

Systems of Equations

A System of equations is a set of two or more equations that use the same variables

If the graph of each equation in a system of two variables is a line, then the system is a linear system.

Solving Systems by Graphing

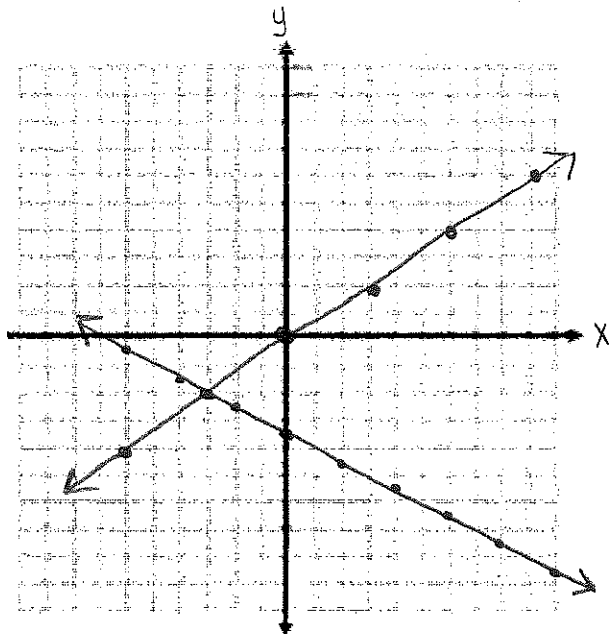
Example 1

a) $x + 2y = -7$
 $2x - 3y = 0$

$(-3, -2)$

$$\begin{array}{r} x + 2y = -7 \\ -x \qquad -x \\ \hline 2y = -x - 7 \\ \frac{2y}{2} = \frac{-x}{2} - \frac{7}{2} \\ y = -\frac{1}{2}x - 3.5 \end{array}$$

$$\begin{array}{r} 2x - 3y = 0 \\ -2x \qquad -2x \\ \hline -3y = -2x \\ \frac{-3y}{-3} = \frac{-2x}{-3} \\ y = \frac{2}{3}x \end{array}$$



Solving Systems by Substitution

Example 2

a) $2x - 3y = 6$
 $x + y = -12$

$(-6, -6)$

$$\begin{array}{r} x + y = -12 \\ -y \qquad -y \\ \hline x = -12 - y \end{array}$$

$$2(-12 - y) - 3y = 6$$

$$-24 - 2y - 3y = 6$$

$$-24 - 5y = 6$$

$$\begin{array}{r} -24 - 5y = 6 \\ +24 \qquad +24 \\ \hline -5y = 30 \\ \frac{-5y}{-5} = \frac{30}{-5} \\ y = -6 \end{array}$$

$$\begin{array}{r} x + (-6) = -12 \\ x - 6 = -12 \\ +6 \quad +6 \\ \hline x = -6 \end{array}$$

Check:

$$2(-6) - 3(-6) = 6$$

$$-12 + 18 = 6$$

$$\checkmark 6 = 6$$

b) $3x - y = 0$
 $4x + 3y = 26$

$(2, 6)$

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

$$4x + 3(3x) = 26$$

$$4x + 9x = 26$$

$$\frac{13x}{13} = \frac{26}{13}$$

$$x = 2$$

$$3(2) - y = 0$$

$$6 - y = 0$$

$$\begin{array}{r} 6 - y = 0 \\ -6 \quad -6 \\ \hline -y = -6 \\ \frac{-y}{-1} = \frac{-6}{-1} \\ y = 6 \end{array}$$

* Get one set of coefficients opposite, then add the two equations together.

Solving Systems by Elimination

Example 3

$$\begin{array}{r} \text{a) } 3x - 2y = 14 \\ 2x + 2y = 6 \\ \hline 5x = 20 \\ \hline = \end{array}$$

$$x = 4$$

$$(4, -1)$$

$$3(4) - 2y = 14$$

$$12 - 2y = 14$$

$$\begin{array}{r} -12 \\ \hline -2y = 2 \end{array}$$

$$\begin{array}{r} -2y = 2 \\ \hline -2 \\ \hline y = -1 \end{array}$$

$$y = -1$$

Check:

$$2(4) + 2(-1) = 6$$

$$8 - 2 = 6$$

$$\checkmark 6 = 6$$

$$\begin{array}{l} \text{b) } 4x + 9y = 1 \\ (4x + 6y = -2)(-1) \end{array}$$

$$\begin{array}{r} \cancel{4x} + 9y = 1 \\ -\cancel{4x} - 6y = 2 \\ \hline 0 - 3y = 3 \\ \hline - 3y = 3 \\ \hline = \end{array}$$

$$y = 1$$

$$4x + 9(1) = 1$$

$$4x + 9 = 1$$

$$\begin{array}{r} -9 \\ \hline 4x = -8 \end{array}$$

$$\begin{array}{r} 4x = -8 \\ \hline = \end{array}$$

$$x = -2$$

$$(-2, 1)$$

$$\begin{array}{l} \text{c) } (3x + 5y = 7)(2) \\ 6x - 10y = -14 \end{array}$$

$$\begin{array}{r} \cancel{6x} + 10y = 14 \\ \cancel{6x} - 10y = -14 \\ \hline 0 = 0 \end{array}$$

