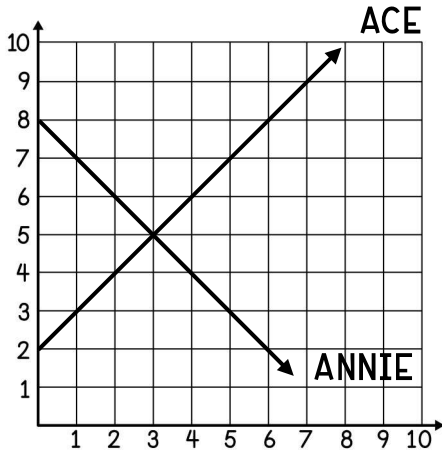


INTRO TO SYSTEMS OF EQUATIONS

Ace and Annie graphed linear equations on the same grid as shown below. Use their graphs to answer a-d.



a. Write an equation to represent each person's line.

ACE: $y = x + 2$

ANNIE: $y = -x + 8$

- b. List the ordered pair where the lines intersect. $(3, 5)$
- c. Is the point above a solution to Ace's equation? Give two ways you can tell. Yes; it is a point on the graphed line and the values of x and y make the equation true when plugged in.
- d. Is the point from part b also a solution to Annie's equation? Give two ways you can tell. Yes; it is a point on the graphed line and the values of x and y make the equation true when plugged in.

SYSTEM OF EQUATIONS

- A system of equations is a set of more than one equation with the same variables.
- The point of intersection of two graphed equations is the solution of the system of equations, or the ordered pair that makes both equations true.

1. Use the system of linear equations graphed below to answer a-d.

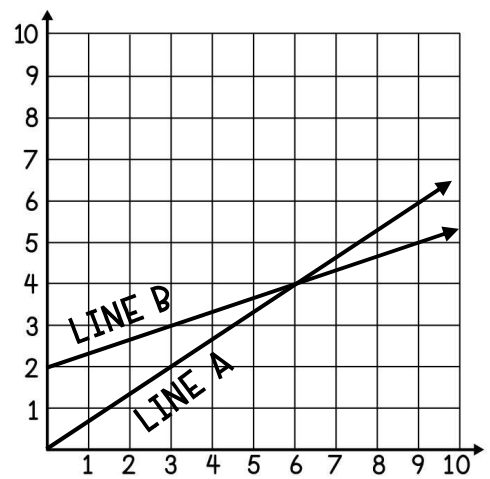
a. List the two linear equations graphed at the right.

A: $y = 2/3x$ B: $y = 1/3x + 2$

b. What is the solution to the system of equations? $(6, 4)$

c. Show work below to prove your answer is correct.

$y = 2/3x$	$y = 1/3x + 2$
$4 = (2/3)(6)$	$4 = (1/3)(6) + 2$
$4 = 4$	$4 = 2 + 2$
	$4 = 4$

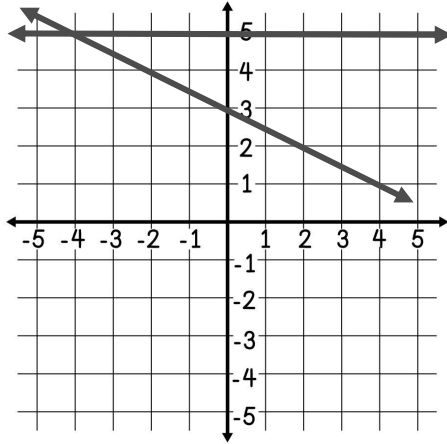


d. Record if each ordered pair below is a solution to equation A, B, both or neither.

$(3, 2)$: A $(4, 6)$: Neither $(3, 3)$: B $(6, 4)$: Both

In 2-3, graph the system of equations to find the solution to the system. Then, use the check step to prove that the solution works in both equations. Show all work.

2. $y = -\frac{1}{2}x + 3$
 $y = 5$



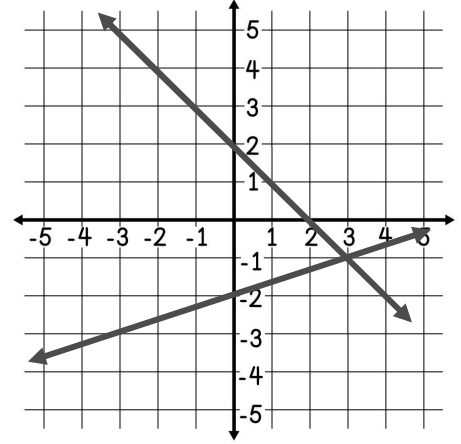
Solution:

$(-4, 5)$

CHECK:

$$\begin{array}{ll} y = -1/2x + 3 & y = 5 \\ 5 = -1/2(-4) + 3 & 5 = 5 \\ 5 = 2 + 3 & \\ 5 = 5 & \end{array}$$

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



Solution:

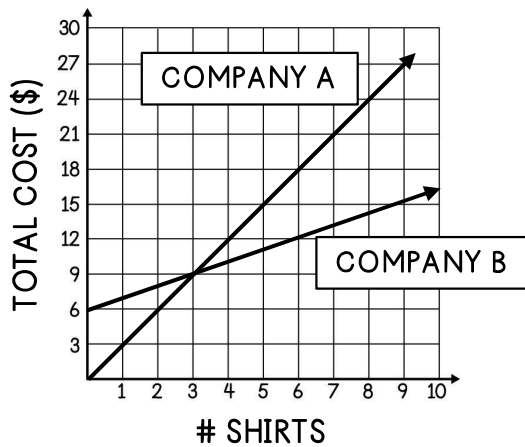
$(3, -1)$

CHECK:

$$\begin{array}{ll} y = 1/3x - 2 & y = -x + 2 \\ -1 = 1/3(3) - 2 & -1 = -3 + 2 \\ -1 = 1 - 2 & -1 = -1 \\ -1 = -1 & \end{array}$$

For 4-5, use the graph to answer a-c.

4. The total cost of two t-shirt companies based on the number of shirts ordered is shown below.



a. Write an equation to represent each company.

Company A: $y = 3x$
 Company B: $y = x + 6$

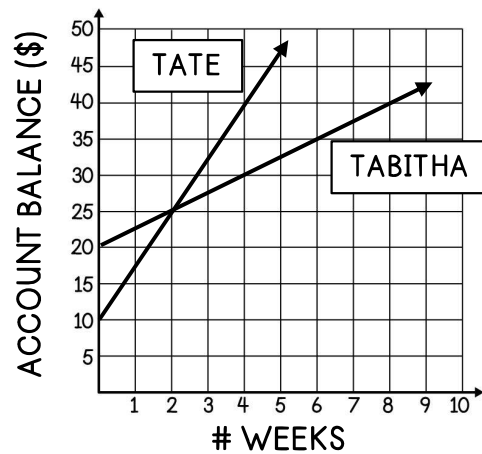
b. How many shirts would need to be ordered for the cost to be the same at either company? What would the total cost be?

3 shirts; \$9

c. If Justin needs to order 5 shirts, which company would be the cheaper option?

Company B

5. The balance of two siblings' savings accounts based on the number of weeks is shown below.



a. Describe the amount each sibling started with and the rate at which his or her account balance is changing.

Tate began with \$10 and saves at a rate of \$7.50 each week. Tabitha began with \$20 and saves at a rate of \$2.50 each week.

b. After how many weeks will the siblings have the same amount, and what will the amount be?

2 weeks; \$25

c. Which sibling will have the highest balance after 5 weeks?

Tate

INTRO TO SYSTEMS OF EQUATIONS

Use the system of equations in A-C to answer the questions.

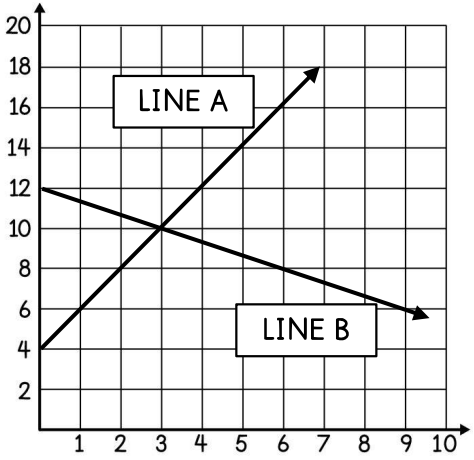
A Use the graphed system of equations to answer 1-3.

1. Write the equation of each line in slope-intercept form.
A: $y = 2x + 4$ B: $y = -\frac{2}{3}x + 12$

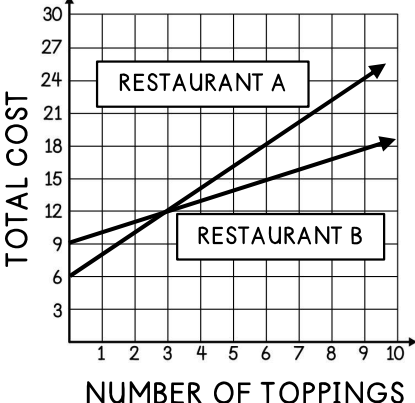
2. What is the solution to the system of equations? (3, 10)

3. Show work below to prove the solution is correct.

$10 = 2(3) + 4$	$10 = -\frac{2}{3}(3) + 12$
$10 = 6 + 4$	$10 = -2 + 12$
$10 = 10$	$10 = 10$



B The graph shows the cost of a pizza at two restaurants based on the number of toppings ordered. Use the graph to answer 4-6.



