Warm-Up | Solving Systems of Linear Equations: Linear Combinations

Lesson Question

Lesson Goals

Model problems using a ______ of linear equations.

Create equivalent equations by multiplying by ______.

Solve systems of two linear equations using the linear ______ method.

______ the solution in the context of the problem.

Words to Know

Fill in this table as you work through the lesson. You may also use the glossary to help you.

eliminate	to ______; to omit
additive inverse	the ______ of a number
equivalent equation	equations that have the same ______ and can be formed from one another using the ______

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Words to Know

system of linear equations	a set of linear equations that have the same _____; has one solution if the lines _____, infinitely many solutions if the lines are the _____, and no solution if the lines are _____

The Linear Combination Method

To solve the **system of linear equations** using the linear combination method, one of the variables must have opposite coefficients.

$$x + 4y = 7$$
$$3x - 2y = -1$$

How could you create an **equivalent equation** to **eliminate** x?

Multiply the top equation by 3.

The resulting system is:

$$\square + \square = 21$$
$$-3x - 2y = -1$$

How could you create an equivalent equation to eliminate y?

Multiply the bottom equation by 2.

The resulting system is:

$$1x + 4y = 7$$
$$\square - 4y = \square$$

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How to Solve a System Using the Linear Combination Method

To solve a system of equations using linear combinations:

1. **Create** coefficients that are [ ] **inverses** on one of the variables, if needed.
2. **Add** the equations to [ ] one of the variable terms.
3. **Solve** the new equation for the remaining variable.
4. [ ] back into either original equation to find the value of the other variable.
5. **Check** the solution.

Multiplying before Using the Linear Combination Method

Solve: $3x - 7y = 5$

$5x - 9y = -5$

1. **Create** coefficients that are additive inverses on one of the variables.
2. **Add** the equations to eliminate the x-terms.
3. **Solve** the new equation for y.
4. **Substitute** back into either original equation to find the value of x.
5. **Check** the solution.

$3x - 7y = 5$ → multiply by [ ]

$5x - 9y = -5$ → multiply by [ ]

$15x - 35y = 25$

[ ] + [ ] $= 15$

$\frac{-8y}{-8} = \frac{40}{-8}$

$y =$ [ ]

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Multiplying before Using the Linear Combination Method

Solve: $3x - 7y = 5$

$5x - 9y = -5$

$y = -5$

1. **Create** coefficients that are additive inverses on one of the variables.
2. **Add** the equations to eliminate the x-terms.
3. **Solve** the new equation for y.
4. **Substitute** back into either original equation to find the value of x.
5. ____ the solution.

$3x - 7(-5) = 5$

$3x +$ ____ $= 5$

$-35 \quad -35$

$\frac{3x}{3} = \frac{-30}{3}$

$x =$ ____

Solution: (____ , ____)

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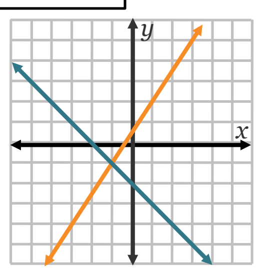
The Number of Solutions of a System of Linear Equations

____ solution



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

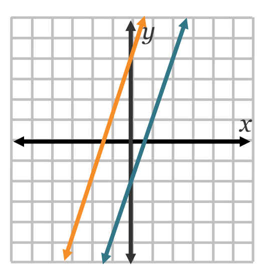
$-6x + 4y = 2$

$\underline{6x + 6y = -12}$

$\frac{10y}{10} = \frac{-10}{10}$

$y =$ ____

No solution



$-3x + y = 4 \quad -6x + 2y = -4$

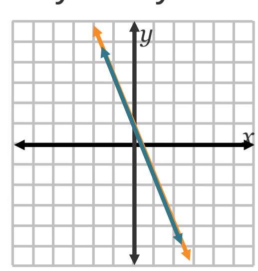
$-6x + 2y = -4$

$\underline{6x - 2y = -8}$

____ $\neq$ ____

False

Infinitely many solutions



$5x + 2y = 2 \quad 2.5x + y = 1$

$5x + 2y = 2$

$\underline{-5x - 2y = -2}$

____ $=$ ____

True

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Modeling a Situation with a System of Linear Equations

