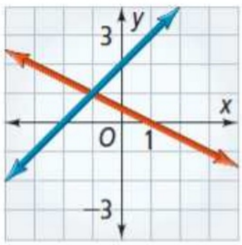
B $y = 3x - 3$
$3y = 9x - 9$



Concept Understanding

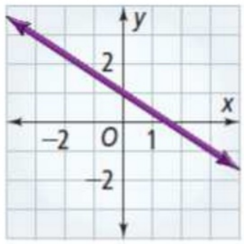
Key Concept: Systems of Linear Equations

One solution



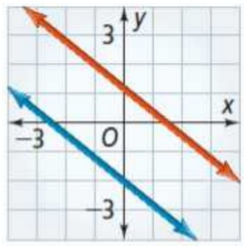
The lines intersect at one point. The lines have different slopes. The equations are consistent and independent.

Infinitely many solutions



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

No solution



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

Lesson 6-1

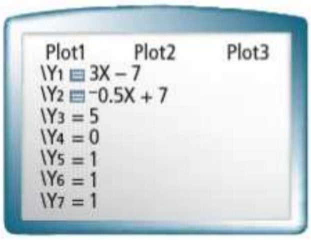
Concept Understanding

Solve the system using a table.

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

Step 1

Enter the equations in the y= screen.

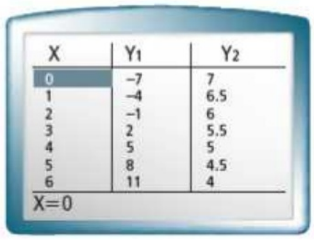


Step 2

Use the tblset function. Set TblStart to 0 and $\triangle$Tbl to 1.

Step 3

Press table to show the table on the screen.



1. Which x-value gives the same value for $\mathbf{Y}_1$ and $\mathbf{Y}_2$?

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

Concept Understanding

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

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

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

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

$y = 5x - 3$ $y = 3x + 1$