

Simple Algebra

Part 2 • Going Further

In Part 1, you solved this:

$$x + 5 = 12$$

Now we'll tackle this:

$$2x + 3 = 11$$

1. Welcome Back!

If you read Part 1, you already know the basics. Quick reminder:

Quick Review

Variables (x, n, ?) are mystery numbers.

Equations have an = sign — both sides balance.

Use **inverse operations** to undo: $+$ $\leftrightarrow$ $-$ and $\times$ $\leftrightarrow$ $\div$.

The Golden Rule: do the same thing to BOTH sides.

Got it? Great! Now we'll do harder problems — but they all use the same tricks. You just use them MORE TIMES.

2. Two-Step Equations

Sometimes an equation has TWO things being done to the variable. So you need TWO steps to undo them.

$$2x + 3 = 11$$

Look closely. The x is being:

- **multiplied by 2** (because of the 2 next to it)
- **then added to 3** (because of the + 3)

Unwrap It Like a Present

x is wrapped up in TWO layers. To get x by itself, unwrap one layer at a time — in REVERSE order!

Step 1: Undo the addition/subtraction first → subtract 3 from both sides.

Step 2: Then undo the multiplication → divide both sides by 2.

$$\begin{array}{ccc} 2x + 3 = 11 & & \\ \downarrow & & \\ 2x + 3 - 3 = 11 - 3 & \text{(subtract 3 from both sides)} & \\ \downarrow & & \\ 2x = 8 & & \\ \downarrow & & \\ 2x \div 2 = 8 \div 2 & \text{(divide both sides by 2)} & \\ \downarrow & & \\ x = 4 \checkmark & & \end{array}$$

Always check: plug 4 back into the original. $2 \times 4 + 3 = 8 + 3 = 11$. ✓

3. Combining Like Terms

What if you see this:

$$x + x + x = 12$$

Three x's added together is the same as $3 \times x$, which we write as $3x$. So we can simplify:

$$x + x + x = 12$$



$$3x = 12$$



$$x = 4 \quad \checkmark$$

Like Terms

"Like terms" are pieces that match each other — same letter, or just plain numbers.

You can combine like terms by adding (or subtracting) the numbers in front:

- $4x + 5x = 9x$
- $7n - 2n = 5n$
- $6 + 4 = 10$

But you CANNOT combine UNLIKE terms!

- $3x + 5$ stays $3x + 5$ (the x's and the plain numbers don't combine)

Here's a bigger example. Simplify first, then solve:

$$2x + 5 + 3x = 20$$



$$5x + 5 = 20 \quad (\text{combine } 2x \text{ and } 3x)$$



$$5x = 15 \quad (\text{subtract } 5 \text{ from both sides})$$



$$x = 3 \quad \checkmark \quad (\text{divide both sides by } 5)$$

4. Variables on BOTH Sides

What if x shows up on both the left AND the right?

$$3x + 2 = x + 10$$

Your goal is the same: get x alone on ONE side. So first, move all the x 's together.

The Strategy

Step 1: Pick a side for x to live on. Move all x 's there. (Use the Golden Rule!)

Step 2: Move all plain numbers to the OTHER side.

Step 3: Solve like before.

$$\begin{array}{ccc} 3x + 2 = x + 10 & & \\ \downarrow & & \\ 3x + 2 - x = x + 10 - x & \text{(subtract } x \text{ from both sides)} & \\ \downarrow & & \\ 2x + 2 = 10 & & \\ \downarrow & & \\ 2x = 8 & \text{(subtract 2 from both sides)} & \\ \downarrow & & \\ x = 4 \checkmark & \text{(divide both sides by 2)} & \end{array}$$

Check: $3(4) + 2 = 12 + 2 = 14$, and $4 + 10 = 14$. Both sides match! $\checkmark$

5. Expressions vs Equations

People sometimes mix these up. They're different!

Expression	Equation
$3x + 5$ (no equals sign) You SIMPLIFY it.	$3x + 5 = 11$ (has an equals sign) You SOLVE it.

Think of it Like Sentences

Expression = a phrase. "the tall boy with brown hair." Just a description.

Equation = a complete sentence. "The tall boy with brown hair is my friend." Has a verb (= is the verb!).

6. Always Check by Substituting

After you solve an equation, you should ALWAYS check your answer. The easiest way? Substitution.

