

7.2 Solve Linear Systems by Substitution

- ① GRAPHING
- ② SUBSTITUTION (today)
- ③ ELIMINATION

Goal • Solve systems of linear equations by substitution.

SOLVING A LINEAR SYSTEM USING THE SUBSTITUTION METHOD

- ① ISOLATE 1 VARIABLE
- ② Substitute
- ③ FIND THE VALUE FOR THE OTHER VARIABLE.

- Step 1 Solve one of the equations for one of its variables. When possible, solve for a variable that has a coefficient of 1 or -1.
- Step 2 Substitute the expression from Step 1 into the other equation and solve for the other variable.
- Step 3 Substitute the value from Step 2 into the revised equation from Step 1 and solve.

Example 1 Use the substitution method

Solve the linear system: $x = -2y + 2$ Equation 1 *← x is ISOLATED*
 $3x + y = 16$ Equation 2

- 1. Solve for x. Equation 1 is already solved for x.
- 2. Substitute $-2y + 2$ for x in Equation 2 and solve for y.

$3x + y = 16$ ← Write Equation 2.

Substitute $x = -2y + 2$ for x.

Distributive property

Simplify.

Subtract 6 from each side.

Divide each side by -5.

Solve for y →

$$3(-2y + 2) + y = 16$$

$$-6y + 6 + y = 16$$

$$-5y + 6 = 16$$

$$\underline{-6 \quad -6}$$

$$-5y = 10$$

$$\underline{-5 \quad -5}$$

$$y = -2$$

- 3. Substitute -2 for y in the original Equation 1 to FIND X

$$x = -2y + 2$$

$$x = -2(-2) + 2$$

$$x = 6$$

The solution is $(6, -2)$.

C: $6 = -2(-2) + 2$
 $6 = 6 ✓$

C: $3(6) + (-2) = 16$
 $16 = 16 ✓$

TO STUDENTS - WRITE THE STEPS IN SPACE PROVIDED

STEP 4 ↴

Remember to check your solution in each of the original equations.

Means ISOLATE 1 VARIABLE

Example 2 Use the substitution method

Solve the linear system: $4x - 2y = 14$ Equation 1

$2x + y = -3$ Equation 2 ← ISOLATE Y

Solution

1 ISOLATE 1 VARIABLE

PICKED EQ 2:

$$\begin{array}{r} 2x + y = -3 \\ -2x \quad -2x \end{array}$$

$y = -2x - 3$

2 Substitute

$$4x - 2y = 14$$

$$4x - 2(-2x - 3) = 14$$

Write Equation

Substitute

SOLVE FOR X

$$4x + 4x + 6 = 14$$

$$8x + 6 = 14$$

$$\begin{array}{r} 8x + 6 = 14 \\ -6 \quad -6 \\ \hline 8x = 8 \\ \frac{8x}{8} = \frac{8}{8} \end{array}$$

$x = 1$

3 SOLVE FOR OTHER VARIABLE.

FIND Y

$$y = -2x - 3$$

$$y = -2(1) - 3$$

$y = -5$

4 CHECK BOTH ORIG EQ'S

The solution is $(1, -5)$.

C: $4(1) - 2(-5) = 14$
 $14 = 14$ ✓

C: $2(1) + (-5) = -3$
 $-3 = -3$ ✓

✓ **Checkpoint** Solve the linear system using the substitution method.

1 $5x - 4y = -1$

$y = 6x + 5$

$$5x - 4(6x + 5) = -1$$

Solve for x

$$5x - 24x - 20 = -1$$

$$-19x - 20 = -1$$

$$\begin{array}{r} -19x - 20 = -1 \\ +20 \quad +20 \\ \hline -19x = 19 \\ \frac{-19x}{-19} = \frac{19}{-19} \end{array}$$

$x = -1$

Solve for y

$y = 6(-1) + 5$ | $y = -1$

C: $5(-1) - 4(-1) = -1$ | $-1 = -1$ ✓
C: $-1 = 6(-1) + 5$ | $-1 = -1$ ✓

2. $x + y = 5$

$7x - 9y = 3$

$$7x - 9(-x + 5) = 3$$

$$7x + 9x - 45 = 3$$

$$16x - 45 = 3$$

$$\begin{array}{r} 16x - 45 = 3 \\ +45 \quad +45 \\ \hline 16x = 48 \end{array}$$

$x = 3$

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

C: $3 + 2 = 5$ | $5 = 5$ ✓

2 OPTIONS

$x = -y + 5$ OR
 $y = -x + 5$

C: $7(3) - 9(2) = 3$
 $3 = 3$ ✓