Warm Up

Determine if the given ordered pair is an element of the solution set of

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

2(3)-1=5
5=5
3(1)+3=6

1. (3, 1) ✓ **2.** (−1, 1)

Solve each equation for *y*.

3. $x + 3y = 2x + 4y - 4$
-2x -3y -2x -3y
-x = y-4
y=4-x

4. $6x + 5 + y = 3y + 2x - 1$

15.

$x + y = 0$	
$-2 + 2$	0
0	0 ✓

$7y - 14x = 42$	
$7(2) - 14(-2)$	42
42	42 ✓

Because the point is a solution of both equations, (−2, 2) is a solution of the system.

16.

$2y - 6x = 8$	
$2(-5) - 6(-3)$	8
8	8 ✓

$4y = 8x + 4$	
$4(-5)$	$8(-3) + 4$
-20	-20 ✓

Because the point is a solution of both equations, (−3, −5) is a solution of the system.

17.

$y = 2$	
2	2 ✓

$y + 8 = 6x$	
$(2) + 8$	$6(3)$
10	18 ✗

Because the point is not a solution of both equations, (3, 2) is not a solution of the system.

18. $y = 8x + 2$

1	8(6) + 2
1	50 ✗

Because the point is not a solution of both equations, (6, 1) is not a solution of the system.

19. $\begin{cases} 2 + y = x \\ x + y = 4 \end{cases}$

$y = x - 2$

x	y
0	−2
1	−1
3	1

$y = -x + 4$

x	y
0	4
1	3
3	1

The solution to the system is (3, 1).

20. $\begin{cases} 4y - 2x = 4 \\ 10x - 5y = 10 \end{cases}$

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

x	y
0	1
2	2
4	3

$y = 2x - 2$

x	y
0	−2
2	2
4	6

The solution to the system is (2, 2).

21. $\begin{cases} 12x + 4y = -4 \\ 2x - y = 6 \end{cases}$

$y = -3x - 1$

x	y
0	−1
1	−4
2	−7

$y = 2x - 6$

x	y
0	−6
1	−4
2	−2

The solution to the system is (1, −4).

22. $\begin{cases} y = 10 - x \\ 3x - 3y = 0 \end{cases}$

$y = -x + 10$

x	y
−5	15
0	10
5	5

$y = x$

x	y
−5	−5
0	0
5	5

The solution to the system is (5, 5).

23. $-27y = -24x + 42$

$y = \frac{8}{9}x - \frac{14}{9}$

$9y = 8x - 14$

$y = \frac{8}{9}x - \frac{14}{9}$

consistent, dependent; infinite number of solutions

24. $\frac{3}{2}x + 9 = 45$

$y = \frac{3}{2}x + 9$

$4y - 6x = 36$

$4y = 6x + 36$

$y = \frac{3}{2}x + 9$

consistent, dependent; infinite number of solutions

25. $7y + 42x = 56$

$7y = -42x + 56$

$y = -6x + 8$

$25x - 5y = 100$

$5y = 25x - 100$

$y = 5x - 20$

consistent, independent; one solution

26. $3y = 2x$

$y = \frac{2}{3}x$

$-4x + 6y = 3$

$6y = 4x + 3$

$y = \frac{2}{3}x + \frac{1}{2}$

inconsistent; no solution

27. Let x be the number of systems sold, and y be the total money earned.

Jamail: $y = 100x + 2400$

Wanda: $y = 120x + 2200$

$y = 100x + 2400$

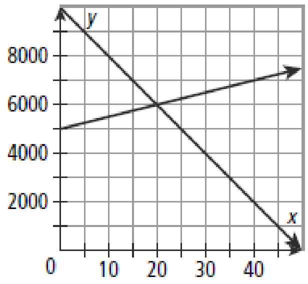
x	y
2	2600
4	2800
6	3000
8	3200
10	3400

$y = 120x + 2200$

x	y
2	2440
4	2680
6	2920
8	3160
10	3400

So they have to sell 10 systems to earn the same amount.

33a. Lynn: $l = -200x + 10{,}000$
Miguel: $m = 50x + 5000$



b. from the graph:
20 min

c. from the graph:
6000 ft

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

consistent, independent

$-x + 6 = 2x - 3$
$-3x + 6 = -3$
$-3x = -9$
$x = 3$

$y = -x + 6$
$y = -(3) + 6$
$y = 3$

The solution of the system is (3, 3).

36. $\begin{cases} x = 2 \\ y = 3 \end{cases}$

consistent, independent
The solution to the system is (2, 3).

37. $\begin{cases} y = 3x + 1 \\ y = 3x - 3 \end{cases}$

inconsistent; no solution

47. D

48. G

49. B

56a. Brad: $y = -12x + 70$
Cliff: $y = -15x + 100$
$-12x + 70 = -15x + 100$
$3x + 70 = 100$
$3x = 30$
$x = 10$ days

b. Brad: $y = -12(10) + 70$
$y = -50$ lb
Cliff: $y = -15(10) + 100$
$y = -50$ lb
No; they will both run out of food before that time.

c. Brad: $y = -12(4) + 70 + 100$
$y = 122$ lb
Cliff: $y = -15(4) + 100 + 100$
$y = 140$ lb
On day 10 (6 days later) they have used up:
Brad: $-12(6) = -72$ lb
$122 - 72 = 50$ lb
Cliff: $-15(6) = -90$ lb
$140 - 90 = 50$ lb
The answer would make sense. Each farmer would have 50 lb of food on day 10.

Objectives

Solve systems of equations by substitution.

Solve systems of equations by elimination.

