LESSON 6-2

Practice A

Solving Systems by Substitution

Fill in the blanks to solve each system by substitution.

1. $\begin{cases} y = 3x \\ y = x + 4 \end{cases}$

Substitute ___3x___ for y in the second equation.

___3x___ $= x + 4$

$-$ ___x___ $\quad -x$

___2x___ $= 4$

$\div$ ___2___ $\quad \div$ ___2___

___x___ $=$ ___2___

Since $x =$ ___2___, substitute ___2___ for x in one of the equations to find the value of y:

$y = 3x$

$y = 3($ ___2___ $)$

$y =$ ___6___

Solution: (___2___ , ___6___)

2. $\begin{cases} 3x + y = 25 \\ y = x - 3 \end{cases}$

Substitute ___x − 3___ for y in the first equation.

$3x + ($ ___x − 3___ $) = 25$

___4x___ $- 3 = 25$

$+3 \quad +3$

___4x___ $= 28$

$\div$ ___4___ $\quad \div$ ___4___

___x___ $=$ ___7___

Since $x =$ ___7___, substitute ___7___ for x in one of the equations to find the value of y:

$y = x - 3$

$y =$ ___7___ $- 3$

$y =$ ___4___

Solution: (___7___ , ___4___)

Solve each system by substitution. Check your answer.

3. $\begin{cases} y = 4x \\ y = 2x + 6 \end{cases}$ **(3, 12)**

4. $\begin{cases} y = x - 2 \\ 2x + y = 4 \end{cases}$ **(2, 0)**

5. $\begin{cases} 2x + y = -1 \\ -x + y = -7 \end{cases}$ **(2, −5)**

6. A professional organizer charges a $45 consultation fee, plus $20 per hour. Her competitor charges a $30 consultation fee, plus $26 per hour.

a. Write a system of equations to represent the situation. $\begin{cases} y = 20x + 45 \\ y = 26x + 30 \end{cases}$

b. Solve the system by substitution. For what number of hours will the total charge be the same? **2.5**

c. What will that charge be? **$95**

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LESSON 6-2

Practice B

Solving Systems by Substitution

Solve each system by substitution. Check your answer.

1. $\begin{cases} y = x - 2 \\ y = 4x + 1 \end{cases}$ **(−1, −3)**

2. $\begin{cases} y = x - 4 \\ y = -x + 2 \end{cases}$ **(3, −1)**

3. $\begin{cases} y = 3x + 1 \\ y = 5x - 3 \end{cases}$ **(2, 7)**

4. $\begin{cases} 2x - y = 6 \\ x + y = -3 \end{cases}$ **(1, −4)**

5. $\begin{cases} 2x + y = 8 \\ y = x - 7 \end{cases}$ **(5, −2)**

6. $\begin{cases} 2x + 3y = 0 \\ x + 2y = -1 \end{cases}$ **(3, −2)**

7. $\begin{cases} 3x - 2y = 7 \\ x + 3y = -5 \end{cases}$ **(1, −2)**

8. $\begin{cases} -2x + y = 0 \\ 5x + 3y = -11 \end{cases}$ **(−1, −2)**

9. $\begin{cases} \frac{1}{2}x + \frac{1}{3}y = 5 \\ \frac{1}{4}x + y = 10 \end{cases}$ **(4, 9)**

Write a system of equations to represent the situation. Then, solve the system by substitution.

10. The length of a rectangle is 3 more than its width. The perimeter of the rectangle is 58 cm. What are the rectangle's dimensions?

$\begin{cases} l = w + 3 \\ 2l + 2w = 58 \end{cases}$; **13 cm by 16 cm**

11. Carla and Benicio work in a men's clothing store. They earn commission from each suit and each pair of shoes they sell. For selling 3 suits and one pair of shoes, Carla has earned $47 in commission. For selling 7 suits and 2 pairs of shoes, Benicio has earned $107 in commission. How much do the salespeople earn for the sale of a suit? for the sale of a pair of shoes?

$\begin{cases} 3s + 1p = 47 \\ 7s + 2p = 107 \end{cases}$; **suit: $13; pair of shoes: $8**

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LESSON 6-2

Practice C

Solving Systems by Substitution

Solve each system by substitution. Check your answer.

