

Solving Systems by Substitution

Steps

1. One equation will have either x or y by itself, or can be solved for x or y easily.
2. Substitute the expression from Step 1 into the other equation and solve for the other variable.
3. Substitute the value from Step 2 into the equation from Step 1 and solve.
4. Your solution is the ordered pair formed by x & y.
5. Check the solution in each of the original equations.

1. $x = -4$
 $3x + 2y = 20$

$$3(-4) + 2y = 20$$

$$\begin{array}{r} -12 + 2y = 20 \\ +12 \quad +12 \end{array}$$

$$\frac{2y}{2} = \frac{32}{2} \quad y = 16$$

$(-4, 16)$

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

$$x + x - 1 = 3$$

$$2x - 1 = 3$$

$$\frac{2x}{2} = \frac{4}{2} \quad x = 2$$

$y = x - 1$
 $y = 2 - 1$
 $y = 1$

$(2, 1)$

3. $x = -5y + 4$
 $3x + 15y = -1$

$$3(-5y + 4) + 15y = -1$$

$$-15y + 12 + 15y = -1$$

$$12 \neq -1$$

No Solutions

4. $x = 5y + 10$
 $2x - 10y = 20$

$$2(5y + 10) - 10y = 20$$

$$10y + 20 - 10y = 20$$

$$20 = 20$$

∞ Solutions

5. $3x + 2y = -12$
 $y = x - 1$

$$3x + 2(x - 1) = -12$$

$$3x + 2x - 2 = -12$$

$$\begin{array}{r} 5x - 2 = -12 \\ +2 \quad +2 \end{array}$$

$$5x = -10 \quad x = -2$$

$y = x - 1$
 $y = -2 - 1$
 $y = -3$

$(-2, -3)$

6. $2x - 5y = 29$
 $x = -4y + 8$

$$2(-4y + 8) - 5y = 29$$

$$-8y + 16 - 5y = 29$$

$$-13y + 16 = 29$$

$$\frac{-13y}{-13} = \frac{13}{-13} \quad y = -1$$

$x = -4(-1) + 8$
 $x = 4 + 8$
 $x = 12$

$(12, -1)$

7. $x = \frac{1}{2}y - 3$
 $4x - y = 10$

$$4\left(\frac{1}{2}y - 3\right) - y = 10$$

$$2y - 12 - y = 10$$

$$y - 12 = 10$$

$$\begin{array}{r} y - 12 = 10 \\ +12 \quad +12 \end{array}$$

$$y = 22$$

$x = \frac{1}{2}y - 3$
 $x = \frac{1}{2}(22) - 3$
 $x = 11 - 3$
 $x = 8$

$(8, 22)$

8. $2x - 3y = -24$
 $x + 6y = 18 - 6y$

$$2(18 - 6y) - 3y = -24$$

$$36 - 12y - 3y = -24$$

$$\frac{36}{-36} - 15y = \frac{-24}{-36}$$

$$\frac{-15y}{-15} = \frac{-60}{-15}$$

$$y = 4$$

$x = 18 - 6(4)$
 $x = 18 - 24$
 $x = -6$

$(-6, 4)$