4. Write the equation of each line in slope-intercept form.
A: $y = 2x + 6$ B: $y = x + 9$

5. What is the solution to the system of equations? (3, 12)

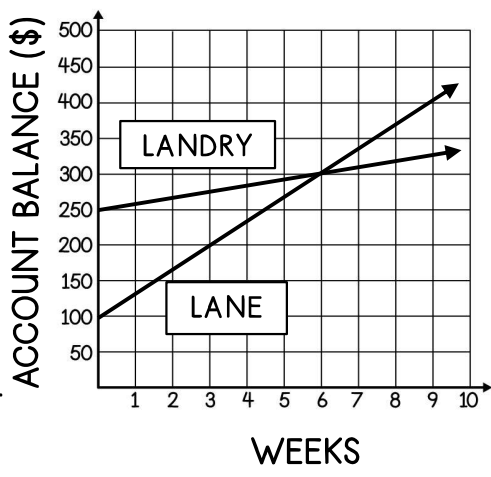
6. What does the solution mean in the context of the situation?
A pizza with 3 toppings will cost \$12 at either restaurant.

C The graph compares the amount of money in two accounts based on the number of weeks each person has been saving. Use the graph to answer 7-8.

7. What is the solution to the system of equations? (6, 300)

8. Which statement is true?

- At 6 weeks, Lane and Landry will have the same amount of money.
- After 6 weeks, Lane will have more money than Landry.
- Lane saves at a rate more than three times that of Landry.
- All of the above.



SOLVING SYSTEMS BY GRAPHING

When solving a system of equations by graphing, the solution to the system of equations is the point of intersection on the graph. Brainstorm and answer the following:

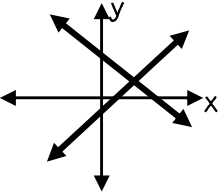
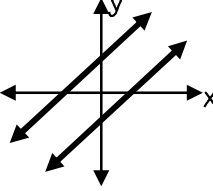
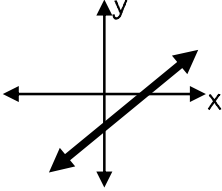
Would it be possible to have a system of equations with "no solution"? Explain.

Sample: Yes, if the lines were parallel and did not intersect.

Would it be possible to have a system of equations with infinitely many solutions? Explain.

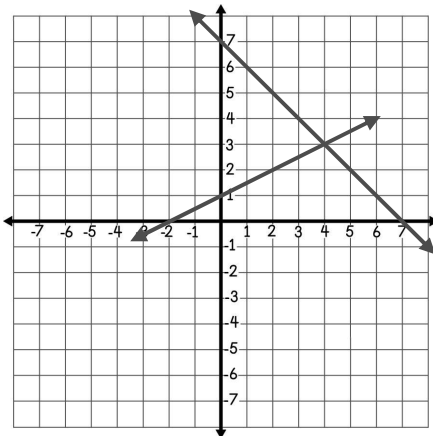
Sample: Yes, if the lines shared all of the same points (the same line).

The table below describes the characteristics of the types of solutions on a graph.

<u>ONE</u> SOLUTION	<u>NO</u> SOLUTION	<u>INFINITELY MANY</u>
<p>Lines have <u>different slopes</u> and intersect at <u>one</u> point.</p> 	<p>Lines have the same <u>slope</u> and different y-intercepts; they do not intersect.</p> 	<p>Lines have the same <u>slope</u> and same y-intercept.</p> 

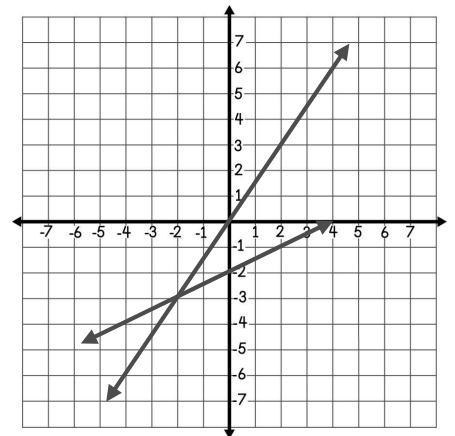
For 1-2, solve the system of equations by graphing.

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



Solution: (4, 3)

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



Solution: (-2, -3)

When solving a system of equations by graphing, equations should first be written in slope - intercept form. Practice rewriting equations A-C in slope-intercept form.

A. $2x + y = 7$

$y = -2x + 7$

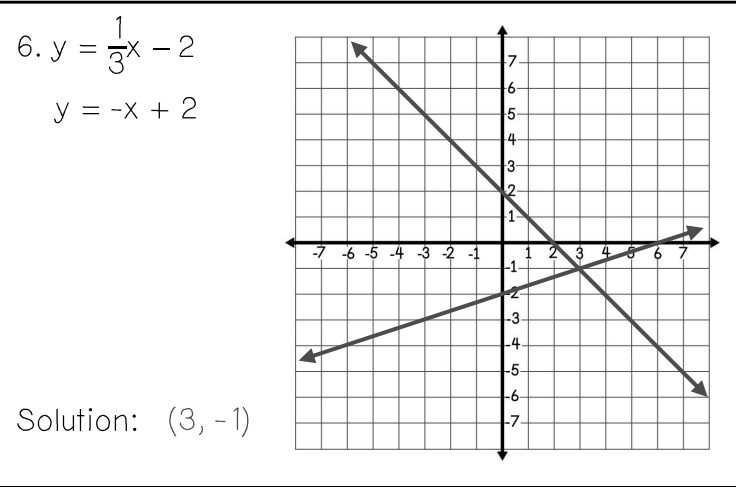
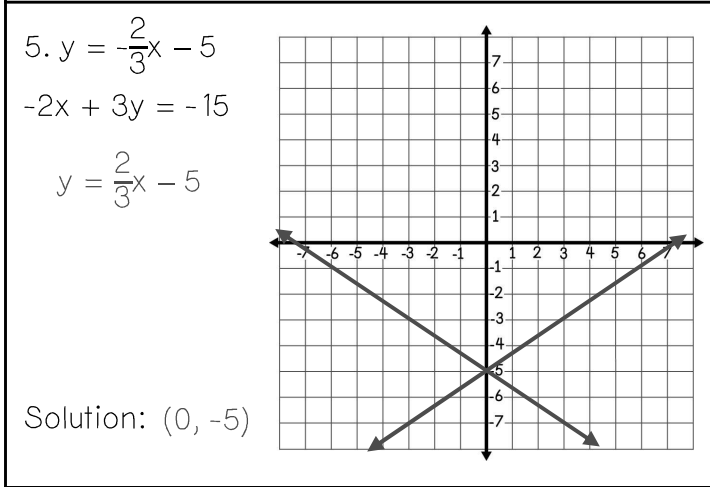
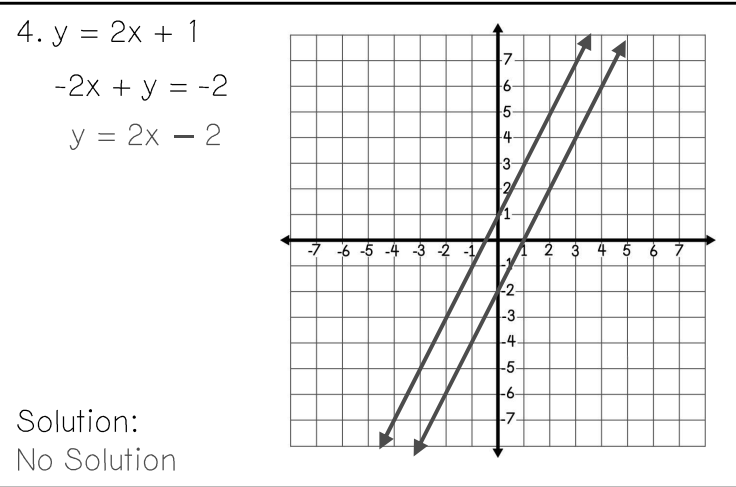
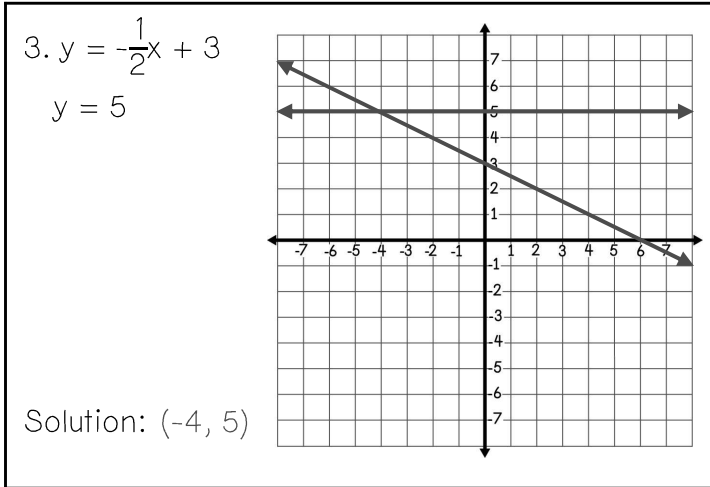
B. $x + 3y = -9$

$y = -\frac{1}{3}x - 3$

C. $-4x - 2y = -12$

$y = -2x + 6$

In 3-6, solve the system of equations by graphing. If necessary, rewrite equations in slope-intercept form first.



7. Constance graphed a system of equations with no solution. If the first equation was $y = 6x - 2$, circle the letter of the equation that could be the second equation in the system. Explain your choice.

Sample: When equation A is written in slope-intercept form, it has the same slope but a different y-intercept. The lines would be parallel with no solution.

A
B
C

$-24x + 4y = 8$

$-12x + 2y = -4$

$18x + 3y = -6$

8. Jude's water balloon is empty but filling up at a rate of 5 mL per second. Ian's water balloon contains 45 mL of water and is losing 10 mL of water per second.

