

9.7 SOLVING SYSTEMS OF EQUATIONS BY SUBSTITUTION

Solve the linear system using substitution.

1. $y = 4$ $(-\frac{5}{3}, 4)$ 2. $x = -5$ $(-5, -\frac{8}{7})$
 $3x - y = -9$ $-2x + 7y = 2$

$$\begin{aligned} 3x - 4 &= -9 \\ +4 \quad +4 & \\ \hline 3x &= -5 \\ \frac{3x}{3} &= \frac{-5}{3} \\ x &= -\frac{5}{3} \end{aligned}$$

$$\begin{aligned} -2(-5) + 7y &= 2 \\ 10 + 7y &= 2 \\ -10 & \quad -10 \\ \hline 7y &= -8 \\ \frac{7y}{7} &= \frac{-8}{7} \\ y &= -\frac{8}{7} \end{aligned}$$

Solve the linear system using substitution.

3. $y = 2x + 3$ $(1, 5)$ 4. $y = -8 + 4x$ $(1, -4)$
 $y = 5x = 5 \cdot 1 = 5$ $y = 2x - 6$

$$\begin{aligned} 5x &= 2x + 3 \\ -2x \quad -2x & \\ \hline 3x &= 3 \end{aligned}$$

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

$$x = 1$$

$$\begin{aligned} -8 + 4x &= 2x - 6 \\ -2x \quad -2x & \\ \hline -8 + 2x &= -6 \end{aligned}$$

$$\begin{aligned} -8 + 2x &= -6 \\ +8 & \quad +8 \end{aligned}$$

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

$$x = 1$$

This method is **BEST** to use
when one of the variables
in either equation
has a **coefficient of 1 or -1**.

Solve the linear system using substitution.

5. $y = x + 1$ $= -1 + 1 = 0$
 $2x + y = -2$

$$\boxed{(-1, 0)}$$

$$2x + x + 1 = -2$$

$$3x + 1 = -2$$

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

$$x = -1$$

6. $y = -3x + 5$ $= -3 \cdot 3 + 5$
 $= -9 + 5$
 $= -4$
 $2x - y = 10$

$$2x - (-3x + 5) = 10$$

$$2x + 3x - 5 = 10$$

$$5x - 5 = 10$$

$$\frac{5x}{5} = \frac{15}{5}$$

$$x = 3$$

$$\boxed{(3, -4)}$$

7. $x = 2y$ $= 2 \cdot \frac{3}{2} = 3$
 $2x + 6y = 15$

$$2(2y) + 6y = 15$$

$$4y + 6y = 15$$

$$\frac{10y}{10} = \frac{15}{10} \div 5$$

$$y = \frac{3}{2}$$

$$\boxed{(3, \frac{3}{2})}$$

If an equation is **not** already solved for a variable,
you will need to do that first!

Pick the variable with
a coefficient of 1 or -1.

8. $2x + 2y = 3$
 $x - 4y = -1$

Which variable should we solve for?

$x = -1 + 4y$

$x = -1 + 4 \cdot \frac{1}{2}$

$x = -1 + 2$

$x = 1$

$2(-1 + 4y) + 2y = 3$

$-2 + 8y + 2y = 3$

$10y = 5$

$\frac{10y}{10} = \frac{5}{10}$

$y = \frac{1}{2}$

$(1, \frac{1}{2})$

9. $3x + y = 3$
 $7x + 2y = 1$

Which variable should we solve for?

$y = 3 - 3x$

$7x + 2(3 - 3x) = 1$

$7x + 6 - 6x = 1$

$x + 6 = 1$

$x = -5$

$(-5, 18)$

10. $11x - 7y = -14$

$-x + 2y = 4$

$-2y \quad -2y$

$$\frac{-x}{-1} = \frac{4-2y}{-1}$$

$x = -4 + 2y$

$x = -4 + 2 \cdot 2$

$x = -4 + 4$

$x = 0$

$$(0, 2)$$

Which variable should we solve for?

$11(-4 + 2y) - 7y = -14$

$-44 + 22y - 7y = -14$

$-44 + 15y = -14$
 $+44 \quad +44$

$$\frac{15y}{15} = \frac{30}{15}$$

$y = 2$

11. $x + y = 16$

$2y = -2x + 2$

$y = 16 - x$

Which variable should we solve for?

$2(16 - x) = -2x + 2$

$32 - 2x = -2x + 2$

$+2x \quad +2x$

$32 \neq 2$

$$\text{NO SOLUTION}$$