Solving by Substitution

Put one equation's expression in place of the variable in the other. Two variables become one Unit 1 equation. Back-substitute, then check the pair in both.

1 THE VOCABULARY

Words we use

Substitution swap an expression in for a variable in the other equation.

Back-substitute use the value found to get the other variable from the solved equation.

Solve for a variable get x or y alone (Unit 1); pick the one that comes free easily.

Check the pair both numbers into both originals.

- Watch out for these.
- Substituting into the same equation you solved. Use the other one.
- Dropping the parentheses: 3(8 – 2y) needs the distributive property.
- Stopping after one variable. Back-substitute for the other.
- Not checking in both originals.

2 THE METHOD

The five steps

1. SOLVE ONE FOR ONE VARIABLE already y = ... or x = ...? Use it. Otherwise pick the lonely variable.
2. SUBSTITUTE replace that variable in the other equation with the expression, in parentheses.
3. SOLVE one variable now: Unit 1 moves.
4. BACK-SUBSTITUTE the number into the solved equation gives the other variable.
5. CHECK the pair in both original equations.

WHY THE SWAP IS ALLOWED

The solution satisfies both equations, so y is the same number in both. Whatever the first equation says y equals, the second equation can use instead of y.

3 SUBSTITUTION

x + 2y = 8 and 3x – y = 3

x = 8 – 2y	step 1: solve the first for the lonely x
3(8 – 2y) – y = 3	step 2: substitute into the second, with parentheses
24 – 6y – y = 3, so 24 – 7y = 3	distribute, combine like terms
–7y = –21, so y = 3	add –24 to both sides, multiply by –1/7
x = 8 – 2(3) = 2	step 4: back-substitute
check: 2 + 6 = 8; 6 – 3 = 3	step 5: both true. (2, 3)

A STRANGE FINAL LINE

If the variable disappears and you get a false statement like –6 = –10, the system has no solution (parallel lines). A true statement like 0 = 0 means infinitely many. Lesson 4.

SAY IT OUT LOUD

Solve one, swap it in, solve, back-substitute, check both.