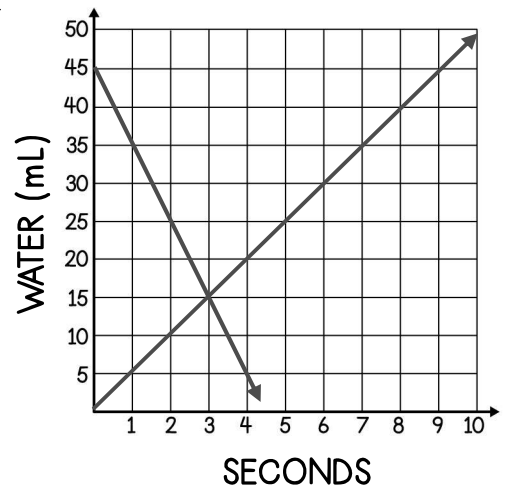
a. Write an equation to represent y , the amount of water in each balloon based on x , the number of seconds.

Jude: $y = 5x$
 Ian: $y = -10x + 45$

b. Graph each equation.

c. What is the solution to the system of equations, and what does it mean in the context of the situation?

The solution to the system is $(3, 15)$ which means that both balloons will have 15 mL after 3 seconds.



SOLVING SYSTEMS BY GRAPHING

Use your knowledge of solving systems by graphing to answer each question below.

1. Ashton graphed a system of equations with infinitely many solutions. What must be true about the equations of the lines?

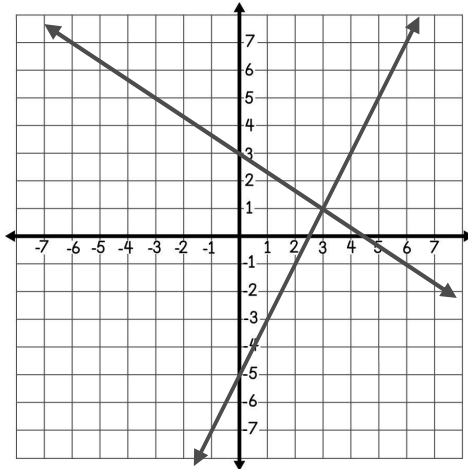
- a. They have the same slope.
- b. They have different y-intercepts.
- c. The lines are parallel.
- d. All of the above.

2. Willa graphed a system of equations on the same coordinate grid. The equations had the same slope, but the y-intercepts were different. Which must be true?

- a. The system has infinitely many solutions.
- b. The system has one solution.
- c. The system has no solution.
- d. There is not enough information to tell.

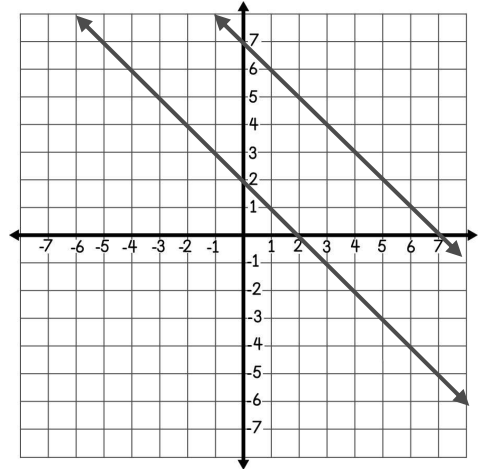
Solve each system of equations below by graphing.

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



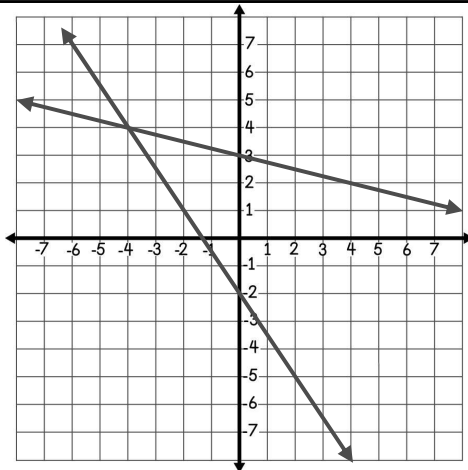
Solution: (3, 1)

4. $y = -x + 7$
 $5x + 5y = 10$



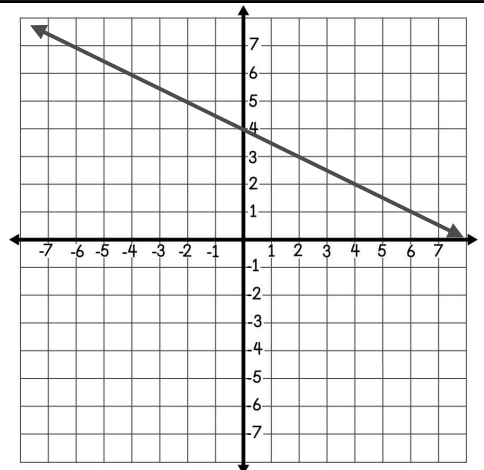
Solution: No solution

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



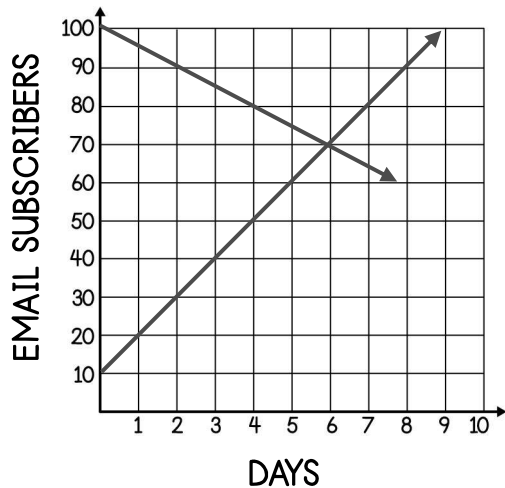
Solution: (-4, 4)

6. $y = -\frac{1}{2}x + 4$
 $x + 2y = 8$



Solution: Infinitely many solutions

Mia currently has 10 email subscribers to her blog and gains an average of 10 new subscribers per day. Julie currently has 100 email subscribers to her blog and loses an average of 5 email subscribers per day. Use this information to answer questions 7-10.



7. Write an equation to represent y , the total number of subscribers after x days for each girl.

Mia: $y = 10x + 10$

Julie: $y = -5x + 100$

8. Graph each equation on the grid at the left.

9. What is the solution to the system of equations?

$(6, 70)$

10. What does the solution mean in the context of the situation?

After 6 days, both Mia and Julie will have 70 email subscribers.

SOLVING SYSTEMS BY SUBSTITUTION: PART I

STEPS TO SOLVE SYSTEMS BY SUBSTITUTION

- Solve _____ one of the equations for “y =” if necessary.
- Substitute _____ the value for “y” in the second equation.
- Solve _____ the new equation to find “x”.
- Substitute _____ the value for “x” in either of the original equations to find “y”.
- Check _____ your answer by plugging the x and y-values back into the original equations.

Solve each system of equations using substitution. Be sure to check your solution.

1. $y = 3x$
 $x + y = -32$

$(-8, -24)$

✓CHECK:

$y = 3x$	$x + y = -32$
$-24 = 3(-8)$	$-8 + -24 = -32$
$-24 = -24$	$-32 = -32$

2. $y = 9x - 2$
 $y = 3x + 10$

$(2, 16)$

✓CHECK:

$y = 9x - 2$	$y = 3x + 10$
$16 = 9(2) - 2$	$16 = 3(2) + 10$
$16 = 18 - 2$	$16 = 6 + 10$
$16 = 16$	$16 = 16$

3. $y = -x + 4$
 $5x + 6y = 13$

$(11, -7)$

✓CHECK:

$y = -x + 4$	$5x + 6y = 13$
$-7 = -11 + 4$	$5(11) + 6(-7) = 13$
$-7 = -7$	$55 + (-42) = 13$
	$13 = 13$

4. $-3x + 4y = 7$
 $y = 3x - 5$

$(3, 4)$

✓CHECK:

$-3x + 4y = 7$	$y = 3x - 5$
$-3(3) + 4(4) = 7$	$4 = 3(3) - 5$
$-9 + 16 = 7$	$4 = 9 - 5$
$7 = 7$	$4 = 4$

<p>5.</p> $\begin{aligned} -2x + y &= -3 \\ -6x + 4y &= 4 \end{aligned}$ <p style="text-align: right;">(8, 13)</p>	<p>6.</p> $\begin{aligned} -10x + 2y &= 4 \\ -9x + 3y &= 18 \end{aligned}$ <p style="text-align: right;">(2, 12)</p>
<p>✓CHECK:</p> $\begin{aligned} -2x + y &= -3 \\ -2(8) + 13 &= -3 \\ -16 + 13 &= -3 \\ -13 &= -13 \end{aligned}$	<p>✓CHECK:</p> $\begin{aligned} -6x + 4y &= 4 \\ -6(8) + 4(13) &= 4 \\ -48 + 52 &= 4 \\ 4 &= 4 \end{aligned}$
$\begin{aligned} -10x + 2y &= 4 \\ -10(2) + 2(12) &= 4 \\ -20 + 24 &= 4 \\ 4 &= 4 \end{aligned}$	$\begin{aligned} -9x + 3y &= 18 \\ -9(2) + 3(12) &= 18 \\ -18 + 36 &= 18 \\ 18 &= 18 \end{aligned}$

Apply your knowledge of solving systems using substitution to answer the questions below.

7. The sum of Andy and Brett's ages is 44. Andy's age is 8 more than twice Brett's age.

a. What are the variables in this situation? Andy's age (x) and Brett's age (y)

b. Write a system of equations that could be used to represent the situation.

$$\begin{aligned} x + y &= 44 \\ x &= 8 + 2y \end{aligned}$$

c. Solve the system of equations by using substitution. Then, list Andy's age and Brett's age.

