

Name: KEY
Algebra 1

Date: _____ Period: _____
Day 15 - Solving Systems of Equations

There are multiple different ways to solve systems of linear equations - today we will focus on elimination.

• Elimination

○ Addition/Subtraction

- Step 1: Write the system so that like terms with the same or opposite coefficients are aligned.
- Step 2: Add or subtract the equations, eliminating one variable. Then solve the equation.
- Step 3: Substitute the value from Step 2 into one of the equations, and solve for the other variable. Write the solution as an ordered pair!

○ Multiplication

- Step 1: Multiply at least one equation by a constant to get two equations that contain opposite terms.
- Step 2: Add the equations, eliminating one variable. Then solve the equation.
- Step 3: Substitute the value from Step 2 into one of the equations, and solve for the other variable. Write the solution as an ordered pair!

Solving Systems by Elimination

1.
$$\begin{array}{r} x + y = 12 \\ -x + 3y = -8 \\ \hline 2y = 4 \\ y = 2 \\ x - (2) = 12 \\ x = 14 \\ (14, 2) \end{array}$$

2.
$$\begin{array}{r} 5x - 4y = -21 \\ -2x + 4y = 18 \\ \hline 3x = -3 \\ x = -1 \\ -2(-1) + 4y = 18 \\ 2 + 4y = 18 \\ 4y = 16 \\ y = 4 \\ (-1, 4) \end{array}$$

3.
$$\begin{array}{r} 2x + 7y = 31 \\ 5x - 7y = -45 \\ \hline 7x = -14 \\ x = -2 \\ 2(-2) + 7y = 31 \\ -4 + 7y = 31 \\ 7y = 35 \\ y = 5 \\ (-2, 5) \end{array}$$

4.
$$\begin{array}{r} x + y = 30 \\ x + 7y = 6 \\ \hline x + y = 30 \\ -x - 7y = 6 \\ \hline -6y = 24 \\ y = -4 \\ x + (-4) = 30 \\ x = 34 \\ (34, -4) \end{array}$$

5.
$$\begin{array}{r} -2x + y = 4 \\ 2x + 3y = 9 \\ \hline -2x + y = 4 \\ -2x - 2y = -9 \\ \hline y = 1 \\ x + 1 = 4 \\ x = 3 \\ (3, 1) \end{array}$$

6.
$$\begin{array}{r} 5x + 6y = -8 \\ -2(2x + 3y) = -5 \\ \hline 5x + 6y = -8 \\ -4x - 6y = 10 \\ \hline x = -2 \\ 2(-2) + 3y = -5 \\ -4 + 3y = -5 \\ 3y = -1 \\ y = -1/3 \\ (-2, -1/3) \end{array}$$

You Try:

$$\begin{array}{r} 7. \quad 3x - 5y = 7 \\ \quad 2x - 5y = 13 \\ \hline 5x = 20 \\ \boxed{x = 4} \end{array} \quad (4, 1)$$

$$\begin{array}{r} 2(4) + 5y = 13 \\ 8 + 5y = 13 \\ 5y = 5 \\ \boxed{y = 1} \end{array}$$

$$\begin{array}{r} 10. \quad -2x - 9y = -25 \\ \quad -4x - 9y = -23 \\ \hline 2x = -2 \\ \boxed{x = -1} \end{array}$$

$$\begin{array}{r} (-1, 3) \quad -2(-1) - 9y = -25 \\ 2 - 9y = -25 \\ -9y = -27 \\ \boxed{y = 3} \end{array}$$

Extension

$$\begin{array}{r} 13. \quad -2(2x + y = 3) \\ \quad 4x + 4y = 8 \\ \quad -4x - 2y = -6 \\ \hline 2y = 2 \\ \boxed{y = 1} \end{array} \quad (1, 1)$$

$$\begin{array}{r} 2x + 1 = 3 \\ 2x = 2 \\ \boxed{x = 1} \end{array}$$

$$\begin{array}{r} 16. \quad 8x + 14y = 4 \\ \quad -6x - 7y = -10 \\ \hline 8x + 14y = 4 \\ -12x - 7y = -20 \\ \hline -4x = -16 \\ \boxed{x = 4} \end{array} \quad (4, -2)$$

$$\begin{array}{r} 8(4) + 14y = 4 \\ 32 + 14y = 4 \\ 14y = -28 \\ \boxed{y = -2} \end{array}$$

$$\begin{array}{r} 8. \quad 4x + y = 24 \\ \quad 5x - y = 12 \\ \hline 9x = 36 \\ \boxed{x = 4} \end{array} \quad (4, 8)$$

$$\begin{array}{r} 4(4) + y = 24 \\ 16 + y = 24 \\ \boxed{y = 8} \end{array}$$

$$\begin{array}{r} 11. \quad x - y = 11 \\ \quad 2x + y = 19 \\ \hline 3x = 30 \\ \boxed{x = 10} \end{array}$$

$$\begin{array}{r} 2(10) + y = 19 \\ 20 + y = 19 \\ \boxed{y = -1} \end{array} \quad (10, -1)$$

$$\begin{array}{r} 9. \quad -6x + 5y = 1 \\ \quad 6x + 4y = -10 \\ \hline 9y = -9 \\ \boxed{y = -1} \end{array} \quad (-1, -1)$$

$$\begin{array}{r} 6x + 4(-1) = -10 \\ 6x - 4 = -10 \\ 6x = -6 \\ \boxed{x = -1} \end{array}$$

$$\begin{array}{r} 12. \quad 8x + y = -16 \\ \quad -3x + y = -5 \\ \hline 11x = -11 \\ \boxed{x = -1} \end{array}$$

$$\begin{array}{r} 8(-1) + y = -16 \\ -8 + y = -16 \\ \boxed{y = -8} \end{array} \quad (-1, -8)$$

$$\begin{array}{r} 14. \quad 5x - y = 5 \\ \quad -x + 3y = 13 \\ \hline 5x - y = 5 \\ -5x + 15y = 65 \\ \hline 14y = 70 \\ \boxed{y = 5} \end{array} \quad (2, 5)$$

$$\begin{array}{r} -x + 3(5) = 13 \\ -x + 15 = 13 \\ \boxed{x = 2} \end{array}$$

$$\begin{array}{r} 17. \quad 3(5x + 4y = -30) \\ \quad -5(3x - 9y = -18) \\ \hline 15x + 12y = -90 \\ -15x + 45y = 90 \\ \hline 57y = 0 \\ \boxed{y = 0} \end{array} \quad (-6, 0)$$

$$\begin{array}{r} 3x - 9(0) = -18 \\ 3x = -18 \\ \boxed{x = -6} \end{array}$$

$$\begin{array}{r} 15. \quad -2(3x + y = 5) \\ \quad 6x + 2y = 10 \\ \quad -6x - 2y = -10 \\ \hline 0 = 0 \\ \text{infinitely many solutions} \end{array}$$

$$\begin{array}{r} 18. \quad 5(3x - 3y = 2) \\ \quad -3(5x - 5y = 10) \\ \hline 15x - 15y = 10 \\ -15x + 15y = -30 \\ \hline 0 = -20 \\ \text{NO SOLUTION} \end{array}$$