

LESSON 18 | MEET THE IDEA

Solving systems by elimination

Thursday, December 17, 2026 . 6:00–7:00 PM Central

By the end, I can...

Add equivalent equations to eliminate a variable, then find and check both coordinates.

Elimination uses opposite coefficients so one variable adds to zero. Adding equal quantities to equal quantities keeps an equality true.

Example 1 | $3x + 2y = 16$ and $x - 2y = 0$

$$\begin{aligned}(3x + 2y) + (x - 2y) \\ = 16 + 0\end{aligned}$$

Add the entire left sides and the entire right sides.

$$4x = 16$$

The y terms cancel: $2y + (-2y) = 0$.

$$x = 4$$

Divide by 4.

$$4 - 2y = 0, \text{ so } y = 2$$

Use an original equation to find y.

Solution: (4, 2). Checks: $3(4) + 2(2) = 16$; $4 - 2(2) = 0$.

Keep one original equation

The added equation alone is not the whole system. Use it together with an original equation to recover the second coordinate. This is why elimination preserves the shared solution.

LESSON 18 | SCALING ONE OR BOTH EQUATIONS

Make opposite coefficients

Scale one | $2x + 3y = 17$ and $4x + y = 19$

$$-4x - 6y = -34$$

$$\begin{aligned} (-4x - 6y) + (4x + y) \\ = -34 + 19 \end{aligned}$$

$$-5y = -15, \text{ so } y = 3$$

$$4x + 3 = 19, \text{ so } x = 4$$

Multiply every term of the first equation by -2 .

Add it to the unchanged second equation.

The x terms disappear; divide by -5 .

Substitute $y = 3$. Check $(4, 3)$ in both originals.

Scale both | $2x + 3y = 12$ and $3x - 2y = 5$

$$4x + 6y = 24$$

$$9x - 6y = 15$$

$$13x = 39, \text{ so } x = 3$$

$$6 + 3y = 12, \text{ so } y = 2$$

Check $(3, 2)$: $2(3) + 3(2) = 12$ and $3(3) - 2(2) = 5$.

Multiply the first equation by 2 .

Multiply the second equation by 3 .

Add; opposite y terms cancel.

Use the first original equation.

Use a nonzero multiplier and multiply **every term on both sides**. Multiplying only the x term creates a different equation.

LESSON 18 | COUNT AND COST

Use the method in context

A group buys 13 snacks: granola bars at \$3 each and smoothies at \$5 each. They spend \$49. Let g count bars and s count smoothies.

$g + s = 13$ and $3g + 5s = 49$

$-3g - 3s = -39$

$2s = 10$, so $s = 5$

$g + 5 = 13$, so $g = 8$

8 bars and 5 smoothies. Check: $8 + 5 = 13$, and $3(8) + 5(5) = 24 + 25 = \49 .

Multiply the count equation by -3 .

Add to the cost equation: $3g + 5s = 49$.

Use the original count equation.

Which method looks convenient?

What you notice	A useful choice
A variable is already isolated.	Substitution often needs fewer steps.
A pair of coefficients is opposite, or easily made opposite.	Elimination often keeps the arithmetic simple.
You need to see how two quantities compare.	Graphing gives a visual interpretation.

There can be more than one good method

For the snack problem, substitution would also work: $g = 13 - s$. Choose a clear route, and check the same two original conditions at the end.

LESSON 18 | SHORT CHECKS

Your turn

1. Solve $2x + 3y = 13$ and $2x - 3y = 7$.

2. Solve $x + 2y = 8$ and $3x + 2y = 12$. Make opposite coefficients before adding.

3. Solve $2x + 3y = 13$ and $3x - 2y = 0$ by scaling both equations.

4. Nine cartons cost \$46. Small cartons cost \$4; large cartons cost \$6. Write a system and find each count.

5. A student multiplies $2x + 3y = 12$ by -2 and writes $-4x + 3y = -24$. Correct the equation and explain.

Remember the special cases

If valid elimination produces $0 = 0$, use an original equation to describe the shared line. If it produces $0 =$ a nonzero number, there is no solution. The variables disappearing does not mean their values are zero.

LESSON 18 | WORKED ANSWERS

Check, then choose your next step

1. Add: $4x = 20$, so $x = 5$. Then $10 + 3y = 13$ gives $y = 1$. **(5, 1)**. Checks: $10 + 3 = 13$; $10 - 3 = 7$.
2. Multiply the first equation by -1 , then add to the second: $2x = 4$. So $x = 2$ and $y = 3$. **(2, 3)**. Checks: $2 + 6 = 8$; $6 + 6 = 12$.
3. Multiply the first equation by 2 and the second by 3: $4x + 6y = 26$ and $9x - 6y = 0$. Add: $13x = 26$, so $x = 2$; $y = 3$. **(2, 3)**. Checks: $4 + 9 = 13$; $6 - 6 = 0$.
4. Let s and l count small and large cartons. $s + l = 9$; $4s + 6l = 46$. Multiply the first equation by -4 and add: $2l = 10$. **5 large and 4 small cartons**. Checks: $4 + 5 = 9$; $4(4) + 6(5) = 46$.
5. **$-4x - 6y = -24$** . All three terms must be multiplied by -2 , including $3y$. The incorrect equation changes the relationship.

A light plan for the winter break

Complete the normal digital practice set your teacher assigns. For optional retrieval, redo one substitution example and one elimination example without looking at their next lines. Our next live class is **Tuesday, January 5, 2027**.

I can...

- ☐ Create opposite coefficients and eliminate.
- ☐ Check both original equations and explain the context.

Next class: solution regions that satisfy two inequalities together. Curriculum focus: A.5C.