Guided Practice 2.2.2

Example 1

Graph the system of equations. Then determine whether the system has one solution, no solution, or infinitely many solutions. If the system has a solution, name it.

$$\begin{cases} 4x-6y=12 \\ y=-x+3 \end{cases}$$

1. Solve each equation for y.

   The first equation needs to be solved for y.

$4x - 6y = 12$	Original equation
$-6y = 12 - 4x$	Subtract $4x$ from both sides.
$y=-2+\frac{2}{3}x$	Divide both sides by –6.
$y=\frac{2}{3}x-2$	Write the equation in slope-intercept form ($y = mx + b$).

   The second equation ($y = -x + 3$) is already in slope-intercept form.

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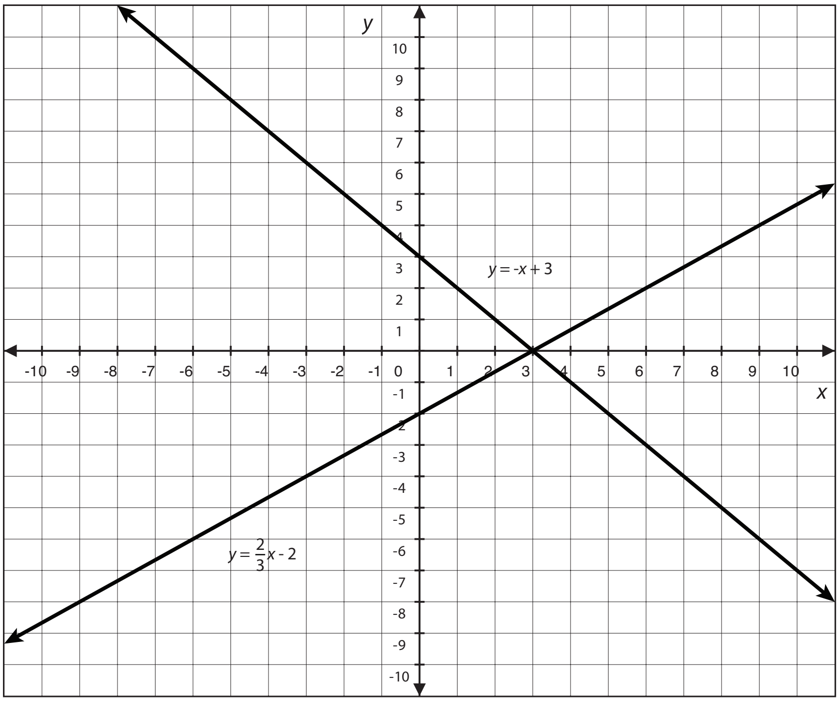
Instruction

2. Graph both equations using the slope-intercept method.

   The y-intercept of $y=\frac{2}{3}x-2$ is –2. The slope is $\frac{2}{3}$.

   The y-intercept of $y = -x + 3$ is 3. The slope is –1.



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3. Observe the graph.

   The lines intersect at the point (3, 0).

   This appears to be the solution to this system of equations.

   To check, substitute (3, 0) into both original equations. The result should be a true statement.

$4x - 6y = 12$	First equation in the system
$4(3) - 6(0) = 12$	Substitute (3, 0) for x and y.
$12 - 0 = 12$	Simplify.
$12 = 12$	This is a true statement.

$y = -x + 3$	Second equation in the system
$(0) = -(3) + 3$	Substitute (3, 0) for x and y.
$0 = -3 + 3$	Simplify.
$0 = 0$	This is a true statement.

4. The system $\begin{cases} 4x - 6y = 12 \\ y = -x + 3 \end{cases}$ has one solution, (3, 0).

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Example 2

Graph the system of equations. Then determine whether the system has one solution, no solution, or infinitely many solutions. If the system has a solution, name it.

$$\begin{cases} -8x+4y=4 \\ y=2x+1 \end{cases}$$

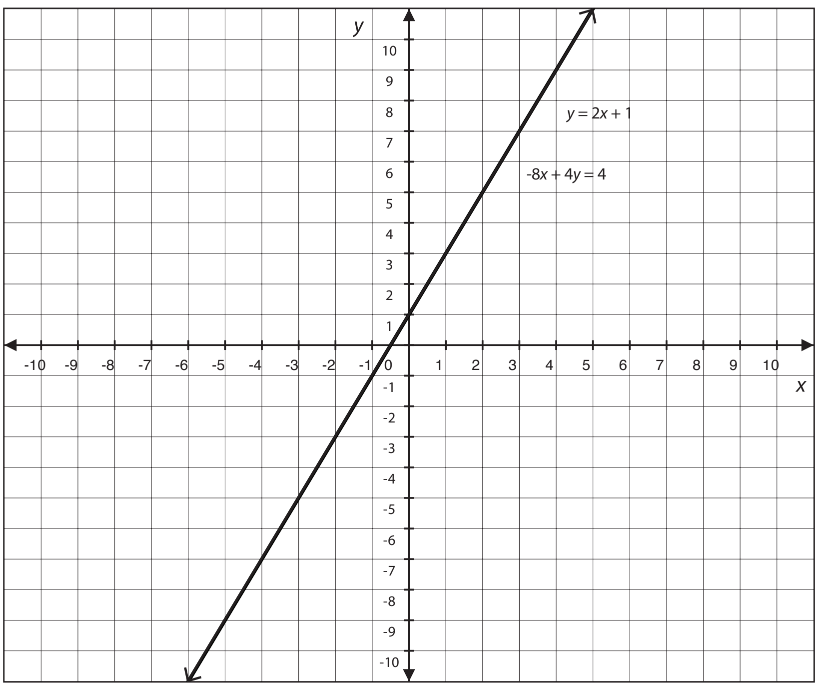
1. Solve each equation for y.

