Name: Key

Solving Linear Systems Using Elimination

We have learned how to solve systems of linear equations by graphing and by substitution. There is a third method that we will explore called elimination. In the elimination method, you can add or subtract equations to get rid of (or eliminate!) a variable.

Sometimes it is easy to see which variable can be eliminated. For example, consider the system:

$$\begin{array}{r} 5x - 6y = -32 \\ + \quad 3x + 6y = 48 \\ \hline 8x = 16 \\ x = 2 \end{array}$$

$$3(2) + 6y = 48$$
$$6 + 6y = 48$$
$$6y = 42$$
$$y = 7$$

answer: (2, 7)

Sometimes, you have to multiply one or both of the equations by a nonzero number to make the coefficients work out. For example, consider the system

$$\begin{array}{rl} 2x + 5y = -22 & \xrightarrow{m(-5)} -10x + -25y = 110 \\ 10x + 3y = 22 & \longrightarrow \quad 10x + 3y = 22 \\ & + \overline{\qquad\qquad\qquad} \\ & -22y = 132 \\ & y = -6 \end{array}$$

$$2x + 5(-6) = -22$$
$$2x + -30 = -22$$
$$2x = 8$$
$$x = 4$$

Answer: (4, -6)

Try some on your own...

1. $2x - 3y = 61$
$2x + y = -7$

$\xrightarrow{\quad}$ $2x + {}^-3y = 61$

$\xrightarrow{m(3)}$ $6x + 3y = {}^-21$

$+$

$8x = 40$

$x = 5$

$2(5) + y = {}^-7$

$10 + y = {}^-7$

$y = {}^-17$

#1 answer: $(5, {}^-17)$

2. $2x + 5y = 17$
$6x - 5y = -9$

$+$

$8x = 8$

$x = 1$

$2(1) + 5y = 17$

$2 + 5y = 17$

$5y = 15$

$y = 3$

#2 answer: $(1, 3)$

3. $3x + 6y = -6$
$-5x - 2y = -14$

$\xrightarrow{\quad}$ $3x + 6y = {}^-6$

$\xrightarrow{m(3)}$ ${}^-15x + {}^-6y = {}^-42$

$+$

${}^-12x = {}^-48$

$x = 4$

$3(4) + 6y = {}^-6$

$12 + 6y = -6$

$6y = {}^-18$

$y = -3$

#3 answer: $(4, {}^-3)$