1. $\begin{cases} y = x - 6 \\ y = 2x - 8 \end{cases}$ **(2, −4)**

2. $\begin{cases} y = x - 4 \\ y = -2x + 5 \end{cases}$ **(3, −1)**

3. $\begin{cases} y = 2x + 8 \\ y = 8 \end{cases}$ **(0, 8)**

4. $\begin{cases} x + y = -3 \\ x - y = -1 \end{cases}$ **(−2, −1)**

5. $\begin{cases} 4x + 2y = -2 \\ y = 6x - 5 \end{cases}$ $\left(\frac{1}{2}, -2\right)$

6. $\begin{cases} \frac{1}{2}x = y - 1 \\ \frac{1}{3}x = y \end{cases}$ **(−6, −2)**

7. $\begin{cases} 4x + y = 3.4 \\ x = 4y \end{cases}$ **(0.8, 0.2)**

8. $\begin{cases} x = -\frac{1}{4}y + 5 \\ 3x + 2y = 0 \end{cases}$ **(8, −12)**

9. $\begin{cases} 3x = -y + 10 \\ 2x + 3y = -12 \end{cases}$ **(6, −8)**

Solve.

10. The sum of two numbers is 39. The greater number is 5 less than 3 times the smaller number. What are the two numbers?

11 and 28

11. Adam has dimes and quarters in his pocket. There are 28 coins in all, and they are worth $4.60 altogether. How many quarters does Adam have?

12 quarters

12. At a pet store, Rhonda paid $11.50 for 3 dog bowls and 4 bones. Kelly paid $13 for 2 dog bowls and 8 bones. How much will Andrew pay for 4 dog bowls and 2 bones?

$12.00

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LESSON 6-2

Reteach

Solving Systems by Substitution

You can use substitution to solve a system of equations if one of the equations is already solved for a variable.

Solve $\begin{cases} y = x + 2 \\ 3x + y = 10 \end{cases}$

Step 1: Choose the equation to use as the substitute.

Use the first equation $y = x + 2$ because it is already solved for a variable.

Step 2: Solve by substitution.

$x + 2$

$3x + y = 10$

$3x + (x + 2) = 10$ *Substitute $x + 2$ for y.*

$4x + 2 = 10$ *Combine like terms.*

$-2 \quad -2$

$4x = 8$

$\frac{4x}{4} = \frac{8}{4}$

$x = 2$

Step 3: Now substitute $x = 2$ back into one of the original equations to find the value of y.

$y = x + 2$

$y = 2 + 2$

$y = 4$

The solution is $(2, 4)$.

Check:

Substitute (2, 4) into both equations.

$y = x + 2$ | $3x + y = 10$

$4 \stackrel{?}{=} 2 + 2$ | $3(2) + 4 \stackrel{?}{=} 10$

$4 \stackrel{?}{=} 4$ ✓ | $6 + 4 \stackrel{?}{=} 10$

$10 \stackrel{?}{=} 10$ ✓

Solve each system by substitution. Check your answer.

1. $\begin{cases} x = y - 1 \\ x + 2y = 8 \end{cases}$ **(2, 3)**

2. $\begin{cases} y = x + 2 \\ y = 2x - 5 \end{cases}$ **(7, 9)**

3. $\begin{cases} y = x + 5 \\ 3x + y = -11 \end{cases}$ **(−4, 1)**

4. $\begin{cases} x = y + 10 \\ x = 2y + 3 \end{cases}$ **(17, 7)**

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LESSON 6-2 Reteach

Solving Systems by Substitution (continued)

You may need to solve one of the equations for a variable before solving with substitution.

Solve $\begin{cases} y - x = 4 \\ 2x + 3y = 27. \end{cases}$

Step 1: Solve the first equation for y.

$y - x = 4$

$+x \quad +x$

$y = x + 4$

Step 2: Solve by substitution.

$x + 4$

$2x + 3y = 27$

$2x + 3(x + 4) = 27$ *Substitute $x + 4$ for y.*

$2x + 3x + 12 = 27$ *Distribute.*

$5x + 12 = 27$ *Combine like terms.*

$-12 \quad -12$

$5x = 15$

$\frac{5x}{5} = \frac{15}{5}$

$x = 3$

Step 3: Now substitute $x = 3$ back into one of the original equations to find the value of y.

$y - x = 4$

$y - 3 = 4$

$+3 \quad +3$

$y = 7$

The solution is $(3, 7)$.

Check:

Substitute $(3, 7)$ into both equations.

$y - x = 4$ $\quad 7 - 3 \stackrel{?}{=} 4$ $\quad 4 \stackrel{?}{=} 4$ ✓

$2x + 3y = 27$ $\quad 2(3) + 3(7) \stackrel{?}{=} 27$ $\quad 6 + 21 \stackrel{?}{=} 27$ $\quad 27 \stackrel{?}{=} 27$ ✓

Solve each system by substitution. Check your answer.