Andy- 32, Brett- 12

8. Describe some advantages to solving a system of equations by substitution instead of by graphing.

Sample answer: Equations don't have to be in slope-intercept form. Also, equations with larger values can be time consuming to graph or may not fit on the specific intervals of a coordinate plane.

Summarize today's lesson:

SOLVING SYSTEMS BY SUBSTITUTION: PART I

Solve each system of equations by substitution. Match each answer below to help you solve the riddle.

E	1 $y = x + 2$ $5x - 4y = -3$ (5, 7)	S
R	3 $y = 5x - 9$ $-2x - 3y = -7$ (2, 1)	L
A	5 $x + y = 75$ $10x + y = 48$ (-3, 78)	B
G	7 $y = 2x + 3$ $y = -2x + 15$ (3, 9)	O
	2 $3x - 8y = 24$ $y = x - 8$ (8, 0)	
	4 $-4x + y = 6$ $y = 7x - 6$ (4, 22)	
	6 $y = x + 8$ $4x - 2y = -12$ (2, 10)	
	8 $-3x - 4y = 2$ $6x + 6y = -6$ (-2, 1)	

A: (-3, 78)	C: (4, 18)	O: (-2, 1)	L: (4, 22)	M: (50, 3)	E: (5, 7)
R: (2, 1)	D: (10, 2)	G: (3, 9)	U: (-5, 7)	S: (8, 0)	B: (2, 10)

WHAT DO YOU CALL YOUR FRIENDS IN MATH CLASS?

$\frac{A}{5}$ $\frac{L}{4}$ $\frac{G}{7}$ $\frac{E}{1}$ $\frac{B}{6}$ $\frac{R}{3}$ $\frac{O}{8}$ $\frac{S}{2}$

SOLVING SYSTEMS BY SUBSTITUTION: PART II

TYPES OF SOLUTIONS

- A system of linear equations might have one solution, no solution, or infinitely many solutions.
- When solving by substitution, if the variables cancel and the remaining statement is true, the system has infinitely many solutions.
- When solving by substitution, if the variables cancel and the remaining statement is not true, the system has no solution.

Use substitution to solve the following systems of equations. Then, describe what the graph of the system of equations would look like.

1.

$$\begin{aligned}y &= x + 4 \\ -4x + 4y &= 3\end{aligned}$$

SOLUTION: No solution

GRAPH: Parallel lines; same slope but different y-intercepts

2.

$$\begin{aligned}y &= 3x - 2 \\ -6x + 2y &= -4\end{aligned}$$

SOLUTION: Infinitely many solutions

GRAPH: The same line; same slope and same y-intercept

3.

$$\begin{aligned}y &= \frac{1}{4}x - 1 \\ -x + 4y &= -4\end{aligned}$$

SOLUTION: Infinitely many solutions

GRAPH: The same line; same slope and same y-intercept

4.

$$\begin{aligned}y &= 2x - 1 \\ -2x + y &= 2\end{aligned}$$

SOLUTION: No solution

GRAPH: Parallel lines; same slope but different y-intercepts

Solve each system of equations below for practice. Roll a pair of dice, find the sum of the two numbers showing, and solve that problem.

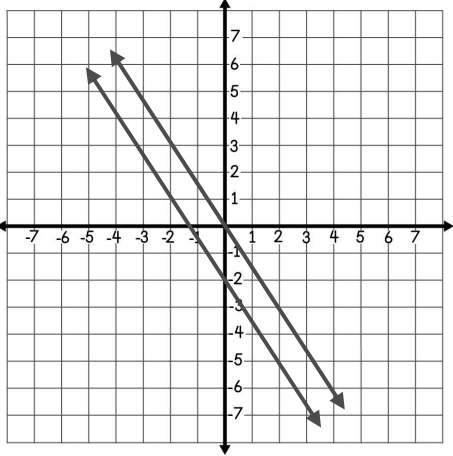
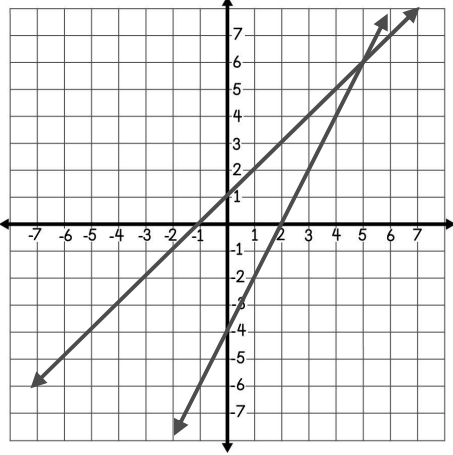
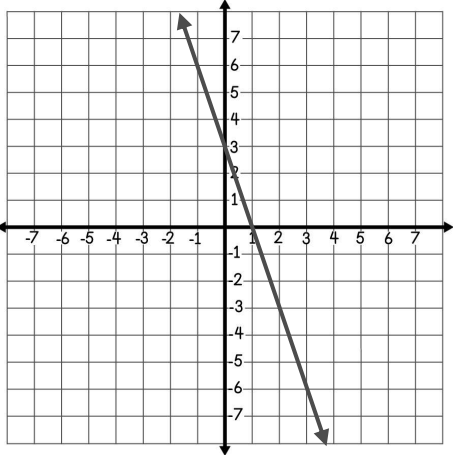
SHOW WORK HERE:

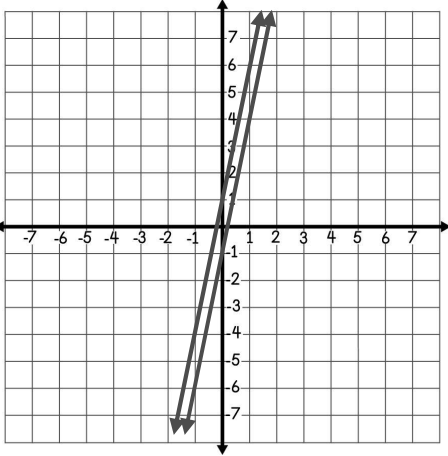
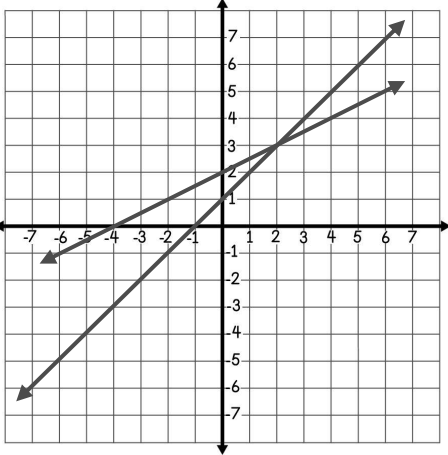
DICE ROLL	SYSTEM	SOLUTION
2	$y = \frac{1}{2}x + 4$ $y = -x - 2$	(-4, 2)
3	$6x + 2y = 1$ $y = -3x + 3$	No solution
4	$-3x + y = -1$ $2x - y = -3$	(4, 11)
5	$4x + 2y = 10$ $y = -2x + 5$	Infinitely many
6	$-2x + 4y = 16$ $y = \frac{1}{2}x + 4$	Infinitely many
7	$y = -\frac{3}{2}x + 1$ $2x + y = 4$	(6, -8)
8	$y = \frac{1}{4}x - 7$ $-x + 4y = 12$	No solution
9	$x + y = 5$ $3x - y = -5$	(0, 5)
10	$y = -\frac{3}{4}x + 3$ $3x + 4y = 12$	Infinitely many
11	$y = x - 5$ $5x + 2y = -3$	(1, -4)
12	$y = -\frac{1}{2}x$ $2x + 4y = 16$	No solution

Summarize today's lesson:

SOLVING SYSTEMS BY SUBSTITUTION: PART II

Solve each of the systems below by substitution. Then, check your answer by graphing.

SYSTEM	SUBSTITUTION	GRAPHING
<p>1.</p> $y = -\frac{3}{2}x$ $3x + 2y = -4$	<p>Solution: <u> No solution </u></p>	
<p>2.</p> $y = 2x - 4$ $y = x + 1$	<p>Solution: <u> (5, 6) </u></p>	
<p>3.</p> $y = -3x + 3$ $6x + 2y = 6$	<p>Solution: <u> Infinitely many </u></p>	

SYSTEM	SUBSTITUTION	GRAPHING
<p>4.</p> $-5x + y = 1$ $-10x + 2y = -2$	<p>Solution: <u> No solution </u></p>	
<p>5.</p> $y = \frac{1}{2}x + 2$ $y = x + 1$	<p>Solution: <u> (2, 3) </u></p>	

SOLVING SYSTEMS BY ELIMINATION

Another method to solve systems of equations is known as elimination. In cases where the variables in two equations have opposite coefficients, we can solve the system with the following steps:

SOLVING BY ELIMINATION

- Line up the like terms in the equations.
- Add the equations to eliminate one variable and solve for the other.
- Substitute your answer into one of the original equations to solve for the other variable.
- Write your variables as an ordered pair and check your answer.

Use the method of elimination to solve each of the systems of equations below.