3-2 Using Algebraic Methods to Solve Linear Systems

Vocabulary

substitution

elimination

Holt Algebra 2
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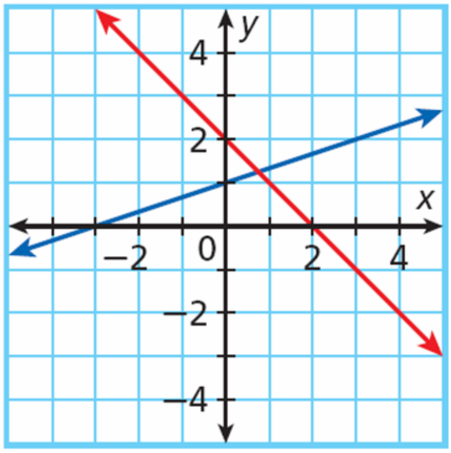
The graph shows a system of linear equations. As you can see, without the use of technology, determining the solution from the graph is not easy. You can use the *substitution* method to find an exact solution. In **substitution**, you solve one equation for one variable and then substitute this expression into the other equation.



Since we will know what either y equals or what x equals we can just plug it in and solve for the other variable. Once we have one variable, we can find the other.

Use substitution to solve the system of equations.

$$\begin{cases} y = x - 1 \\ x + y = 7 \end{cases}$$

$x + (x-1) = 7$

$2x - 1 = 7$

$2x = 8$

$x = 4$

$y = 4 - 1$

$y = 3$

$(4, 3)$

Use substitution to solve the system of equations.

$$\begin{cases} 2y + x = 4 \\ 3x - 4y = 7 \end{cases}$$

$x = 4 - 2y$

$3(4-2y) - 4y = 7$

$12 - 6y - 4y = 7$

$12 - 10y = 7$

$-10y = -5$

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

$x = 4 - 2(\frac{1}{2})$

$x = 3$

$(3, \frac{1}{2})$

Use substitution to solve the system of equations.

$$\begin{cases} y = 2x - 1 \\ 3x + 2y = 26 \end{cases}$$

$3x + 2(2x-1) = 26$

$3x + 4x - 2 = 26$

$7x = 28$

$x = 4$

$y = 2(4) - 1$

$y = 7$

$(4, 7)$

Use substitution to solve the system of equations.

$$\begin{cases} 5x + 6y = -9 \\ 2x - 2 = -y \end{cases}$$

You can also solve systems of equations with the *elimination* method. With **elimination**, you get rid of one of the variables by adding or subtracting equations. You may have to multiply one or both equations by a number to create variable terms that can be eliminated.

Reading Math

The elimination method is sometimes called the *addition method* or *linear combination*.

To use elimination:
1) Scale the equations so there is a positive and negative of the same number tied to a variable.
2) Add the equations together, one variable will disappear.
3) Solve for remaining variable and substitute in equation to get answer.

Use elimination to solve the system of equations.

$$\begin{cases} 3x + 2y = 4 \\ 4x - 2y = -18 \end{cases}$$

Use elimination to solve the system of equations.

$$2(\;3x + 5y = -16\;)$$
$$-3(\;2x + 3y = -9\;)$$

$$6x + 10y = -32$$
$$+\; -6x - 9y = 27$$
$$1y = -5$$
$$y = -5$$

$$(3, -5)$$

$$3x + 5(-5) = -16$$
$$3x - 25 = -16$$
$$3x = 9$$
$$x = 3$$

Use elimination to solve the system of equations.

$$\begin{cases} 4x + 7y = -25 \\ -12x - 7y = 19 \end{cases}$$

$-8x = -6$

$x = \frac{3}{4}$

$4\left(\frac{3}{4}\right) + 7y = -25$

$3 + 7y = -25$

$7y = -28$

$y = -4$

Use elimination to solve the system of equations.

$$\begin{cases} 5(5x - 3y = 42) \\ 3(8x + 5y = 28) \end{cases}$$

$25x - 15y = 210$

$24x + 15y = 84$

$49x = 294$

$x = 6$

$5(6) - 3y = 42$

$-3y = 12$

$y = -4$

$(6, -4)$

In Lesson 3-1, you learned that systems may have infinitely many or no solutions. When you try to solve these systems algebraically, the result will be an identity or a contradiction.

Remember!

An *identity*, such as 0 = 0, is always true and indicates infinitely many solutions. A *contradiction*, such as 1 = 3, is never true and indicates no solution.

We are looking for identities and contradictions. If you find a contradiction then there are no solutions, if you find an identity then there are infinitely many solutions.

Classify the system and determine the number of solutions.

$$\begin{cases} 3x + y = 1 \\ 2y + 6x = -18 \end{cases}$$

$y = 1 - 3x$

No soln

$2(1-3x)+6x=-18$

$2-6x+6x=-18$

$2=-18$

Classify the system and determine the number of solutions.

$$\begin{cases} 56x + 8y = -32 \\ 7x + y = -4 \end{cases}$$

$y=-7x-4$

infinite soln

$56x+8(-7x-4)=-32$

$56x-56x-32=-32$

$-32=-32$

Classify the system and determine the number of solutions.

$$\begin{cases} 6x + 3y = -12 \\ 2x + y = -6 \end{cases}$$

Develop your own system of equations. What are the solutions, if any?

A coffee blend contains Sumatra beans which cost $5/lb, and Kona beans, which cost $13/lb. If the blend costs $10/lb, how much of each type of coffee is in 50 lb of the blend?

x (Sumatra), y (Kona)

lb: $x + y = 50$

\$: $5x + 13y = 500$

Homework:

p. 194 #16-26(even), 28-31, 34, 36, 40-44