Mario's family goes to the movies and spends \$38 on 2 child tickets and 3 adult tickets. Lou's family goes to the movies and spends \$34.50 on 3 child tickets and 2 adult tickets. What is the cost of each type of ticket?

x = cost of a ______ ticket

y = cost of an ______ ticket

$$\begin{cases} 2x + \boxed{} = \boxed{} & \text{multiply by } 3 \\ \boxed{} + 2y = \boxed{} & \text{multiply by } (-2) \end{cases}$$

Solving a System of Linear Equations

Mario's family goes to the movies and spends \$38 on 2 child tickets and 3 adult tickets. Lou's family goes to the movies and spends \$34.50 on 3 child tickets and 2 adult tickets. What is the cost of each type of ticket?

1. Multiply the first equation by 3 and the second equation by -2.
2. Add to ______ the x-terms.
3. Solve the new equation for y.
4. Substitute back into either original equation to find the x-value.
5. Check and interpret the solution.

$$3(2x + 3y = 38) \rightarrow 6x + 9y = 114$$

$$-2(3x + 2y = 34.5) \rightarrow \underline{-6x - 4y = -69}$$

$$\frac{\boxed{}}{5} = \frac{45}{5}$$

$$y = \boxed{}$$

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Solving a System of Linear Equations

Mario's family goes to the movies and spends $38 on 2 child tickets and 3 adult tickets. Lou's family goes to the movies and spends $34.50 on 3 child tickets and 2 adult tickets. What is the cost of each type of ticket?

1. Multiply the first equation by 3 and the second equation by -2.
2. Add to eliminate the x-terms.
3. Solve the new equation for y.
4. ______ back into either original equation to find the x-value.
5. Check and ______ the solution.

$$2x + 3y = 38$$

$$3x + 2y = 34.50$$

$$y = 9$$

$$2x + 3(9) = 38$$

$$2x + 27 = 3$$

$$-27 \quad -27$$

$$\frac{2x}{2} = \frac{11}{2}$$

$x =$ ______

Child tickets: $ ______

Adult tickets: $ ______

Check: $2(5.5) + 3(9) = 38$

$$3(\quad) + 2(\quad) = 34.5$$

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Modeling a Situation with a System of Linear Equations

A bag of baby carrots and a container of hummus dip contain a total of 470 calories. For a snack, Rosarita ate $\frac{3}{4}$ of the bag of carrots and $\frac{4}{7}$ of the container of hummus. Her snack contained a total of 290 calories. If x represents the total number of calories in the bag of carrots and y represents the total number of calories in the container of hummus, how many calories were in each?

Write a system.

$$x + y = 470$$

$$\frac{3}{4}x + \frac{4}{7}y = 290$$

Multiply each equation through by a number to eliminate fractions and to eliminate x.

$x + y = 470 \xrightarrow{\bullet(-21)}$ [ ] $-21y = -9870$

$\frac{3}{4}x + \frac{4}{7}y = 290 \xrightarrow{\bullet(28)}$ [ ] $+16y = 8120$

$$\frac{-5y}{-5} = \frac{-1750}{-5}$$

$y =$ [ ]

Find x.

$x + ($ [ ] $) = 470$

$-350 \qquad -350$

$x =$ [ ]

There are 120 calories in a bag of chips and 350 calories in a container of hummus.

Summary

Solving Systems of Linear Equations: Linear Combinations

?

Lesson Question

Why are equivalent equations important when solving a system using linear combinations?

Answer

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Review: Key Concepts

- Multiply the equations in a system by constants to create [ ] equations so the coefficients of one variable are additive inverses.
- Add the equations together to [ ] a variable and solve for the other variable.
- Substitute the value of the variable back into [ ] original equation to find the other variable.

Summary | Solving Systems of Linear Equations: Linear Combinations

Use this space to write any questions or thoughts about this lesson.