

3.4 Solving Systems of Equations by Substitution

Solutions

Solve by substitution. State the system solution category.	
<p>1. $\begin{cases} y = 2x - 3 \\ 3x + y = 7 \end{cases}$</p> <p>$3x + 2x - 3 = 7$</p> <p>$5x - 3 = 7$</p> <p>$\begin{array}{r} +3 \quad +3 \\ 5x \quad = 10 \end{array}$</p> <p>$\frac{5x}{5} = \frac{10}{5}$</p> <p>$x = 2$</p> <p>$y = 2x - 3$</p> <p>$= 2 \cdot 2 - 3$</p> <p>$= 4 - 3$</p> <p>$= 1$</p> <p>System solution: $\{(2, 1)\}$</p> <p>System category: consistent and independent</p>	<p>2. $\begin{cases} y = 3x + 1 \\ 4x + 2y = -8 \end{cases}$</p>
<p>3. $\begin{cases} x = 2y + 5 \\ x - 3y = 7 \end{cases}$</p> <p>$2y + 5 - 3y = 7$</p> <p>$-y + 5 = 7$</p> <p>$\begin{array}{r} -5 \quad -5 \\ -y \quad = 2 \end{array}$</p> <p>$-1(-y) = -1 \cdot 2$</p> <p>$y = -2$</p> <p>$x = 2y + 5$</p> <p>$= 2 \cdot -2 + 5$</p> <p>$= -4 + 5$</p> <p>$= 1$</p> <p>System solution: $\{(1, -2)\}$</p> <p>System category: consistent and independent</p>	<p>4. $\begin{cases} y = 2x - 3 \\ 2x - 3y = -3 \end{cases}$</p>
Answers: 1. $\{(2, 1)\}$, consistent and independent; 3. $\{(1, -2)\}$, consistent and independent	

Solve by substitution. State the system solution category.

$$5. \begin{cases} 5x + y = -5 \\ y = 3x - 1 \end{cases}$$

$$5x + 3x - 1 = -5$$

$$8x - 1 = -5$$

$$8x \begin{matrix} +1 \\ -1 \end{matrix} = -4$$

$$\frac{8x}{8} = \frac{-4}{8}$$

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

$$y = 3x - 1 \\ = 3 \cdot -\frac{1}{2} - 1$$

$$= -\frac{3}{2} - 1$$

$$= -\frac{5}{2}$$

System solution: $\left\{\left(-\frac{1}{2}, -\frac{5}{2}\right)\right\}$

System category: consistent and independent

$$6. \begin{cases} 3x - 4y = 10 \\ x = -2y + 5 \end{cases}$$

$$7. \begin{cases} -3x + 2y = -7 \\ x + 2y = 7 \end{cases}$$

$$\begin{matrix} -2y \\ -2y \end{matrix}$$

$$x = -2y + 7$$

$$-3(-2y + 7) + 2y = -7$$

$$6y - 21 + 2y = -7$$

$$8y - 21 = -7$$

$$8y \begin{matrix} +21 \\ -21 \end{matrix} = 14$$

$$\frac{8y}{8} = \frac{14}{8}$$

$$y = \frac{7}{4}$$

$$x = -2y + 7$$

$$= -2 \cdot \frac{7}{4} + 7$$

$$= -\frac{7}{2} + \frac{14}{2}$$

$$= \frac{7}{2}$$

System solution: $\left\{\left(\frac{7}{2}, \frac{7}{4}\right)\right\}$

System category: consistent and independent

$$8. \begin{cases} x + 2y = -3 \\ 2x - y = -4 \end{cases}$$

Answers: 5. $\left\{\left(-\frac{1}{2}, -\frac{5}{2}\right)\right\}$, consistent and independent; 7. $\left\{\left(\frac{7}{2}, \frac{7}{4}\right)\right\}$, consistent and independent

Solve by substitution. State the system solution category.

$$9. \begin{cases} x = 2y + 6 \\ -2x + 4y = -1 \end{cases}$$

$$\begin{aligned} -2(2y + 6) + 4y &= -1 \\ -4y - 12 + 4y &= -1 \\ -12 &= -1 \\ &\text{False.} \end{aligned}$$

System solution: \emptyset
System category: inconsistent

$$10. \begin{cases} -x + 3y = -18 \\ 2x - 6y = 9 \end{cases}$$

$$11. \begin{cases} 4x - y = 2 & 4x - y = 2 \\ 2y + 4 = 8x & \begin{array}{r} -4x \quad -4x \\ -y = -4x + 2 \\ -1(-y) = -1(-4x + 2) \\ y = 4x - 2 \end{array} \end{cases}$$

$$\begin{aligned} 2(4x - 2) + 4 &= 8x \\ 8x - 4 + 4 &= 8x \\ 8x &= 8x \\ \underline{-8x} \quad \underline{-8x} & \\ 0 &= 0 \\ &\text{True.} \end{aligned}$$

System solution: $\{(x, y) | 4x - y = 2\}$
System category: consistent and dependent

$$12. \begin{cases} 6x - y = -8 \\ -9x + \frac{3}{2}y = 12 \end{cases}$$

Answers: 9. \emptyset , inconsistent; 11. $\{(x, y) | 4x - y = 2\}$, consistent and dependent