   The first equation needs to be solved for y.

$-8x + 4y = 4$	Original equation
$4y = 4 + 8x$	Add $8x$ to both sides.
$y = 1 + 2x$	Divide both sides by 4.
$y = 2x + 1$	Write the equation in slope-intercept form ($y = mx + b$).

   The second equation ($y = 2x + 1$) is already in slope-intercept form.

2. Graph both equations using the slope-intercept method.
   The y-intercept of both equations is 1.
   The slope of both equations is 2.



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3. Observe the graph.

   The graphs of $y = 2x + 1$ and $-8x + 4y = 4$ are the same line.

   There are infinitely many solutions to this system of equations.

   To check, choose any point on the graph of $-8x + 4y = 4$ and substitute it into both original equations. The result should be a true statement. Let's use (2, 5).

$-8x + 4y = 4$	First equation of the system
$-8(2) + 4(5) = 4$	Substitute (2, 5) for x and y.
$-16 + 20 = 4$	Simplify.
$4 = 4$	This is a true statement.

$y = 2x + 1$	Second equation of the system
$(5) = 2(2) + 1$	Substitute (2, 5) for x and y.
$5 = 4 + 1$	Simplify.
$5 = 5$	This is a true statement.

   You could choose any other point on the line of $-8x + 4y = 4$ to show it is true for any point, and not just for the point you originally chose. Let's try again with (1, 3).

$-8x + 4y = 4$	First equation of the system
$-8(1) + 4(3) = 4$	Substitute (1, 3) for x and y.
$-8 + 12 = 4$	Simplify.
$4 = 4$	This is a true statement.

$y = 2x + 1$	Second equation of the system
$(3) = 2(1) + 1$	Substitute (1, 3) for x and y.
$3 = 2 + 1$	Simplify.
$3 = 3$	This is a true statement.

4. The system $\begin{cases} -8x + 4y = 4 \\ y = 2x + 1 \end{cases}$ has infinitely many solutions. ✓

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Example 3

Graph the system of equations. Then determine whether the system has one solution, no solution, or infinitely many solutions. If the system has a solution, name it.

$$\begin{cases} -6x+2y=8 \\ y=3x-5 \end{cases}$$

1. Solve each equation for y.

   The first equation needs to be solved for y.

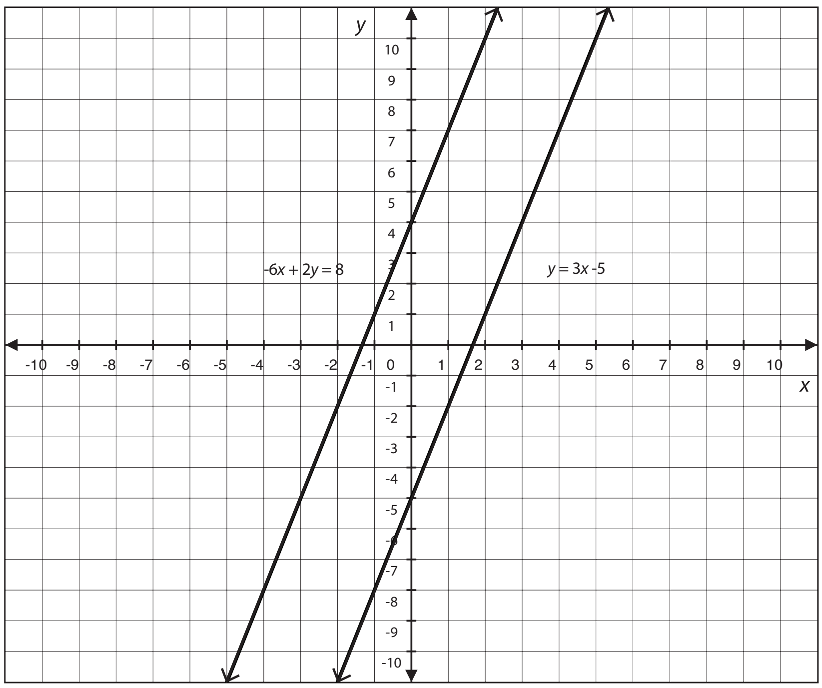
$-6x + 2y = 8$	Original equation
$2y = 8 + 6x$	Add $6x$ to both sides.
$y = 4 + 3x$	Divide both sides by 2.
$y = 3x + 4$	Write in slope-intercept form ($y = mx + b$).

   The second equation ($y = 3x - 5$) is already in slope-intercept form.

2. Graph both equations using the slope-intercept method.

   The y-intercept of $y = 3x + 4$ is 4. The slope is 3.

   The y-intercept of $y = 3x - 5$ is –5. The slope is 3.



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3. Observe the graph.

   The graphs of $-6x + 2y = 8$ and $y = 3x - 5$ are parallel lines and never cross.

   There are no values for x and y that will make both equations true.

4. The system $\begin{cases} -6x+2y=8 \\ y=3x-5 \end{cases}$ has no solutions. ✓

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