

Instruction Coach[™] Mathematics







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Chapter 2

Expressions and Equations

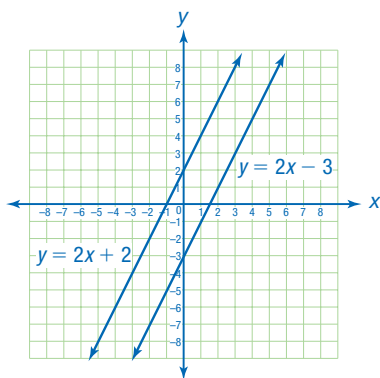
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Solving Systems of Two Linear Equations Graphically

UNDERSTAND You can find the solution of a system by graphing the two lines and identifying the coordinates of the point(s) of intersection. There may be no solution, one solution, or infinitely many solutions.

Find the solution(s) to $y = 2x - 3$
and $y = 2x + 2$.

Graph the equations.

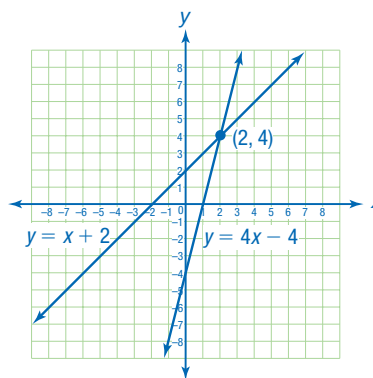


The lines do not intersect.

There is no solution.

Find the solution(s) to $y = 4x - 4$
and $y = x + 2$.

Graph the equations.

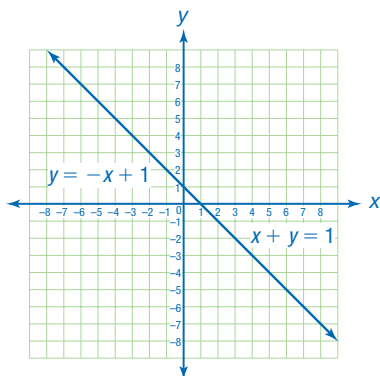


The lines intersect at $(2, 4)$.

There is one solution, $(2, 4)$.

Find the solution(s) to $y = -x + 1$ and $x + y = 1$.

Graph the equations.



The lines are identical. They coincide. **Coincident lines** intersect at every point.

There are infinitely many solutions.

Connect

Find the solution(s) to $y = x + 3$ and $y = 2x - 2$.

1

Find some ordered pairs for $y = x + 3$.

Create a table of values. Use any values for x . Then substitute those x -values and find the resulting y -values.

$$y = x + 3$$

x	y
-3	0
-1	2
1	4
3	6
5	8

2

Find some ordered pairs for $y = 2x - 2$.

Create a table of values. Use any values for x . Then substitute those x -values and find the resulting y -values.

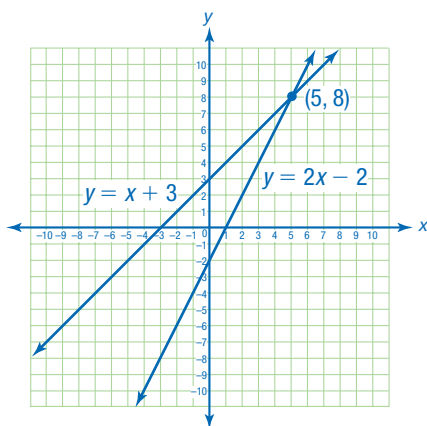
$$y = 2x - 2$$

x	y
-3	-8
-1	-4
1	0
3	4
5	8

3

Graph the system of equations.

Graph the ordered pairs for each equation and draw a line through each set of points.



The one point of intersection is at $(5, 8)$.

► The solution is $(5, 8)$.

4

Check the solution.

Substitute 5 for x and 8 for y in both equations.

$$y = x + 3$$

$$8 \stackrel{?}{=} 5 + 3$$

$$8 = 8 \checkmark$$

$$y = 2x - 2$$

$$8 \stackrel{?}{=} 2(5) - 2$$

$$8 \stackrel{?}{=} 10 - 2$$

$$8 = 8 \checkmark$$

The ordered pair $(5, 8)$ satisfies both equations, so the solution is correct.

TRY

Find the solution(s) to the system $y = -x + 2$ and $y = 2x - 1$.

EXAMPLE A Find the solution(s) to $y = \frac{1}{2}x - 6$ and $y = \frac{1}{2}x$.

1

Find some ordered pairs for

$$y = \frac{1}{2}x - 6.$$

Create a table of values for the equation. Use any values for x . Then find the resulting y -values.

$$y = \frac{1}{2}x - 6$$

x	y
-4	-8
-2	-7
0	-6
2	-5
4	-4

2

Find some ordered pairs for $y = \frac{1}{2}x$.

Create a table of values for the equation. Use any values for x . Then find the resulting y -values.

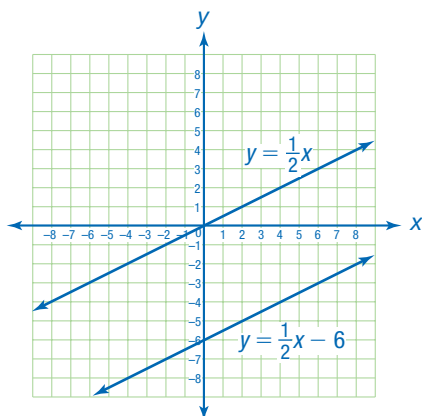
$$y = \frac{1}{2}x$$

x	y
-4	-2
-2	-1
0	0
2	1
4	2

3

Graph the system of equations.