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

6. $\begin{cases} y - x = 8 \\ 5x + 2y = 9 \end{cases}$

$(3, 6)$

$(-1, 7)$

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LESSON 6-2 Challenge

Three Equations in Three Variables

To solve a system with two variables, you must have two equations. To solve a system in three variables, you must have three equations.

Use substitution to find the values of *x*, *y*, and *z*.

1. $\begin{cases} 2x + 4y + 3z = 14 \\ y + 3z = 11 \\ z = 4 \end{cases}$

2. $\begin{cases} 4x + y + 3z = -9 \\ 2y - 5z = 23 \\ z = -3 \end{cases}$

$x = 3; y = -1, z = 4$

$x = -1; y = 4, z = -3$

3. $\begin{cases} 2x + 3y + 2z = 18 \\ -4x + y - z = 5 \\ 2z = -10 \end{cases}$

4. $\begin{cases} x + y + z = 15 \\ 2x - y + 3z = -5 \\ -x - y + z = -7 \end{cases}$

[Hint: Solve for z and get two equations to have x and y only.]

$x = 2; y = 8, z = -5$

$x = -2; y = 13, z = 4$

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LESSON 6-2 Problem Solving

Solving Systems by Substitution

Write the correct answer.

1. Maribel has $1.25 in her pocket. The money is in quarters and dimes. There are a total of 8 coins. How many quarters and dimes does Maribel have in her pocket?

3 quarters, 5 dimes

2. Fabulously Fit offers memberships for $35 per month plus a $50 enrollment fee. The Fitness Studio offers memberships for $40 per month plus a $35 enrollment fee. In how many months will the fitness clubs cost the same? What will the cost be?

3 months; $155

3. Vong grilled 21 burgers at a block party. He grilled the same number of pounds of turkey burgers as hamburgers. Each turkey burger weighed $\frac{1}{4}$ pound and each hamburger weighed $\frac{1}{3}$ pound. How many of each did Vong grill?

12 turkey burgers, 9 beef hamburgers

4. Kate bought 3 used CDs and 1 used DVD at the bookstore. Her friend Joel bought 2 used CDs and 2 used DVDs at the same store. If Kate spent $20 and Joel spent $22, determine the cost of a used CD and a used DVD.

used CD $4.50, used DVD $6.50

Use the chart below to answer questions 5–8. Select the best answer. The chart compares the quotes that the Masons received from four different flooring contractors to tear out and replace a floor.

Contractor	Cost to tear out old floor	Cost of new floor per square foot
Smith & Son	$250	$8.00
V.I.P. Inc.	$350	$7.75
Dad's Floors	$150	$8.00
Floorshop	$300	$8.25

5. Which expression shows the total cost if the work is done by Dad's Floors?

A $8 + 150x$ **C** $150(8x)$

(B) $150 + 8x$ **D** $158x$

6. How many square feet would the Masons need to have installed to make the total cost of V.I.P. Inc. the same as the total cost of Floorshop?

F 10 sq ft **(H)** 100 sq ft

G 200 sq ft **J** 350 sq ft

7. When the total costs of V.I.P. Inc. and Floorshop are the same, what is the total cost?

(A) $1125.00 **C** $1950.00

B $1900.00 **D** $3187.50

8. How many square feet would the Masons need to have installed to make the total cost of Smith & Son the same as the total cost of V.I.P. Inc.?

F 80 sq ft **(H)** 400 sq ft

G 100 sq ft **J** 1000 sq ft

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LESSON 6-2 Reading Strategies

Use a Sequence Chain

Use the sequence chain below to guide you in solving systems of linear equations by the method of substitution.

Step 1: Isolate one variable in one equation. → **Step 2:** Substitute the expression for that variable into the other equation. → **Step 3:** Solve for the variable remaining in that equation.

Sequence Chain: *Solving Systems by Substitution*

Step 4: Substitute the value for that variable into either original equation and solve for the other variable. → **Step 5:** Write the found values for x and y as an ordered pair (x, y). → **Step 6:** Check your answer by substituting (x, y) into both equations.

Answer each question.

1. Perform Step 1 for $\begin{cases} x + y = 5 \\ -3x + 5 = \frac{1}{2}y \end{cases}$ by solving the first equation for y.

$y = 5 - x$ or $y = -x + 5$

2. To solve the system $\begin{cases} y = x + 2 \\ 2x + y = 6 \end{cases}$ by substitution, you can start at Step 2. Explain why.

The first equation is already solved for y.

3. Why does Step 6 specify substituting into *both* equations?

The solution of a system must satisfy both equations.

Solve each system of equations by substitution.

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

5. $\begin{cases} x + y = 2 \\ -x = 2y - 7 \end{cases}$

$(6, 4)$

$(-3, 5)$

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