

**Elimination Using Subtraction** In systems of equations where the coefficients of the  $x$  or  $y$  terms are the same, solve the system by subtracting the equations. (most students will simply multiply one equation by  $-1$  and then add the equations together)

**Example:** Use elimination to solve the system of equations.

*Addition*

$$\begin{array}{r} -1(2x - 3y = 11) \Rightarrow -2x + 3y = -11 \\ 5x - 3y = 14 \\ \hline 3x = 3 \\ \boxed{x = 1} \end{array}$$

$$\begin{array}{r} 2x - 3y = 11 \\ 2(1) - 3y = 11 \\ 2 - 3y = 11 \\ -3y = 9 \\ \boxed{y = -3} \end{array}$$

*subtraction*

$$\begin{array}{r} 2x - 3y = 11 \\ -(5x - 3y = 14) \\ \hline -3x = -3 \\ \boxed{x = 1} \end{array}$$

$$\begin{array}{r} 2x - 3y = 11 \\ 2(1) - 3y = 11 \\ 2 - 3y = 11 \\ -3y = 9 \\ \boxed{y = -3} \end{array}$$

#### Exercises

Use elimination to solve each system of equations.

$$\begin{array}{r} 1. \begin{array}{l} 6x + 5y = 4 \\ -(6x - 7y = -20) \end{array} \\ \hline 12y = 24 \\ y = 2 \end{array}$$

$6x + 5(2) = 4$   
 $6x + 10 = 4$   
 $6x = -6$   
 $x = -1$   
 solution:  $(-1, 2)$

$$\begin{array}{r} 2. \begin{array}{l} 3m - 4n = -14 \\ -(3m + 2n = -2) \end{array} \\ \hline -6n = -12 \\ n = 2 \end{array}$$

$3m + 2(2) = -2$   
 $3m + 4 = -2$   
 $3m = -6$   
 $m = -2$

$$\begin{array}{r} 3. \begin{array}{l} 3a + b = 1 \\ -(a + b = 3) \end{array} \\ \hline 2a = -2 \\ \boxed{a = -1} \end{array}$$

$a + b = 3$   
 $-1 + b = 3$   
 $b = 4$

4. **GEOMETRY** Two angles are supplementary. The measure of one angle is  $10^\circ$  more than three times the other. Find the measure of each angle.

*Solve w/ addition*

$y = 137.5^\circ$   
 $x = 42.5^\circ$

*Supplementary*

let  $x = 1^{\text{st}}$  angle  
 let  $y = 2^{\text{nd}}$  angle

$$x + y = 180$$

$$y = 3x + 10$$

$$\begin{array}{r} -3x + y = 10 \Rightarrow -3x + y = 10 \\ -1(x + y = 180) \Rightarrow -x - y = -180 \\ \hline -4x = -170 \end{array}$$

$$\begin{array}{r} y = 180 - 42.5^\circ \\ \boxed{y = 137.5^\circ} \end{array}$$

$$\begin{array}{r} -4x = -170 \\ \boxed{x = 42.5^\circ} \end{array}$$

*Standard form*

Key

## 6-3 Notes: Elimination Using Addition and Subtraction

**Elimination Using Addition** In systems of equations in which the coefficients of the  $x$  or  $y$  terms are additive inverses, solve the system by adding the equations. Because one of the variables is eliminated, this method is called **elimination**.

Step 1) All equations in standard form - w/ variables in same order.

Step 2) Make sure 1 of variables has coefficients that are additive inverses. \* you may want to multiply one equation by "-1" &

Step 3) Add equations to "eliminate" one variable. \* note - you can subtract but easier to add to eliminate.

Step 4) solve for 1st variable

Step 5) substitute value into either equation to solve for 2nd variable.

**Example 1:** Use elimination to solve the system of equations.

$$\begin{array}{r} x - 3y = 7 \\ + 3x + 3y = 9 \\ \hline 4x = 16 \\ \frac{4x}{4} = \frac{16}{4} \\ \boxed{x = 4} \end{array}$$

$$\begin{array}{r} 3x + 3y = 9 \\ 3(4) + 3y = 9 \\ 12 + 3y = 9 \\ 3y = -3 \\ \boxed{y = -1} \end{array}$$

Solution: (4, -1)

**Example 1:** The sum of two numbers is 70 and their difference is 24. Find the numbers.

let  $x = 1^{st} \#$       let  $y = 2^{nd} \#$

$$\begin{array}{r} x + y = 70 \\ + x - y = 24 \\ \hline 2x = 94 \\ \boxed{x = 47} \end{array}$$

$$\begin{array}{r} x + y = 70 \\ 47 + y = 70 \\ -47 \quad -47 \\ \hline y = 23 \end{array}$$

numbers = 47 & 23

**Exercises:**

Use elimination to solve each system of equations.

1.  $x + y = -4$   
 $+ x - y = 2$

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

Solution: (-1, -3)

2.  $2x - 3y = 14$   
 $+ x + 3y = -11$

$$\begin{array}{r} 3x = 3 \\ \boxed{x = 1} \\ x + 3y = -11 \\ 1 + 3y = -11 \\ 3y = -12 \\ \boxed{y = -4} \end{array}$$

3.  $3x - y = -9$   
 $-3x - 2y = 0$

$$\begin{array}{r} -3y = -9 \\ \boxed{y = 3} \end{array}$$

Solution: (-2, 3)

$$\begin{array}{r} 3x - y = -9 \\ 3x - 3 = -9 \\ 3x = -6 \\ \boxed{x = -2} \end{array}$$

4. Rema is older than Ken. The difference of their ages is 12 and the sum of their ages is 50. Find the age of each.

let  $x = \text{Rema}$   
 let  $y = \text{Ken}$

$$\begin{array}{r} x - y = 12 \\ + x + y = 50 \\ \hline 2x = 62 \\ \boxed{x = 31} \end{array}$$

Rema = 31 yrs old

$$\begin{array}{r} \text{Ken} = 31 + y = 50 \\ y = 19 \\ \boxed{\text{Ken} = 19 \text{ yrs old}} \end{array}$$