<p>1.</p> $\begin{aligned} -2x + 4y &= 4 \\ 3x - 4y &= 2 \end{aligned}$ <p style="text-align: right;">(6, 4)</p>	<p>2.</p> $\begin{aligned} 6x + 2y &= 4 \\ -6x - 5y &= -28 \end{aligned}$ <p style="text-align: right;">(-2, 8)</p>
<p>✓CHECK:</p> $\begin{aligned} -2(6) + 4(4) &= 4 & 3(6) - 4(4) &= 2 \\ -12 + 16 &= 4 & 18 - 16 &= 2 \\ 4 &= 4 & 2 &= 2 \end{aligned}$	<p>✓CHECK:</p> $\begin{aligned} 6(-2) + 2(8) &= 4 & -6(-2) - 5(8) &= -28 \\ -12 + 16 &= 4 & 12 - 40 &= -28 \\ 4 &= 4 & -28 &= -28 \end{aligned}$
<p>3.</p> $\begin{aligned} 4x - 7y &= 47 \\ 6x + 7y &= -17 \end{aligned}$ <p style="text-align: right;">(3, -5)</p>	<p>4.</p> $\begin{aligned} 5x + 2y &= 18 \\ -5x + 5y &= 45 \end{aligned}$ <p style="text-align: right;">(0, 9)</p>
<p>✓CHECK:</p> $\begin{aligned} 4(3) - 7(-5) &= 47 & 6(3) + 7(-5) &= -17 \\ 12 - (-35) &= 47 & 18 - 35 &= -17 \\ 47 &= 47 & -17 &= -17 \end{aligned}$	<p>✓CHECK:</p> $\begin{aligned} 5(0) + 2(9) &= 18 & -5(0) + 5(9) &= 45 \\ 18 &= 18 & 45 &= 45 \end{aligned}$

In situations where neither of the variables in the two equations have opposite coefficients, it may be necessary to multiply one equation by a constant in order to create opposite terms.

When multiplying an equation by a constant, remember to multiply each term within the equation!

<p>5.</p> $-x + 2y = -13$ $2x + 3y = 12$ <p style="text-align: right;">(9, -2)</p>	<p>6.</p> $4x - y = -19$ $-2x - 5y = -29$ <p style="text-align: right;">(-3, 7)</p>
<p>✓CHECK:</p> $-(9) + 2(-2) = -13$ $-9 - 4 = -13$ $-13 = -13$ $2(9) + 3(-2) = 12$ $18 - 6 = 12$ $12 = 12$	<p>✓CHECK:</p> $4(-3) - 7 = -19$ $-12 - 7 = -19$ $-19 = -19$ $-2(-3) - 5(7) = -29$ $6 - 35 = -29$ $-29 = -29$
<p>7.</p> $-3x + y = -8$ $4x + 3y = 28$ <p style="text-align: right;">(4, 4)</p>	<p>8.</p> $6x - 3y = -3$ $-5x + 6y = 41$ <p style="text-align: right;">(5, 11)</p>
<p>✓CHECK:</p> $-3(4) + 4 = -8$ $-12 + 4 = -8$ $-8 = -8$ $4(4) + 3(4) = 28$ $16 + 12 = 28$ $28 = 28$	<p>✓CHECK:</p> $6(5) - 3(11) = -3$ $30 - 33 = -3$ $-3 = -3$ $-5(5) + 6(11) = 41$ $-25 + 66 = 41$ $41 = 41$

Apply your knowledge of the elimination method to answer the question below.

9. Paulo is solving the system of equations shown and says that the first step is to add the equations together to eliminate the y variables.

a. Describe Paulo's error. The coefficients are not opposite values, they are the same value.

b. What is a possible first step Paulo could take? Multiply either of the equations by -1 .

c. Find the solution to the system of equations. $(-2, 8)$

$$3x + 4y = 26$$

$$2x + 4y = 28$$

SOLVING SYSTEMS BY ELIMINATION

1. McKayla is using elimination to solve the system below and will first add the equations together.

$$\begin{aligned} 5x - 2y &= 42 \\ -3x + 2y &= -26 \end{aligned}$$

Which of the following shows the result of the two equations added together?

- A. $8x = 16$
- B. $2x = 16$
- C. $2x = 68$
- D. $8x = 68$

2. Beckett needs to solve the system of equations below using elimination.

$$\begin{aligned} -2x + 4y &= -2 \\ 6x - y &= 28 \end{aligned}$$

Which correctly describes the first step Beckett should take?

- A. Multiply each term in the 1st equation by -3
- B. Multiply each term in the 1st equation by 3
- C. Multiply each term in the 2nd equation by -4
- D. Both B and C would work

In 3-7, solve each system using elimination. Use the answer bank to check your solutions. Not all choices will be used.

	(-5, 6)	(4, 6)	(-6, -4)	(-4, 3)
(-2, 2)	(1, 5)	(3, -4)	(2, -2)	(1, 6)

<p>3.</p> $\begin{aligned} 9x - 3y &= -42 \\ -9x + 8y &= 22 \end{aligned}$ <p style="text-align: right; margin-top: 20px;"><u> </u> (-6, -4)</p>	<p>4.</p> $\begin{aligned} 2x + 4y &= 14 \\ 3x - 4y &= -39 \end{aligned}$ <p style="text-align: right; margin-top: 20px;"><u> </u> (-5, 6)</p>	<p>5.</p> $\begin{aligned} -5x - y &= 8 \\ 5x - 3y &= -16 \end{aligned}$ <p style="text-align: right; margin-top: 20px;"><u> </u> (-2, 2)</p>
<p>6.</p> $\begin{aligned} 8x + 2y &= 20 \\ -4x + y &= 2 \end{aligned}$ <p style="text-align: right; margin-top: 20px;"><u> </u> (1, 6)</p>	<p>7.</p> $\begin{aligned} -3x - 2y &= -1 \\ 4x + 6y &= -12 \end{aligned}$ <p style="text-align: right; margin-top: 20px;"><u> </u> (3, -4)</p>	

QUIZ: SYSTEMS OF EQUATIONS

Answer each question, and be sure to show work when necessary.

1. Presley graphed a system of equations, and the graph showed two parallel lines. What does this mean?

- A. The system has one solution.
- B. The system has no solution.
- C. The system has infinitely many solutions.
- D. Presley made an error in her graphing.

2. What is true about the graph of a system of equations that has infinitely many solutions?

- A. The lines will have the same slope but different y-intercepts.
- B. The lines will have the same slope and the same y-intercepts.
- C. The lines will have different slopes and different y-intercepts.
- D. The lines will have different slopes but the same y-intercepts.

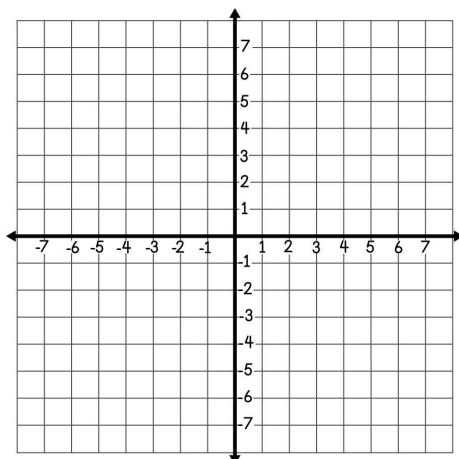
3. Sloan plans to solve the system shown using elimination. Which describes a first step she could take?

- A. Multiply the first equation by 5.
- B. Multiply the second equation by 2.
- C. Both A and B.
- D. Neither A nor B.

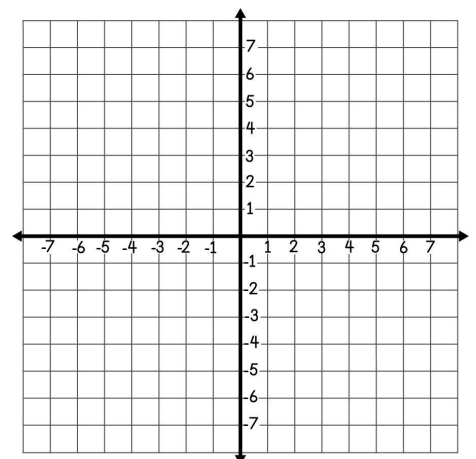
$$\begin{aligned} x + 4y &= 2 \\ -5x - 2y &= -46 \end{aligned}$$

In 4-5, solve the system of equations by graphing.

4. $y = -3x + 1$
 $y = x - 7$



5. $y = \frac{3}{2}x - 1$
 $-6x + 4y = -12$



Answers

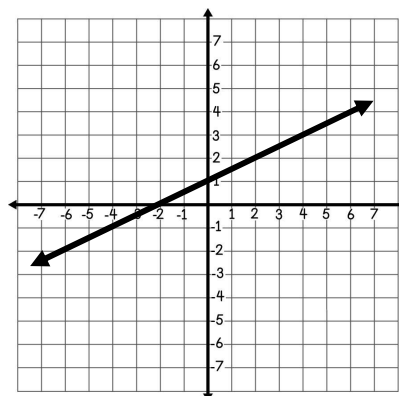
1. B
2. B
3. C
4. (2, -5)
5. No solution
6. A
7. D
8. (8, -2)
9. No solution
10. (6, 3)

6. Which of the following is true about the solution to the system of equations below?

$$\begin{aligned}x + 2y &= -2 \\ -3x - y &= 21\end{aligned}$$

- A. The x-value of the solution is -8.
- B. The y-value of the solution is -3.
- C. Both A and B are true.
- D. Neither A nor B is true.

7. The graph represents the first equation in a system of equations with infinitely many solutions. Which could be the second equation in the system?



- A. $x + 2y = 2$
- B. $2x - 4y = 4$
- C. Both A and B.
- D. Neither A nor B.

8. Solve the system of equations using substitution.

$$\begin{aligned}y &= -\frac{1}{4}x \\ x + 2y &= 4\end{aligned}$$

9. Solve the system of equations using substitution.

$$\begin{aligned}y &= -x - 2 \\ 3x + 3y &= 6\end{aligned}$$

10. Solve the system of equations using elimination.

$$\begin{aligned}3x - 2y &= 12 \\ -x + y &= -3\end{aligned}$$

SOLVING SYSTEMS BY INSPECTION

Sometimes we can determine the number of solutions in a system of equations by simply observing and drawing conclusions from the equations. This is called inspection.

