

Elimination → Equations: Standard Form  
 $Ax + By = C$

- eliminate a variable by
  - Subt **SAMES** →  $3 - 3$
  - add **OPPOSITES** →  $5 + -5$
- add/subt rows (or multiples of rows)
- Solve for the variable(s)

**CRITIQUE & EXPLAIN**

Sadie and Micah used different methods to solve the system of equations.

$y = 2x + 3$   
 $4x - y = 5$

Sadie's work

$4x - (2x + 3) = 5$   
 $4x - 2x - 3 = 5$   
 $2x - 3 = 5$   
 $2x = 8$   
 $x = 4$   
 $y = 2(4) + 3 = 11$   
 The solution is (4, 11).

Substitution

Micah's work

$y = 2x + 3$  and  $y = 4x - 5$   
 $2x + 3 = 4x - 5$   
 $8 = 2x$   
 $x = 4$   
 $y = 2(4) + 3$   
 $y = 11$   
 The solution is (4, 11).

more work...

**4-3**  
 Solving Systems of Equations by Elimination  
 PearsonRealize.com

A. In what ways are Sadie's and Micah's approaches similar? In what ways are they different?

Isolated y...  
 → Micah did it twice...

B. Are both Sadie's and Micah's approaches valid solution methods? Explain.

Yes

C. Reason Which method of solving systems of equations do you prefer when solving, Sadie's method, or Micah's method? Explain. © MP.2

less work

**HABITS OF MIND**

Reason Can you think of an instance when it is more convenient to use Sadie's method? When is it more convenient to use Micah's method? © MP.2



Elimination

→ add/subt multiples of one row to another...

- add OPPOSITES
- subt SAMEs

**EXAMPLE 1** Try It! Solve a System of Equations by Adding

1. Solve each system of equations.

a.  $2x - 4y = 2$   
 $-x + 4y = 3$   
 $(+)$   
 $\frac{1x}{5} = 5$   
 $x = 5$   
 $\rightarrow (5, 2)$

b.  $2x + 3y = 1$   
 $-2x + 2y = -6$   
 $(+)$   
 $\frac{5y}{5} = \frac{-5}{5}$   
 $y = -1$   
 $2x + 3(-1) = 1$   
 $2x - 3 = 1$   
 $\frac{2x}{2} = \frac{4}{2}$   
 $x = 2$   
 $\rightarrow (2, -1)$

c.  $2x + y = 4$   
 $-2x - 4y = 14$   
 $(-)$   
 $0x + 5y = -10$   
 $y = -2$   
 $2x + (-2) = 4$   
 $2x = 6$   
 $x = 3$   
 $\rightarrow (3, -2)$

OR apply a negative...  
 $2x + y = 4$   
 $(+)$   
 $-2x + 4y = -14$   
 $\frac{5y}{5} = \frac{-10}{5}$   
 $y = -2$   
 $2x + (-2) = 4$   
 $2x = 6$   
 $x = 3$   
 $\rightarrow (3, -2)$

ex 1)  $x + y = 7$   
 $(+)$   
 $2x - y = 2$   
 $\frac{3x}{3} = \frac{9}{3}$   
 $x = 3$   
 $(3) + y = 7$   
 $\frac{-3}{-3} = \frac{-3}{-3}$   
 $y = 4$   
 $\rightarrow (3, 4)$

**EXAMPLE 2** Try It! Understand Equivalent Systems of Equations

Find the LCM  
 → make opposites...

2. Solve each system of equations.

a.  $x + 2y = 4$   
 $2x - 5y = -1$   
 $(+)$   
 $\frac{-9y}{-9} = \frac{-9}{-9}$   
 $y = 1$   
 $x + 2(1) = 4$   
 $x + 2 = 4$   
 $\frac{x}{1} = \frac{2}{1}$   
 $x = 2$   
 $\rightarrow (2, 1)$

b.  $2x + y = 2$   
 $x - 2y = -5$   
 $(+)$   
 $\frac{5x}{5} = \frac{-1}{5}$   
 $x = -\frac{1}{5}$   
 $(-\frac{1}{5}) - 2y = -5$   
 $-1 - 10y = -25$   
 $+1 +1$   
 $\frac{-10y}{-10} = \frac{-24}{-10}$   
 $y = \frac{24}{10} = \frac{12}{5}$   
 $\rightarrow (-\frac{1}{5}, \frac{12}{5})$

**HABITS OF MIND**

Look for Relationships How could you write an equivalent system of equations for both of the systems in Try It! 2? MP.7

**EXAMPLE 3** Try It! Apply Elimination

3. Before the florist has a chance to finish the bouquets, a large order is placed. After the order, only 85 roses and 163 peonies remain. How many regular bouquets and mini bouquets can the florist make now?

