

DO NOW

Solve by substitution.

$$\begin{aligned} y &= x + 1 \\ x + y &= 13 \end{aligned}$$

$$\begin{aligned} x + (x + 1) &= 13 \\ x + x + 1 &= 13 \\ x + x &= 13 - 1 \\ 2x &= 12 \\ x &= \frac{12}{2} \\ x &= 6 \end{aligned}$$

$$\begin{aligned} y &= x + 1 \\ y &= 6 + 1 \\ y &= 7 \end{aligned}$$

$$\boxed{\begin{aligned} x &= 6 \\ y &= 7 \end{aligned}}$$

check:

$$\begin{array}{r|l} y & x+1 \\ \hline 7 & 6+1 \\ 7 & 7 \checkmark \end{array}$$

$$\begin{array}{r|l} x+y & 13 \\ \hline 6+7 & 13 \\ 13 & 13 \checkmark \end{array}$$

5.3 Solving Systems of Equations Using the Addition Method

- Procedure:
1. Pick a variable to have opposite coefficients. (Use multiplication when necessary.)
 2. Combine the two equations using addition. (This will eliminate one of the variables.)
 3. Solve for the remaining variable.
 4. Substitute to find the other variable.
 5. Check in both equations.

Examples: Solve using the addition method.

$$\begin{aligned} 1. \quad x + y &= 2 \\ 2x - y &= 1 \\ \hline 3x &= 3 \\ x &= \frac{3}{3} \\ x &= 1 \end{aligned}$$

$$\begin{aligned} x + y &= 2 \\ 1 + y &= 2 \\ y &= 2 - 1 \\ y &= 1 \end{aligned}$$

$$\boxed{\begin{aligned} x &= 1 \\ y &= 1 \end{aligned}}$$

check:

$$\begin{array}{r|l} x+y & 2 \\ \hline 1+1 & 2 \\ 2 & 2 \checkmark \end{array}$$

$$\begin{array}{r|l} 2x-y & 1 \\ \hline 2(1)-1 & 1 \\ 2-1 & 1 \\ 1 & 1 \checkmark \end{array}$$

$$\begin{aligned} 2. \quad x + 3y &= 13 \Rightarrow x + 3y = 13 \\ x + y &= 5 \Rightarrow -x - y = -5 \end{aligned}$$

$$\begin{aligned} x + y &= 5 \\ x + 4 &= 5 \\ x &= 5 - 4 \\ x &= 1 \end{aligned}$$

$$\boxed{(1, 4)}$$

check:

$$\begin{array}{r|l} x+3y & 13 \\ \hline 1+3(4) & 13 \\ 1+12 & 13 \\ 13 & 13 \checkmark \end{array}$$

$$\begin{array}{r|l} x+y & 5 \\ \hline 1+4 & 5 \\ 5 & 5 \checkmark \end{array}$$

$$\begin{aligned} 3. \quad y &= -x + 2 \Rightarrow x + y = 2 \\ 2x - y &= 2 \Rightarrow 2x - y = 2 \\ \hline 3x &= 4 \\ x &= \frac{4}{3} \\ x &= 1\frac{1}{3} \end{aligned}$$

$$\begin{aligned} y &= -x + 2 \\ y &= -1\frac{1}{3} + 2 \\ y &= \frac{2}{3} \end{aligned}$$

$$\boxed{\begin{aligned} x &= 1\frac{1}{3} \\ y &= \frac{2}{3} \end{aligned}}$$

check:

$$\begin{array}{r|l} y & -x+2 \\ \hline \frac{2}{3} & -1\frac{1}{3}+2 \\ \frac{2}{3} & \frac{2}{3} \checkmark \end{array}$$

$$\begin{array}{r|l} 2x-y & 2 \\ \hline 2(1\frac{1}{3})-\frac{2}{3} & 2 \\ \frac{4}{3}-\frac{2}{3} & 2 \\ \frac{2}{3} & 2 \\ 2 & 2 \checkmark \end{array}$$

$$\begin{aligned} 4. \quad 5a + b &= 13 \xrightarrow{\times 3} 15a + 3b = 39 \\ 4a - 3b &= 18 \Rightarrow 4a - 3b = 18 \\ \hline 19a &= 57 \\ a &= \frac{57}{19} \\ a &= 3 \end{aligned}$$

$$\begin{aligned} 5a + b &= 13 \\ 5(3) + b &= 13 \\ 15 + b &= 13 \\ b &= 13 - 15 \\ b &= -2 \end{aligned}$$

$$\boxed{\begin{aligned} a &= 3 \\ b &= -2 \end{aligned}} \text{ or } (3, -2)$$

check:

$$\begin{array}{r|l} 5a+b & 13 \\ \hline 5(3)+2 & 13 \\ 15+2 & 13 \\ 17 & 13 \checkmark \end{array}$$

$$\begin{array}{r|l} 4a-3b & 18 \\ \hline 4(3)-3(-2) & 18 \\ 12+6 & 18 \\ 18 & 18 \checkmark \end{array}$$

$$\begin{array}{lcl}
 5. & 7x = 5 - 2y & \Rightarrow 7x + 2y = 5 \xrightarrow{\times 3} -21x - 6y = -15 \\
 & 3y = 16 - 2x & \Rightarrow 2x + 3y = 16 \xrightarrow{\times 2} 4x + 6y = 32 \\
 & & \hline
 & & -17x = 17
 \end{array}$$

$$3y = 16 - 2x$$

$$3y = 16 - 2(-1)$$

$$3y = 16 + 2$$

$$3y = 18$$

$$y = \frac{18}{3}$$

$$y = 6$$

$$\boxed{
 \begin{array}{l}
 x = -1 \\
 y = 6
 \end{array}
 }$$

$$x = \frac{17}{-17}$$

$$x = -1$$

Check:

$$\begin{array}{r|l}
 7x & 5 - 2y \\
 7(-1) & 5 - 2(6) \\
 -7 & 5 - 12 \\
 -7 & -7 \checkmark
 \end{array}$$

$$\begin{array}{r|l}
 3y & 16 - 2x \\
 3(6) & 16 - 2(-1) \\
 18 & 16 + 2 \\
 18 & 18 \checkmark
 \end{array}$$

HOMEWORK

Worksheet HW 5.3