Graph the ordered pairs for each equation and draw a line through each set of points.



► There is no point of intersection. The system of equations has no solution.

DISCUSS

Compare the slopes and y -intercepts of the two equations. Make a conjecture about the solution of any system of equations in which the slopes are the same but the y -intercepts are different. How could you test your conjecture?

EXAMPLE B Find the solution(s) to $3x + y = 2$ and $6x + 2y = 4$.

1

Convert $3x + y = 2$ to slope-intercept form: $y = mx + b$.

$$3x + y = 2 \quad \leftarrow \text{Subtract } 3x \text{ from each side.}$$

$$3x + y - 3x = 2 - 3x$$
$$y = -3x + 2$$

2

Convert $6x + 2y = 4$ to slope-intercept form: $y = mx + b$.

$$6x + 2y = 4 \quad \leftarrow \text{Subtract } 6x \text{ from each side.}$$

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

$$2y = -6x + 4 \quad \leftarrow \text{Divide both sides by 2.}$$

$$y = -3x + 2$$

3

Compare the slopes and y-intercepts of the equations.

$$y = -3x + 2 \quad \text{slope} = -3, \text{ y-intercept} = 2$$

$$y = -3x + 2 \quad \text{slope} = -3, \text{ y-intercept} = 2$$

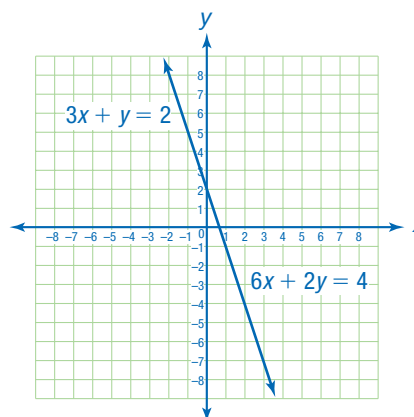
The equations are identical. Because the equations have the same slope and y-intercept, their graphs will intersect at every point.

► The lines coincide and have infinitely many solutions.

4

Check your answer.

You can graph the equations to check that they are coincident.



TRY

Determine whether or not the system $2y = 8x + 6$ and $y = 4x + 3$ has infinitely many solutions. Explain how you know.

Practice

Solve each system of linear equations graphically. Use *Math Tool: Coordinate Plane*.

1. $y = x + 6$
 $y = 2x + 3$

2. $y = x + 2$
 $y = -x$

REMEMBER An equation in slope-intercept form that does not have a b -value intersects the y -axis at 0.

3. $y = \frac{1}{2}x - 4$
 $y = x - 7$

4. $y = 2x + 2$
 $y = -x - 4$

Convert each equation to slope-intercept form.

5. $4x + y = 0$
 $y = \underline{\hspace{2cm}}$

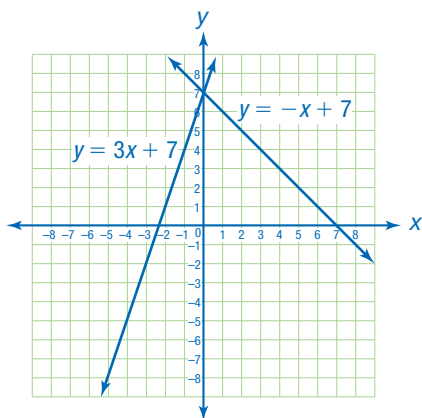
6. $-3x + y = -3$
 $y = \underline{\hspace{2cm}}$

7. $6x + 3y = 18$
 $y = \underline{\hspace{2cm}}$

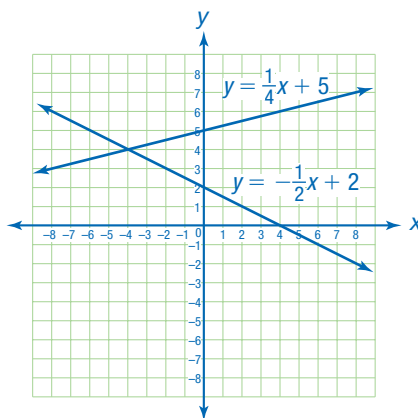
8. $15x - 5y = -10$
 $y = \underline{\hspace{2cm}}$

Determine the solution for each system of linear equations.

9.



10.



Solve each system of linear equations graphically. Use *Math Tool: Coordinate Plane*.

11. $y = \frac{3}{2}x + \frac{1}{2}$
 $y = \frac{3}{2}x - 4\frac{1}{2}$

12. $-2x + y = -5$
 $4x - 2y = 10$

13. $y = -2.5x - 6.5$
 $y = 0.5x - 9.5$

14. $y = \frac{1}{2}x - 5$
 $\frac{1}{5}x - y = 2$

15. $y = -4x + 1$
 $8x + 2y = 3$

16. $3x + y = 10$
 $-9x - 3y = -30$

Without graphing, determine whether each system of equations will have no solution, one solution, or infinitely many solutions. Explain your answer.

17. $y = \frac{3}{5}x + 2$
 $y = \frac{3}{5}x$

18. $y = 6x + 2$
 $-12x + 2y = 4$

Solve.

19. **APPLY** One day, a toy store sells 3 xylophones and 3 yo-yos for \$33. Another day, it sells 2 xylophones and 1 yo-yo for \$19. Equations that represent the sales for the two days are $3x + 3y = 33$ and $2x + y = 19$, where x is the number of xylophones sold and y is the number of yo-yos sold. Solve the system of equations graphically to determine the value of one xylophone and one yo-yo. Use *Math Tool: Coordinate Plane*, and explain your answer.