1. Consider each scenario in a-d and describe what each person would know about the number of solutions to their system.

<p>a. Bianca notices that the two equations have the same slope but different y-intercepts.</p> <p>Bianca's system would have no solution. If each equation were graphed, the lines would be parallel.</p>	<p>b. Charlie notices that if he adds the two equations, both variables cancel. He is left with $0 = 5$.</p> <p>Charlie's system would have no solution because $0 = 5$ is not a true statement.</p>
<p>c. Ava observes that the two equations have the same slope and the same y-intercept.</p> <p>Ava's system would have infinitely many solutions because a graph of the equations would show that they are the same line.</p>	<p>d. Ernesto can mentally add the two equations and is left with $3y = 12$.</p> <p>Ernesto's system would have one solution. He could solve for the y-value, then plug the y-value into an original equation to solve for x.</p>

2. For each system of equations, use inspection to determine the number of solutions. Explain your thinking. If the system has one solution, find the solution.

SYSTEM	# SOLUTIONS	EXPLAIN
<p>A</p> $2x - y = 9$ $2x + y = 11$	<p>One; (5, 1)</p>	<p>Sample: I can mentally add the equations together to get a sum of $4x = 20$. Therefore, the x-value is 5 which I can plug in to find the y-value of 1.</p>
<p>B</p> $y = 1.5x + 9$ $y = 1.5x - 9$	<p>No solution</p>	<p>Sample: The equations have the same slope, but different y-intercepts. On a graph, this would form parallel lines which do not intersect.</p>
<p>C</p> $-4x + 8y = -16$ $-x + 2y = -4$	<p>Infinitely many</p>	<p>Sample: If the second equation is multiplied by 4, it will match the first equation. A graph of the two equations would show that they are the same line.</p>
<p>D</p> $7x + 3y = 10$ $7x + 3y = 30$	<p>No solution</p>	<p>Sample: I can subtract the second equation from the first and both variables will cancel. I would be left with $0 = -20$, which is not a true statement.</p>

In 3-4, the first equation in a system of equations is given. Rewrite the equation in slope-intercept form. Then, determine the number of solutions it would have with each equation in a-c.

<p>3.</p> $3x + y = 6$ <p>a. $y = -3x - 6$ <u>no solution</u></p> <p>b. $y = 3x + 6$ <u>one solution</u></p> <p>c. $y = -3x + 6$ <u>infinitely many</u></p>	<p>4.</p> $-12x + 6y = -30$ <p>a. $y = \frac{1}{2}x - 5$ <u>one solution</u></p> <p>b. $y = 2x - 5$ <u>infinitely many</u></p> <p>c. $y = 2x + 5$ <u>no solution</u></p>
--	---

In 5-7, the first equation in a system of equations is given. Write a second equation in parts a and b that would create a system with the given number of solutions. *sample answers provided

5

$$y = -x + 10$$

a. No solution:
 $y = -x - 10$

b. Infinitely many:
 $3y = -3x + 30$

6

$$2y = -8x + 6$$

a. No solution:
 $y = -4x - 10$

b. Infinitely many:
 $y = -4x + 3$

7

$$4x + 3y = 9$$

a. No solution:
 $y = -\frac{4}{3}x - 3$

b. Infinitely many:
 $y = -\frac{4}{3}x + 3$

8. Zachary needs to determine the number of solutions the given system has. He decides to multiply the second equation by 2. Explain why this might be helpful, and determine the number of solutions to the system.

$$\begin{aligned} 8x - 2y &= 1 \\ 4x - y &= 2 \end{aligned}$$

After multiplying by 2, the second equation of $8x - 2y = 4$ can be mentally subtracted from the first equation to find a difference of $0 = -3$. This is not a true statement and tells us that the system has no solution.

9. Deja subtracts the second equation from the first in the system shown and finds a difference of $0 = 0$. She concludes that the system has infinitely many solutions. Describe Deja's error and determine the number of solutions to the system.

$$\begin{aligned} 9x - y &= 13 \\ 9x + y &= 23 \end{aligned}$$

Deja subtracted the y-values incorrectly. The difference should be $-2y = -10$, which shows us that the y-value is 5. The y-value can be plugged in to find the x-value of 2. The system has one solution of (2, 5).

SOLVING SYSTEMS BY INSPECTION

Six systems of equations are given below. Observe each system and complete the table by recording the number of solutions the system has and an explanation of your choice.

A

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

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

B

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

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

C

$$-3x + 2y = 5$$

$$3x - 2y = 2$$

D

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

$$2y = x + 4$$

E

$$-3x + 9y = -12$$

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

F

$$5x + y = 8$$

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

*Explanations will vary. Sample explanations are provided.

SYSTEM	# SOLUTIONS	EXPLAIN
A	Infinitely many	The equations have the same slope and the same y-intercept. A graph of the equations would show that they are the same line with infinite points of intersection.
B	One	The equations have different slopes but the same y-intercept. A graph would show a point of intersection at the y-intercept of (0, -4).
C	No solution	The sum of the given equations is $0 = 7$ which is not a true statement.
D	No solution	If the second equation is divided by 2, we can see that the slopes of the two equations are the same but the y-intercepts are different.
E	Infinitely many	If the second equation is multiplied by 3, we can see that the two equations are the same.
F	One	The sum of the equations is $2y = 6$, so $y = 3$. I can plug in the y-value in an original equation to find that the x-value is 1. The solution is (1, 3).

APPLYING SYSTEMS OF EQUATIONS

Many real-world situations can be solved with a system of equations. Use the steps described below to help you solve each of the following situations.

STEPS TO PROBLEM SOLVE	<ul style="list-style-type: none"> Define your two _____ variables _____. (Be sure to write them out!) Write your system of _____ equations _____. _____ Solve _____ the system of equations. Find the _____ answer _____ to the question being asked.
-------------------------------	--

1. At Manny's taco shop, you can get an order of chips and two tacos for \$9.25. The cost for two orders of chips and five tacos is \$21.75. What is the cost of an order of chips?

DEFINE YOUR VARIABLES: $x = \text{chips}$ $y = \text{tacos}$	WRITE YOUR SYSTEM OF EQUATIONS: $x + 2y = 9.25$ $2x + 5y = 21.75$
SOLVE THE SYSTEM: <p style="text-align: center;">(2.75, 3.25)</p>	ANSWER THE QUESTION BEING ASKED: <p style="text-align: center;">An order of chips costs \$2.75.</p>

2. The length of a rectangular garden is 4 more than three times the width. If the perimeter of the garden is 104 feet, what are the dimensions of the garden?

DEFINE YOUR VARIABLES: $x = \text{length}$ $y = \text{width}$	WRITE YOUR SYSTEM OF EQUATIONS: $x = 4 + 3y$ $2x + 2y = 104$
SOLVE THE SYSTEM: <p style="text-align: center;">(40, 12)</p>	ANSWER THE QUESTION BEING ASKED: <p style="text-align: center;">The garden has a length of 40 feet and a width of 12 feet.</p>



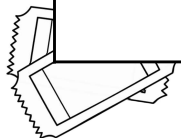


3. Kelly's basketball team made a total of 33 two-point and three-point baskets in their game last week. If her team scored a total of 72 points, how many two-point baskets did they make?

<p>DEFINE YOUR VARIABLES:</p> <p>$x = \text{two-point shots}$ $y = \text{three-point shots}$</p>	<p>WRITE YOUR SYSTEM OF EQUATIONS:</p> <p>$x + y = 33$ $2x + 3y = 72$</p>
<p>SOLVE THE SYSTEM:</p> <p>(27, 6)</p>	<p>ANSWER THE QUESTION BEING ASKED:</p> <p>The team made 27 two-point shots.</p>

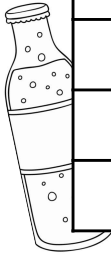
Set up and solve a system of equations to answer 4-6 below. Be sure to show all work.

SITUATION	DEFINE VARIABLES	SYSTEM AND SOLUTION
<p>4. Brooklyn has a combination of dimes and nickels in her wallet. She has three times as many nickels than dimes, and the total value of the coins is \$4.00. How many does she have of each coin?</p>	<p>$x = \text{dimes}$ $y = \text{nickels}$</p>	<p>$y = 3x$ $0.1x + 0.05y = 4$</p> <p>(16, 48)</p> <p>Brooklyn has 16 dimes and 48 nickels.</p>
<p>5. Two angles are complementary. The larger angle is 30 degrees more than 4 times the smaller angle. Find the measure of each angle.</p>	<p>$x = \text{smaller angle}$ $y = \text{larger angle}$</p>	<p>$x + y = 90$ $y = 4x + 30$</p> <p>(12, 78)</p> <p>The smaller angle is 12° and the larger angle is 78°.</p>
<p>6. A circus charges \$2.50 for kid tickets and \$6 for adult tickets. Last weekend, twice as many kids attended the circus than adults. If the ticket sales totaled \$7,150, how many kids attended the circus?</p>	<p>$x = \text{kid tickets}$ $y = \text{adult tickets}$</p>	<p>$2.5x + 6y = 7,150$ $2y = x$</p> <p>(1,300, 650)</p> <p>The circus sold 1,300 kid tickets and 650 adult tickets.</p>



APPLYING SYSTEMS OF EQUATIONS

In 1-5, write and solve a system of equations in order to find the missing prices at the concession stand. Record the price of each item in the blank spot on the sign below.



