

Solving Systems by Elimination

If you don't want to graph the lines, and substitution doesn't seem like the best idea, you have one other option: Elimination.

Elimination is when you line up the equations, making one set of variables "match," then add down to eliminate that variable. Once you have, solve for the remaining variable. Then, plug what you got in to solve for the sad eliminated variable. Beware: there won't always be an answer and sometimes, the answer will be infinitely many solutions.

<p>EXAMPLE: Solve using elimination.</p> $\begin{cases} 6x + 2y = 20 \\ -2x + 5y = -1 \end{cases}$ <p>They're already lined up to cancel, BUT I need to make one of the variables match. I'll multiply the bottom equation by 3...</p> $\begin{array}{r} 6x + 2y = 20 \rightarrow 6x + 2y = 20 \\ +3(-2x + 5y = -1) \rightarrow + -6x + 15y = -3 \\ \hline 17y = 17 \\ y = 1 \end{array}$ <p>Plug it in to solve for x.</p> $\begin{aligned} 6x + 2(1) &= 20 \\ 6x + 2 &= 20 \\ 6x &= 18 \\ x &= 3 \end{aligned}$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">The solution is (3, 1)</div>	<p>EXAMPLE: Solve using elimination.</p> $\begin{cases} -5x + 2y = 10 \\ -2y - 2x = 4 \end{cases}$ <p>CAREFUL!!! They aren't lined up!</p> $\begin{array}{r} -5x + 2y = 10 \rightarrow -5x + 2y = 10 \\ + -2y - 2x = 4 \rightarrow + -2x - 2y = 4 \\ \hline -7x = 14 \\ x = -2 \end{array}$ <p>Plug it in to solve for x.</p> $\begin{aligned} -5(-2) + 2y &= 10 \\ 10 + 2y &= 10 \\ 2y &= 0 \\ y &= 0 \end{aligned}$ <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">The solution is (-2, 0)</div>
<p>1. Solve using elimination.</p> $\begin{cases} 3x + 2y = 22 \\ -x + 5y = 4 \end{cases}$	<p>2. Solve using elimination.</p> $\begin{cases} x = 3 - y \\ -2x = -6 + 2y \end{cases}$
<p>3. Solve using elimination.</p> $\begin{cases} 2y + 6x = 4 \\ x - 2y = -11 \end{cases}$	<p>4. Solve using elimination.</p> $\begin{cases} x + y = 7 \\ 2x + 5y = 26 \end{cases}$
<p>5. Solve using elimination.</p> $\begin{cases} 9x - 6y = 0 \\ 7x + 3y = 0 \end{cases}$	<p>6. Solve using elimination.</p> $\begin{cases} 3y = 3x + 6 \\ y = x + 3 \end{cases}$

<p>7. Solve using elimination.</p> $\begin{cases} 3x - 4y = -8 \\ 2y + x = 4 \end{cases}$	<p>8. Solve using elimination.</p> $\begin{cases} 5x + 3y = -4 \\ 4x + 7y = 6 \end{cases}$
<p>9. Solve using elimination.</p> $\begin{cases} -3x + 4y = 5 \\ 8y - 6x = 10 \end{cases}$	<p>10. Solve using elimination.</p> $\begin{cases} 9x + 6y = 12 \\ -2y - 3x = 4 \end{cases}$

Check if the given point is a solution to the system.

<p>11. Is (4, 3) a solution to the system?</p> $\begin{cases} 2x + 2y = 14 \\ -x + y = -7 \end{cases}$	<p>12. Is (9, -2) a solution to the system?</p> $\begin{cases} y - 5 = 2x \\ 3y - 15 = 6x \end{cases}$	<p>13. Is (0, 0, 0) a solution to the system?</p> $\begin{cases} 2x + 3y = 4z \\ -3y + 5x = z \\ 4x + 8 = 2z \end{cases}$
<p>14. Is (5, 2, -1) a solution to the system?</p> $\begin{cases} 3x + y - z = 18 \\ x + y + 4z = 3 \\ 3x - 9y + 2z = -1 \end{cases}$	<p>15. Is (8, 10) a solution to the system?</p> $\begin{cases} y = 2x - 6 \\ 3x = 6x + 18 \end{cases}$	<p>16. Is (7, 11) a solution to the system?</p> $\begin{cases} 3x - 2y = -1 \\ 3x + 2y = 43 \end{cases}$
<p>14. Is (-1, -1) a solution to the system?</p> $\begin{cases} x + y = -2 \\ 3x - 3y = 0 \end{cases}$	<p>15. Is (1, 2, 3) a solution to the system?</p> $\begin{cases} 4x + 5y + 6z = 32 \\ x - 2y = -3 \\ 6x + 5y - z = 19 \end{cases}$	<p>16. Is (9, 9) a solution to the system?</p> $\begin{cases} 9x - 8y = 9 \\ -9x + 8y = -9 \end{cases}$