

Solving Systems of Linear Equations by Substitution

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

$(-1, 5)$

$$\begin{array}{r} 3 - 2x = 2 - 3x \\ + 3x \quad + 3x \\ \hline 3 + x = 2 \\ -3 \quad -3 \\ \hline x = -1 \end{array}$$

$$\begin{array}{l} y = 3 - 2x \\ y = 3 - 2(-1) \\ y = 5 \end{array}$$

2. $x + y = 5$
 $x = y + 7$

$(6, -1)$

$$\begin{array}{r} (y+7) + y = 5 \\ 2y + 7 = 5 \\ -7 \quad -7 \\ \hline 2y = -2 \\ \frac{2y}{2} = \frac{-2}{2} \\ y = -1 \end{array}$$

$$\begin{array}{l} x = (-1) + 7 \\ x = 6 \end{array}$$

3. $x - y = 1 \rightarrow x = 1 + y$
 $2x + y = 8$

$(3, 2)$

$$\begin{array}{r} 2(1+y) + y = 8 \\ 2 + 2y + y = 8 \\ 3y + 2 = 8 \\ -2 \quad -2 \\ \hline 3y = 6 \\ \frac{3y}{3} = \frac{6}{3} \\ y = 2 \end{array}$$

$$\begin{array}{r} x - (2) = 1 \\ + 2 \quad + 2 \\ \hline x = 3 \end{array}$$

4. $3x - y = 9$
 $y = x + 5$

$(7, 12)$

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

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

$$2x - 5 = 9$$

$$\begin{array}{r} +5 \quad +5 \\ \hline \end{array}$$

$$\frac{2x}{2} = \frac{14}{2}$$

$$x = 7$$

$$y = (7) + 5$$

$$y = 12$$

5. $3x + 4y = 26$

$-2x + y = 1 \rightarrow y = 1 + 2x$

$(2, 5)$

$$3x + 4(1 + 2x) = 26$$

$$3x + 4 + 8x = 26$$

$$11x + 4 = 26$$

$$\begin{array}{r} -4 \quad -4 \\ \hline \end{array}$$

$$\frac{11x}{11} = \frac{22}{11}$$

$$x = 2$$

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

$$-4 + y = 1$$

$$\begin{array}{r} +4 \quad +4 \\ \hline y = 5 \end{array}$$

6. $y = 2x + 3$

$y = 4x + 4$

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

$$2x + 3 = 4x + 4$$

$$\begin{array}{r} -2x \quad -2x \\ \hline 3 = 2x + 4 \\ -4 \quad -4 \end{array}$$

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

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

$$y = 2(-\frac{1}{2}) + 3$$

$$y = -1 + 3$$

$$y = 2$$

7. $2x + 7y = 8$

$x + 5y = 7 \rightarrow x = 7 - 5y$

$(-3, 2)$

$$2(7 - 5y) + 7y = 8$$

$$14 - 10y + 7y = 8$$

$$\begin{array}{r} 14 - 3y = 8 \\ -14 \quad -14 \\ \hline \end{array}$$

$$\begin{array}{r} -3y = -6 \\ \frac{-3y}{-3} = \frac{-6}{-3} \end{array}$$

$y = 2$

$$x + 5(2) = 7$$

$$\begin{array}{r} x + 10 = 7 \\ -10 \quad -10 \\ \hline \end{array}$$

$x = -3$

8. $y = 4x + 4$

$y = 2x + 8$

$(2, 12)$

$$\begin{array}{r} 4x + 4 = 2x + 8 \\ -2x \quad -2x \\ \hline \end{array}$$

$$\begin{array}{r} 2x + 4 = 8 \\ -4 \quad -4 \\ \hline \end{array}$$

$$\begin{array}{r} 2x = 4 \\ \frac{2x}{2} = \frac{4}{2} \end{array}$$

$x = 2$

$$\begin{array}{l} y = 4(2) + 4 \\ y = 12 \end{array}$$

9. $x + 3y = 17 \rightarrow x = 17 - 3y$

$2x + 3y = 22$

$(5, 4)$

$$2(17 - 3y) + 3y = 22$$

$$\begin{array}{r} 34 - 6y + 3y = 22 \\ -34 \quad -34 \\ \hline \end{array}$$

$$\begin{array}{r} -3y = -12 \\ \frac{-3y}{-3} = \frac{-12}{-3} \end{array}$$

$y = 4$

$$x + 3(4) = 17$$

$$\begin{array}{r} x + 12 = 17 \\ -12 \quad -12 \\ \hline \end{array}$$

$x = 5$

10. $4x - 7y = 9$
 $y = x - 3$

$(4, 1)$

$$\begin{aligned}4x - 7(x - 3) &= 9 \\4x - 7x + 21 &= 9 \\-3x + 21 &= 9 \\-21 \quad -21 & \\ \hline-3x &= -12 \\-3 \quad -3 & \\ \hline x &= 4\end{aligned}$$

$$\begin{aligned}y &= (4) - 3 \\y &= 1\end{aligned}$$

11. $8x - 5y = 9$
 $y = 2x - 4$

$(\frac{11}{2}, 7)$

$$\begin{aligned}8x - 5(2x - 4) &= 9 \\8x - 10x + 20 &= 9 \\-2x + 20 &= 9 \\-20 \quad -20 & \\ \hline-2x &= -11 \\-2 \quad -2 & \\ \hline x &= \frac{11}{2}\end{aligned}$$

$$\begin{aligned}y &= 2(\frac{11}{2}) - 4 \\y &= 11 - 4 \\y &= 7\end{aligned}$$

12. $2x + 4y = -2$
 $3x + y = 7 \rightarrow y = 7 - 3x$

$(3, -2)$

$$\begin{aligned}2x + 4(7 - 3x) &= -2 \\2x + 28 - 12x &= -2 \\-10x + 28 &= -2 \\-28 \quad -28 & \\ \hline-10x &= -30 \\-10 \quad -10 & \\ \hline x &= 3\end{aligned}$$

$$\begin{aligned}3(3) + y &= 7 \\9 + y &= 7 \\-9 \quad -9 & \\ \hline y &= -2\end{aligned}$$

13. $3x + y = 5 \rightarrow y = 5 - 3x$
 $2x + 3y = 8$

$$(1, 2)$$

$$\begin{aligned} 2x + 3(5 - 3x) &= 8 \\ 2x + 15 - 9x &= 8 \\ -7x + 15 &= 8 \\ -15 \quad -15 \\ \hline -7x &= -7 \\ \frac{-7}{-7} \quad \frac{-7}{-7} \\ x &= 1 \end{aligned}$$

$$\begin{aligned} 2(1) + 3y &= 8 \\ 2 + 3y &= 8 \\ -2 \quad -2 \\ \hline 3y &= 6 \\ \frac{3}{3} \quad \frac{6}{3} \\ y &= 2 \end{aligned}$$

14. $2x + 6y = 24$
 $x - 4y = -2 \rightarrow x = 4y - 2$

$$(6, 2)$$

$$\begin{aligned} 2(4y - 2) + 6y &= 24 \\ 8y - 4 + 6y &= 24 \\ 14y - 4 &= 24 \\ +4 \quad +4 \\ \hline 14y &= 28 \\ \frac{14}{14} \quad \frac{28}{14} \\ y &= 2 \end{aligned}$$

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