BOTTLED WATER	\$1.50	POPCORN	\$0.50	CORN DOG	\$2.75
SPORTS DRINK	\$1.75	PICKLES	\$1.50	PIZZA	\$2.25
SODA	\$2.00	CHIPS	\$0.75	HOT DOG	\$2.00
CANDY BARS	\$1.00	NACHOS	\$2.50	CHEESEBURGER	\$3.00

SITUATION	VARIABLES	SYSTEM AND SOLUTION
1. Jim ordered a sports drink and three slices of pizza for \$8.50. His friend ordered two sports drinks and two slices of pizza for \$8.00.	x: sports drink y: pizza	$x + 3y = 8.50$ $2x + 2y = 8$ $(1.75, 2.25)$
2. Kaylin bought a soda and two bags of popcorn for \$3.00. Her brother bought three sodas and a bag of popcorn for \$6.50.	x: sodas y: popcorn	$x + 2y = 3$ $3x + y = 6.50$ $(2, 0.5)$
3. Nathan ordered one cheeseburger and one bag of chips for \$3.75. Jack ordered two cheeseburgers and three bags of chips for \$8.25.	x: cheeseburger y: chips	$x + y = 3.75$ $2x + 3y = 8.25$ $(3, 0.75)$
4. A hot dog and three pickles costs \$6.50. Two hot dogs and two pickles costs \$7.00.	x: hotdog y: pickles	$x + 3y = 6.50$ $2x + 2y = 7.00$ $(2, 1.5)$
5. Rachel bought a corn dog and three candy bars for \$5.75. Allison bought two corn dogs and two candy bars for \$7.50.	x: corn dog y: candy bars	$x + 3y = 5.75$ $2x + 2y = 7.50$ $(2.75, 1)$

SYSTEMS OF EQUATIONS STUDY GUIDE

Solve each of the problems below. These represent the types of questions on your test. Be sure to ask questions if you need more help with a topic.

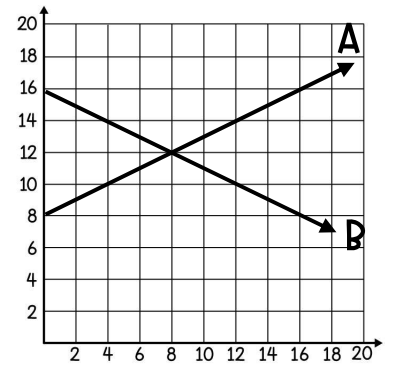
I CAN SOLVE SYSTEMS OF EQUATIONS BY GRAPHING.

1. Write the equation of each line graphed at the right.

Line A: $y = \frac{1}{2}x + 8$

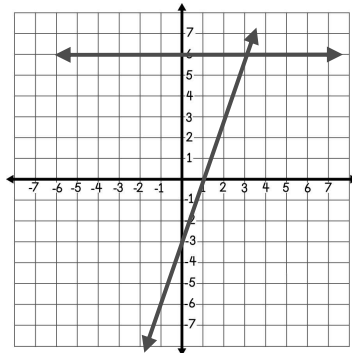
Line B: $y = -\frac{1}{2}x + 16$

What is the solution to the system of equations? (8, 12)



2. Solve the system of equations by graphing.

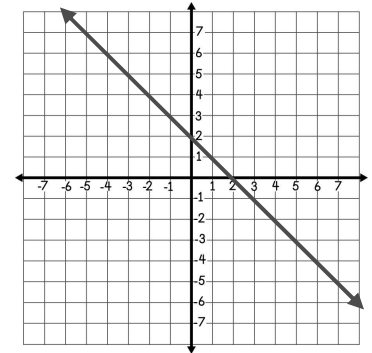
$y = 6$
 $y = 3x - 3$



(3, 6)

3. Solve the system of equations by graphing.

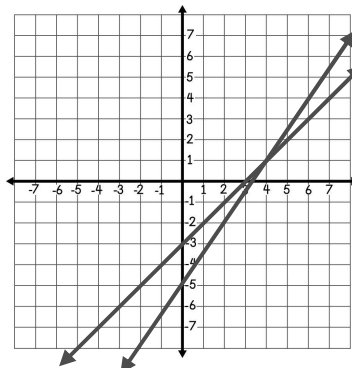
$y = -x + 2$
 $3x + 3y = 6$



Infinitely many solutions

4. Solve the system of equations by graphing.

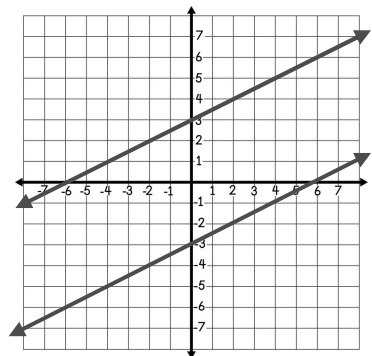
$y = x - 3$
 $y = 1.5x - 5$



(4, 1)

5. Solve the system of equations by graphing.

$y = \frac{1}{2}x + 3$
 $-x + 2y = -6$



No solution

I CAN SOLVE SYSTEMS OF EQUATIONS BY GRAPHING.

6. Ralph's t-shirt company sells custom t-shirts for \$5.00 each plus a \$20 shipping and design fee. Frank's t-shirt company sells t-shirts for \$10 each with no additional fees. Let x represent the number of shirts sold and y represent the total cost.

a. Write an equation to represent each t-shirt company.

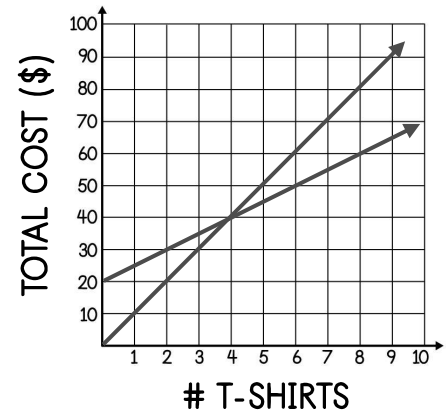
Ralph's: $y = 5x + 20$

Frank's: $y = 10x$

b. Solve the system of equations by using the graph. (4, 40)

c. What does the solution mean in the context of the situation?

The companies both charge \$40 for 4 t-shirts.



I CAN SOLVE SYSTEMS OF EQUATIONS USING SUBSTITUTION.

7.

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

$$x + 3y = 20$$

(14, 2)

8.

$$x + y = 8$$

$$3x + 2y = 8$$

(-8, 16)

9.

$$-5x + 6y = 12$$

$$y = \frac{5}{6}x + 2$$

Infinitely many solutions

I CAN SOLVE SYSTEMS OF EQUATIONS BY ELIMINATION.

10.

$$x + 5y = 19$$

$$-x - 2y = -4$$

(-6, 5)

11.

$$3x - 10y = -84$$

$$x + 5y = 47$$

(2, 9)

12.

$$4x - 8y = -4$$

$$-2x + 8y = -2$$

(-3, -1)

I CAN SOLVE SYSTEMS OF EQUATIONS BY INSPECTION.

13. Aaron and Blake both wrote down equations. Their equations had the same slope, but Aaron's y -intercept was negative, and Blake's y -intercept was positive. How many solutions would their system of equations have? Explain your reasoning.

No solution; lines with the same slope but different y -intercepts will be parallel and will not intersect.

In 14-17, determine the number of solutions the system of equations will have. Explain your reasoning. *Explanations will vary

14.

$$\begin{aligned}6x + y &= 8 \\ y &= -6x + 8\end{aligned}$$

Infinitely many solutions

15.

$$\begin{aligned}x + y &= 7 \\ x + y &= -7\end{aligned}$$

No solution

16.

$$\begin{aligned}y &= 0.75x - 2 \\ y &= -0.75x + 2\end{aligned}$$

One solution

17.

$$\begin{aligned}x + y &= 6 \\ 3x + 3y &= 18\end{aligned}$$

Infinitely many solutions

I CAN SOLVE REAL-WORLD PROBLEMS WITH SYSTEMS OF EQUATIONS.

18. A jar of quarters and dimes has a total value of \$20.70. The jar has 10 more quarters than dimes. To find the number of quarters and dimes in the jar, Addison wrote the following system of equations. Explain Addison's error.

In the first equation, x represented quarters. In the second equation, x represents dimes. Based on the first equation, the second equation should read " $x = 10 + y$."

$$\begin{aligned}0.25x + 0.10y &= 20.70 \\ y &= x + 10\end{aligned}$$

19. Brody went on vacation and purchased postcards and stamps to send letters home while he was away. Two postcards and four stamps cost \$3. A postcard cost 4 times as much as a stamp. Set up a system of equations that could be used to find the cost of a postcard and stamps. Do not solve.

$$\begin{aligned}x &= \text{cost for postcard} \\ y &= \text{cost for stamp}\end{aligned}$$

$$\begin{aligned}2x + 4y &= 3 \\ x &= 4y\end{aligned}$$

I CAN SOLVE REAL-WORLD PROBLEMS WITH SYSTEMS OF EQUATIONS.

For each of the following questions, write a system of equations and then solve.

20. Selena's snow cone stand sells small snow cones for \$2 and large snow cones for \$3.50. One summer day, she sold \$163 worth of snow cones. If the number of large snow cones sold was 12 more than the number of smalls, how many of each size did she sell?

System of equations:

$$\begin{aligned}2x + 3.5y &= 163 \\ y &= 12 + x\end{aligned}$$

Solution: 22 small and 34 large

21. Two angles are supplementary. The larger angle is 15 more than 10 times the smaller angle. Find the measure of each angle.

System of equations:

$$\begin{aligned}x + y &= 180 \\ y &= 15 + 10x\end{aligned}$$

Solution: 15° and 165°

22. Maci put 200 inches of ribbon along the border of a rectangular bulletin board. If the length of the bulletin board is 4 times the width, then what are the dimensions?

System of equations:

$$\begin{aligned}2x + 2y &= 200 \\ y &= 4x\end{aligned}$$

Solution: Length: 80 inches
Width: 20 inches

23. The larger of two numbers is 10 more than three times the smaller number. The larger number decreased by the smaller number is 80. What are the two numbers?

