

Systems of Equations (Elimination)

Recall: Solve the following equation: $-y + y = \underline{0}$ * Additive Inverse *

The **elimination** method is another method used to solve a system of linear equations. The **steps** for this method are as follows:

1. Decide which variable to eliminate.
2. Multiply one equation by a constant so that adding or subtracting will eliminate that variable. (If necessary)
3. Add the equations to eliminate one variable.
4. Solve the resulting equation for the other variable.
5. Substitute the value into either original equation to find the value of the eliminated variable.

Solve the systems of equations using elimination.

Examples

L1)
$$\begin{array}{r} 2x - 3y = 12 \\ + x + 3y = 6 \\ \hline 3x = 18 \\ \hline x = 6 \end{array}$$

Find y

$$\begin{array}{r} x + 3y = 6 \\ (6) + 3y = 6 \\ -6 \quad -6 \\ \hline 3y = 0 \\ \hline y = 0 \end{array}$$

Sol: (6, 0)

Try It

$$\begin{array}{r} x + y = -1 \\ + x + y = 7 \\ \hline 2x = 6 \\ \hline x = 3 \end{array}$$

Find y

$$\begin{array}{r} x + y = -1 \\ 3x + y = -1 \\ -3 \quad -3 \\ \hline y = -4 \end{array}$$

Sol: (3, -4)

L2)
$$\begin{array}{r} 3x + 3y = 6 \\ -1(3x - y = -6) \\ \hline -3x + y = 6 \\ + 3x + 3y = 6 \\ \hline 4y = 12 \\ \hline y = 3 \end{array}$$

almost opposites
need to multiply by (-1)

← stays the same

$$\begin{array}{r} -3x + y = 6 \\ + 3x + 3y = 6 \\ \hline 4y = 12 \\ \hline y = 3 \end{array}$$

Find x

$$\begin{array}{r} 3x + 3y = 6 \\ 3x + 3(3) = 6 \\ 3x + 9 = 6 \\ -9 \quad -9 \\ \hline 3x = -3 \\ \hline x = -1 \end{array}$$

← must use original

Sol: (-1, 3)

$$\begin{array}{r} 2x + 6y = 8 \\ -1(2x + 10y = -4) \\ \hline -2x - 10y = 4 \\ + 2x + 6y = 8 \\ \hline -4y = 12 \\ \hline y = -3 \end{array}$$

$$\begin{array}{r} -2x - 10y = 4 \\ + 2x + 6y = 8 \\ \hline -4y = 12 \\ \hline y = -3 \end{array}$$

Sol: (13, 2)

Find x

$$\begin{array}{r} 2x + 6y = 8 \\ 2x + 6(-3) = 8 \\ 2x - 18 = 8 \\ +18 \quad +18 \\ \hline 2x = 26 \\ \hline x = 13 \end{array}$$

Solve the following systems of equations using elimination.

Examples

L3) $4x + 2y = 6$
 $2(3x - y = -8)$

Find y

$3x - y = -8$

$4x + 2y = 6$
 $+ 6x - 2y = -16$

$3(-1) - y = -8$

$-3 - y = -8$
 $+3 \quad +3$

$\frac{10x}{10} = \frac{-10}{10}$

$-y = -5$

$y = 5$

$x = -1$

Sol: (-1, 5)

L4) $3(4x + 2y = -10)$
 $2(3x + 3y = 33)$

$-12x - 6y = 30$
 $+ 6x + 6y = 66$

$\frac{-6x}{-6} = \frac{96}{-6}$

$x = -16$

Find y

$3x + 3y = 33$

$3(-16) + 3y = 33$

$-48 + 3y = 33$
 $+48 \quad +48$

$3y = 81$
 $\frac{3y}{3} = \frac{81}{3}$

$y = 27$

Sol: (-16, 27)

Try It * or mult by -3

$4x + 3y = 19$
 $-2(2x + y = 11)$

$4x + 3y = 19$
 $+ -4x - 2y = -22$

$y = -3$

Find x

$2x + y = 11$

$2x + (-3) = 11$
 $-3 \quad +3$

$2x = 14$
 $\frac{2x}{2} = \frac{14}{2}$

$x = 7$

Sol: (7, -3)

$3(5x - 2y = -14)$
 $2(-3x + 3y = 3)$

$15x - 6y = -42$

$-6x + 6y = 6$

$\frac{9x}{9} = \frac{-36}{9}$

$x = -4$

Find y

$-3x + 3y = 3$

$-3(-4) + 3y = 3$

$12 + 3y = 3$
 $-12 \quad -12$

$3y = -9$
 $\frac{3y}{3} = \frac{-9}{3}$

$y = -3$

Sol: (-4, 3)