**EXAMPLE 4** Try It! Choose a Method of Solving

- add opposites
- sub same

4. What is the solution of each system of equations? Explain your choice of solution method.

$Ax + By = C$

**LCM:  $\pm 6$**

$$\begin{array}{r} 6x + 12y = -6 \\ 3x - 2y = -27 \end{array} \cdot (-2)$$


---


$$\begin{array}{r} 6x + 12y = -6 \\ -6x + 4y = 54 \end{array}$$


---


$$\frac{16y}{16} = \frac{48}{16}$$

$$y = 3$$

$$3x - 2(3) = -27$$

$$\vdots \text{BLAH}$$

**LCM:  $\pm 12$**

$$\begin{array}{r} 6x + 12y = -6 \\ 3x - 2y = -27 \end{array} \cdot (-6)$$


---


$$\begin{array}{r} 6x + 12y = -6 \\ 18x - 12y = -162 \end{array}$$


---


$$\frac{24x}{24} = \frac{-168}{24}$$

$$x = -7$$

$$3(-7) - 2y = -27$$

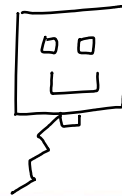
$$\vdots \text{BLAH}$$

**Substitution...**

b.  $3x - 2y = 38$   
 $x = 6 - y$

**HABITS OF MIND**

**Communicate Precisely** Explain the difference between solving a system of equations using substitution and solving a system of equations using elimination. © MP.6



**Do You UNDERSTAND?**

1. **ESSENTIAL QUESTION** Why does the elimination method work when solving a system of equations?

- add opps
- sub "same"

2. **Error Analysis** Esteban tries to solve the following system.

$$7x - 4y = -12$$

$$x - 2y = 4$$

His first step is to multiply the second equation by 3.

$$7x - 4y = -12$$

$$6x - 12y = 12$$

Then he adds the equations to eliminate a term. What is Esteban's error? © MP.3

3. **Construct Arguments** How can you determine whether two systems of equations are equivalent? © MP.3

4. **Mathematical Connections** The sum of 5 times the width of a rectangle and twice its length is 26 units. The difference of 15 times the width and three times the length is 6 units. Write and solve a system of equations to find the length and width of the rectangle.

**Do You KNOW HOW?**

Solve each system of equations.

5.  $4x - 2y = -2$   
 $3x + 2y = -12$

$$\begin{array}{r} 4x - 2y = -2 \\ +) 3x + 2y = -12 \\ \hline 7x = -14 \\ x = -2 \end{array}$$

$4(-2) - 2y = -2$   
 $-8 - 2y = -2$   
 $+8 \quad +8$   
 $-2y = 6$   
 $-2y = 6$   
 $-2 \quad -2$   
 $y = -3$

$\rightarrow (-2, -3)$

6.  $3x + 2y = 4$   
 $-(3x + 6y = -24)$   
 $-3x - 6y = 24$

LCM:  $\pm 6$  opposites

$7(4x - 3y = -9) \times (2) \rightarrow 8x - 6y = -18$   
 $(3x + 2y = -11) \times (3) \rightarrow 9x + 6y = -33$

$$\begin{array}{r} 8x - 6y = -18 \\ +) 9x + 6y = -33 \\ \hline 17x = -51 \\ x = -3 \end{array}$$

$3(-3) + 2y = -11$   
 $-9 + 2y = -11$   
 $+9 \quad +9$   
 $2y = -2$   
 $y = -1$

$x - 3y = -4$   
 $2x - 6y = 6$

$\rightarrow (-3, -1)$

9. Ella is a landscape photographer. One weekend at her gallery she sells a total of 52 prints for a total of \$2,975. How many of each size print did Ella sell?



Small print:  
\$50

Large print:  
\$75