

Solve the following system:

$$-3x + 3y = 5$$

$$y = x + 3$$

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

$$-3x + 3x + 9 = 5$$

$$9 = 5$$

no solution

# Solving Systems of Equations by Elimination

Step 1: Write each equation in  $ax + by = c$  form

Step 2: Multiply, if necessary, one or both equations by a constant so at least one pair of terms has ***opposite but equal*** coefficients

Step 3: Add the equations to *eliminate* one of the variables.

Step 4: Solve the resulting equation

Step 5: Substitute the answer from Step 4 into one of the original equations and solve

$$4x + 3y = 6$$

$$+ \quad -x - 3y = 3 \quad \leftarrow$$

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$$3x + 0y = 9$$

$$3x = 9$$

$$x = 3$$

$$(3, 2)$$

$$-x - 3y = 3$$

$$-3 \cdot 3y = 3$$

$$+3 \quad \quad +3$$

$$-3y = 6$$

$$\frac{-3y}{-3} = \frac{6}{-3}$$

$$y = -2$$

$$(x + y = 7) \cdot 5$$

$$5x + 2y = 8$$

$$+ \begin{array}{r} -5x - 5y = -35 \\ \hline \end{array}$$

$$\begin{array}{r} -3y = -27 \\ \frac{-3y}{-3} = \frac{-27}{-3} \end{array}$$

$$y = 9$$

$$x + 9 = 7$$

$$x = -2$$

$$(-2, 9)$$

$$(3x - 2y = -2) \cdot -4$$

$$(4x - 3y = -4) \cdot 3$$

$$-12x + 8y = 8$$

$$+12x - 9y = -12$$

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$$-y = -4$$

$$y = 4$$

$$(2, 4)$$

$$3x - 2y = -2$$

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

$$3x - 8 = -2$$

$$+8 \quad +8$$

$$\frac{3x}{3} = \frac{6}{3}$$

$$x = 2$$

You Try!

$$(3x + 4y = -1) \times 2$$

$$(-2x - 5y = 10) \times 3$$

$$6x + 8y = -2$$

$$-6x - 15y = 30$$

$$\begin{array}{r} -7y = 28 \\ \hline -7 \\ \hline y = -4 \end{array} \quad (7, -4)$$

$$-2x - 5(-4) = 10$$

$$-2x + 20 = 10$$

$$\begin{array}{r} -20 \quad -20 \\ -2x = -10 \\ \hline -2 \end{array}$$

$$x = 5$$

$$(-5x + 12y = 8) \times 2$$

$$(2x - 8y = 0) \times 5$$

$$-10x + 24y = 16$$

$$10x - 40y = 0$$

$$\begin{array}{r} -16y = 16 \\ \hline -16 \quad -16 \\ \hline \end{array}$$

$$x = -1$$

$$2x - 8(-1) = 0$$

$$2x + 8 = 0$$

$$\begin{array}{r} -8 \quad -8 \\ \hline \end{array}$$

$$\begin{array}{r} 2x = -8 \\ \hline 2 \quad 2 \\ \hline \end{array}$$

$$x = -4$$