$$0 = 0$$

True

Infinitely Many Solutions
(Lines coincide)

$$\begin{array}{l} \text{d) } (-2x + 4y = 6)(3) \\ (-3x + 6y = 8)(-2) \end{array}$$

$$\begin{array}{r} -6x + 12y = 18 \\ 6x - 12y = -16 \\ \hline 0 = 2 \end{array}$$

$$0 = 2$$

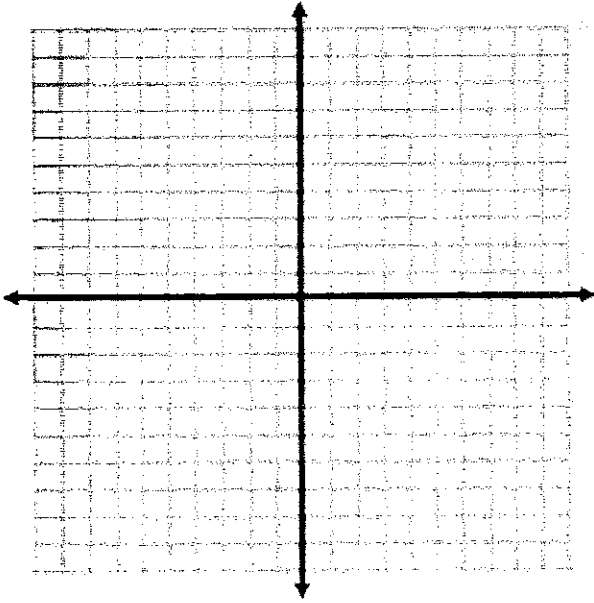
False

No Solution
Lines are Parallel

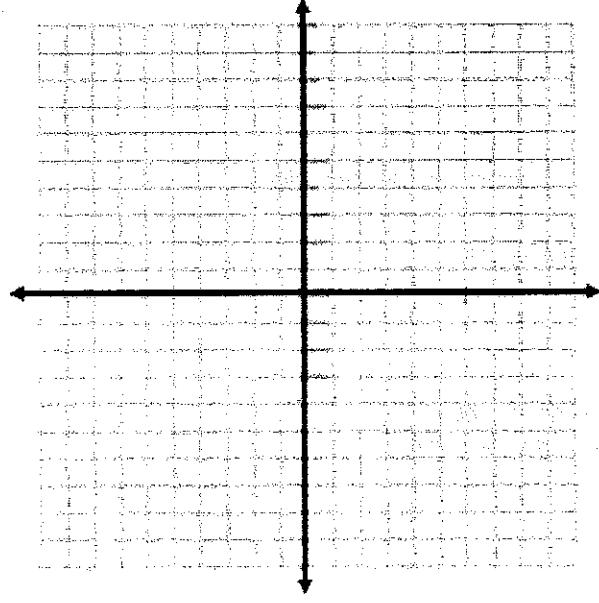
Solving Two-Variable Systems Practice

Solve each system by graphing.

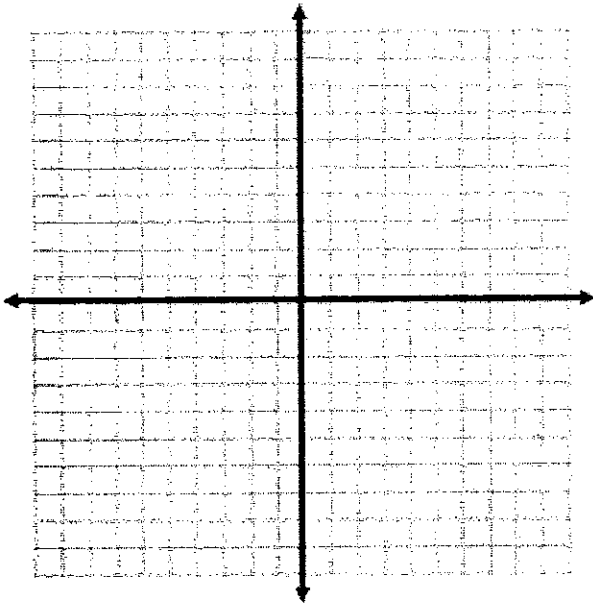
1. $y = 2x + 1$
 $-2x + 3y = -9$



2. $-3x + 4y = 8$
 $x + 2y + 6 = 0$



3. $30x + 50y - 100 = 0$
 $3x - 15y - 30 = 0$



Solve each system by substitution.

$$\begin{aligned} 4. \quad & y = 2x + 4 \\ & -5x - 5y = -5 \end{aligned}$$

$$\begin{aligned} 5. \quad & 2x + y = 7 \\ & -2x - y = 6 \end{aligned}$$

$$\begin{aligned} 6. \quad & 4x + 6y = 22 \\ & -2x + 4y = 10 \end{aligned}$$

$$\begin{aligned} 7. \quad & 8x - 2y = 8 \\ & -4x + y = -4 \end{aligned}$$

Solve each system by elimination.

$$\begin{aligned} 8. \quad & -x + 4y = 25 \\ & 3x - y = 13 \end{aligned}$$

$$\begin{aligned} 9. \quad & -2x - 7y = 22 \\ & -7x - 5y = -1 \end{aligned}$$

$$\begin{aligned} 10. \quad & 8x + 4y = 20 \\ & -10x - 5y = -25 \end{aligned}$$