Solving Linear Equations: Quick Guide + Practice

Pre-Algebra / Algebra I • Foundation to On-Level

Why this works

An equation is a balance statement: the left side and the right side name the same number. Any operation you apply to one side must be applied to the other, or the balance is broken. Solving means peeling away operations in reverse order until the variable stands alone.

Quick strategy — 4 steps

1	**Simplify each side**	Distribute, then combine like terms on the left and on the right separately.
2	**Collect variables**	Add or subtract a variable term so all variables sit on one side.
3	**Undo addition/subtraction**	Move the constant away from the variable term.
4	**Undo multiplication/division**	Divide (or multiply) to get a coefficient of 1, then check by substitution.

Worked example 1

Solve $3x + 5 = 20$.

$3x + 5 = 20$	Original equation.
$3x + 5 - 5 = 20 - 5$	Subtract 5 from both sides to isolate the variable term.
$3x = 15$	Simplify.
$x = 5$	Divide both sides by 3.
$3(5) + 5 = 20$ (true)	Check by substitution.

Worked example 2

Solve $4(x - 2) = 2x + 6$.

$4(x - 2) = 2x + 6$	Original equation.
$4x - 8 = 2x + 6$	Distribute 4 across the parentheses.
$4x - 2x - 8 = 6$	Subtract 2x from both sides to collect variables.
$2x - 8 = 6$	Combine like terms.
$2x = 14$	Add 8 to both sides.
$x = 7$	Divide both sides by 2.

`4(7 – 2) = 20 = 2(7) + 6 (true)` Check by substitution.

Common mistakes to avoid

Distributing to only the first term: 4(x – 2) is 4x – 8, not 4x – 2.

Forgetting to apply an operation to *both* sides.

Dropping a negative sign when moving a term across the equals sign.

Dividing only part of a side: from 2x + 4 = 10, divide after isolating 2x, not before.

Stopping before checking the solution by substitution.

Guided practice

Fill in the missing reason or step, then finish the solve.

a) `5x – 7 = 18 → 5x = ____ → x = ____`

b) `2(x + 3) = 16 → 2x + ____ = 16 → x = ____`

Independent practice — 10 problems

1. `x + 9 = 14`	2. `7x = 42`
3. `x/4 = 5`	4. `3x – 8 = 13`
5. `2x + 5 = x + 12`	6. `5(x – 1) = 20`
7. `4x + 3 = 2x + 11`	8. `6 – 2x = 14`
9. `3(2x + 1) = 4x + 15`	10. `(x + 5)/3 = 4`

Challenge problem

Solve for x and explain in one sentence why the equation has no solution or infinitely many solutions if that occurs: 3(2x – 4) = 6x – 12.

Answer key

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1. x = 5	2. x = 6	3. x = 20	4. x = 7	5. x = 7
6. x = 5	7. x = 4	8. x = –4	9. x = 6	10. x = 7

Guided practice: a) 5x = 25, x = 5. b) 2x + 6 = 16, x = 5.
Challenge: distributing gives 6x – 12 = 6x – 12, a statement true for every x, so the equation has infinitely many solutions — the two sides are the same expression.

Self-check

Before you move on, can you…

[ ] State the four steps without looking?

[ ] Distribute correctly across a negative or a subtraction?

[ ] Collect variable terms on either side and get the same answer?

[ ] Check a solution by substitution every time?