System of equations:

$$\begin{aligned}x &= 10 + 3y \\ x - y &= 80\end{aligned}$$

Solution: 115 and 35

SYSTEMS OF EQUATIONS UNIT TEST

Solve the problems below. Be sure to show your thinking.

1. Mateo plans to solve the system below using elimination. Which is a reasonable first step Mateo could take?

$$\begin{aligned} -x + 6y &= 9 \\ 3x + 2y &= 13 \end{aligned}$$

- A. Multiply the 2nd equation by 3
- B. Multiply the 2nd equation by -3
- C. Multiply the 1st equation by -3
- D. Any of the above

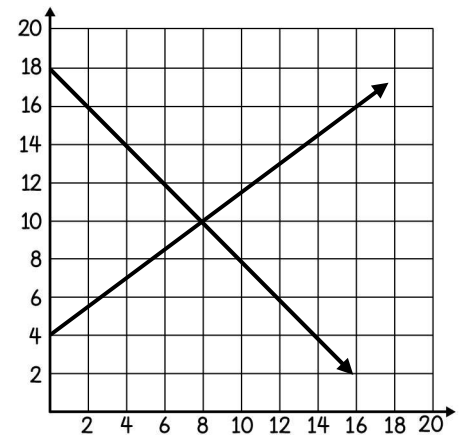
2. Which of the following is true about the solution to the system of equations below?

$$\begin{aligned} 2x + 4y &= 9 \\ 2x + 4y &= -9 \end{aligned}$$

- A. The system has no solution.
- B. The system has infinitely many solutions.
- C. The system has one solution.
- D. None of the above.

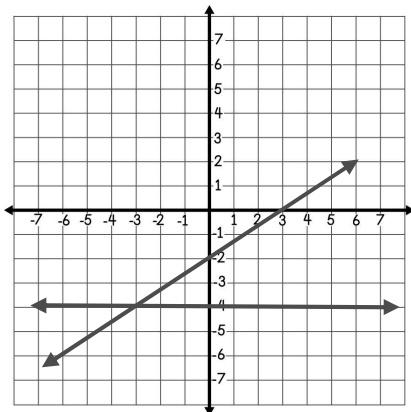
3. What can you conclude from the graph of the equations shown below?

- A. The solution to the equations $y = -2x + 18$ and $y = \frac{4}{3}x + 4$ is (8, 10).
- B. The solution to the equations $y = -x + 18$ and $y = \frac{4}{3}x + 4$ is (10, 8).
- C. The solution to the equations $y = -x + 18$ and $y = \frac{3}{4}x + 4$ is (10, 8).
- D. The solution to the equations $y = -x + 18$ and $y = \frac{3}{4}x + 4$ is (8, 10).



4. Solve the system of equations by graphing.

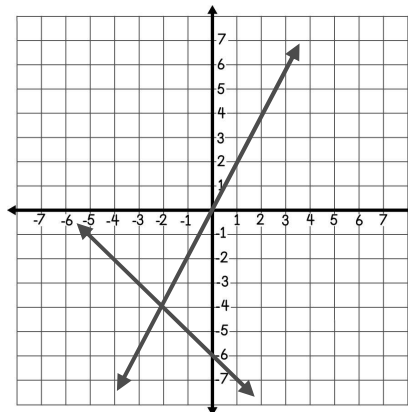
$$\begin{aligned} y &= \frac{2}{3}x - 2 \\ y &= -4 \end{aligned}$$



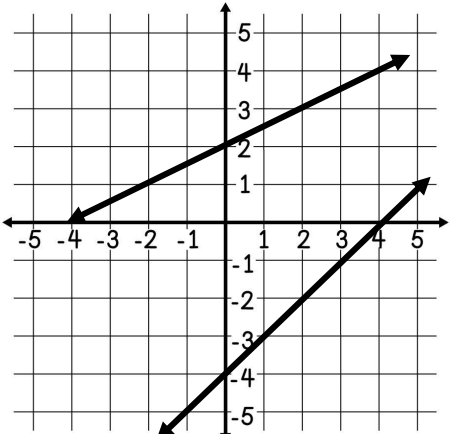
(-3, -4)

5. Solve the system of equations by graphing.

$$\begin{aligned} y &= 2x \\ x + y &= -6 \end{aligned}$$



(-2, -4)

<p>6. Which is the solution to the system of equations?</p> $x + y = -7$ $3x + 2y = -17$ <p>A. (-1, -6) B. (3, -13) C. (4, -11) <input checked="" type="radio"/> D. (-3, -4)</p>	<p>7. Which system of equations would have no solution?</p> <p>A. $x + y = 4$ and $y = -x + 4$ B. $y = 3x + 2$ and $y = -3x - 2$ C. $2x + y = 10$ and $y = -2x + 10$ <input checked="" type="radio"/> D. $3x + y = 8$ and $3x + y = 9$</p>
<p>8. Solve the system of equations.</p> $y = -\frac{3}{2}x + 9$ $2x + 2y = 16$ <p style="text-align: right;">_____ (2, 6) _____</p>	<p>9. Solve the system of equations.</p> $-3x + 2y = 48$ $3x + y = 42$ <p style="text-align: right;">_____ (4, 30) _____</p>
<p>10. Which of the following statements is NOT true about the graph of a system of equations with infinitely many solutions?</p> <p>A. The lines will have the same slope. B. The lines will have the same y-intercept. <input checked="" type="radio"/> C. The lines will have one positive y-intercept and one negative y-intercept. D. The lines will share all of the same points.</p>	
<p>11. Which is a true statement about the system of equations graphed below?</p> <p>A. The system of equations does not have a solution because the lines do not intersect. <input checked="" type="radio"/> B. The system of equations has one solution, although it is not visible on the graph. C. The system of equations has an infinite number of solutions. D. None of the statements above are true.</p>	

12. Jane is observing the system of equations below and thinks it will have exactly one solution. Is she correct? Why or why not?

$$y = \frac{5}{6}x + 2$$

$$6y = 5x - 12$$

No; the slopes are the same, but the y-intercepts are different, so there would be no solution to the system of equations.

13. At a concession stand, a pickle and two bags of chips costs a total of \$3.25. Three pickles and four bags of chips costs a total of \$7.25. To determine the cost of one pickle, Kevin is writing a system of equations. His first equation is shown:

$$x + 2y = 3.25$$

Which of the following could be the second equation in his system of equations?

- A. $3x + 4y = 7.25$
- B. $4x + 3y = 7.25$
- C. $3x - 4y = 7.25$
- D. $(3 + 4)x = 7.25$

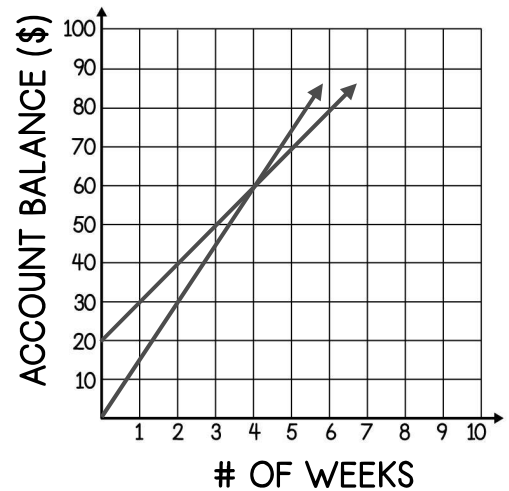
14. Jacobi wants to solve the system of equations below by using elimination. Which of the following describes the next step Jacobi should take?

$$8x - 2y = -6$$

$$-3x + y = 4$$

- A. Multiply each term in the 1st equation by -1
- B. Multiply each term in the 2nd equation by -2
- C. Multiply each term in the 2nd equation by 2
- D. Add the two equations together

15. Macy doesn't have any money in her bank account, but begins saving \$15 each week. Robby has \$20 in his bank account and saves \$10 each week. After how many weeks will Macy and Robby have the same amount in their accounts? Use the graph to solve.



Number of weeks: 4

16. At a movie theater, 2 medium drinks and a large popcorn costs \$13.85. At the same theater, a family bought 3 medium drinks and 2 large popcorns for a total of \$23.90. Which system of equations could be used to find x, the cost of a medium drink and y, the cost of a large popcorn?

- | | | | |
|------------------|-------------------------------------|-------------------|------------------|
| A. | <input checked="" type="radio"/> B. | C. | D. |
| $x + 2y = 13.85$ | $2x + y = 13.85$ | $3x + 2y = 13.85$ | $2x + y = 13.85$ |
| $3x + 2y = 23.9$ | $3x + 2y = 23.9$ | $2x + y = 23.9$ | $2x + 3y = 23.9$ |

17. Christine's rectangular bedroom has a perimeter of 44 feet. The length of her bedroom is 2 feet more than the width. Which of the following is a true statement?

- A. The width of Christine's bedroom is 10 feet.
- B. The length of Christine's bedroom is 8 feet.
- C. Both A and B are true.
- D. Neither A nor B is true.

18. Tickets to a concert cost \$15 online and \$25 at the door. One hundred more people bought their tickets at the door than online. If ticket sales totaled \$20,500, write and solve a system to determine the number of people who bought their concert tickets online.

450 people

19. Two angles are complementary. The larger angle is 36 more than the smaller angle. What is the measure of the larger angle?

63°

20. Hudson worked two jobs last summer to start saving for a car. He mowed lawns during the day and worked at a pizza place in the evenings. In one month, Hudson earned a total of \$1,400. If he earned \$360 more at the pizza place than mowing lawns, how much did he earn at each job?

Mowing lawns: \$520
Pizza place: \$880