What is Substitution?

Substitution = putting a number in place of a variable.

Take your answer for x , plug it back into the ORIGINAL equation, and see if both sides match.

Example: You solved $4x - 5 = 19$ and got $x = 6$. Check it!

Original: $4x - 5 = 19$



Substitute $x = 6$: $4(6) - 5 = 19?$



$24 - 5 = 19?$



$19 = 19$ ✓ YES!

If both sides match, you're right! If they don't, go back and find your mistake.

7. The Distributive Property

Sometimes you'll see parentheses in an equation:

$$2(x + 3) = 14$$

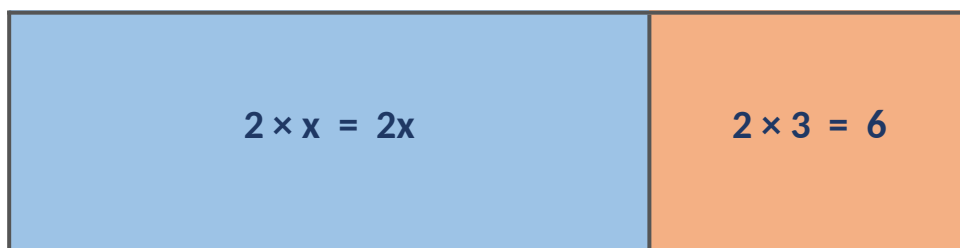
What does the 2 outside the parentheses do? It MULTIPLIES everything inside!

The Distributive Property

$$2(x + 3) = 2 \times x + 2 \times 3 = 2x + 6$$

The 2 "distributes" — it visits each thing inside the parentheses and multiplies.

Picture a rectangle. The total area is $2 \times (x + 3)$, but you can also see it as two smaller rectangles: $2 \times x$ and 2×3 .



So now let's solve $2(x + 3) = 14$:

$$\begin{array}{l} 2(x + 3) = 14 \\ \downarrow \\ 2x + 6 = 14 \quad \text{(distribute the 2)} \\ \downarrow \\ 2x = 8 \quad \text{(subtract 6 from both sides)} \\ \downarrow \\ x = 4 \quad \checkmark \quad \text{(divide both sides by 2)} \end{array}$$

8. Negative Numbers in Algebra

Sometimes the answer to an algebra problem is NEGATIVE. That's totally OK!

$$x + 7 = 3$$

Hmm — what number plus 7 equals 3? It must be SMALLER than 3 (because we're adding 7 to get up to it). It has to be negative.

$$x + 7 = 3$$



$$x = 3 - 7 \quad (\text{subtract 7 from both sides})$$



$$x = -4 \quad \checkmark$$

Check: $-4 + 7 = 3$. $\checkmark$ Yes!

The Number Line Goes Both Ways!

Numbers don't stop at 0. They keep going into the NEGATIVES: -1, -2, -3, ...

Adding a negative number is the same as subtracting: $5 + (-3) = 5 - 3 = 2$.

Subtracting a negative is the same as adding: $5 - (-3) = 5 + 3 = 8$.

9. Trickier Word Problems

Word problems get harder when there are multiple steps. The trick: read carefully, then translate piece by piece.



Worked Example

"Sara has \$20. She buys 3 books that all cost the same amount. After buying them, she has \$5 left. How much did each book cost?"

Translate piece by piece:

- "each book cost" → let b = cost of one book
- "3 books that all cost the same" → $3b$ total cost
- "\$20 minus the cost" → $20 - 3b$
- "has \$5 left" → $= 5$

Equation: $20 - 3b = 5$

$$20 - 3b = 5$$



$$-3b = -15 \quad (\text{subtract 20 from both sides})$$



$$b = 5 \quad \checkmark \quad (\text{divide both sides by } -3)$$

Each book cost \$5. Let's check: $3 \text{ books} \times \$5 = \15 . Sara starts with \$20, spends \$15, has \$5 left. ✓

10. Try It Yourself!

Try this!

Question 1: Solve this two-step equation: $3x + 4 = 19$

$x =$ _____

Try this!

Question 2: Combine like terms, then solve: $2x + 3 + 5x = 24$

$x =$ _____

Try this!

Question 3: Variables on both sides: $4x + 1 = 2x + 9$

$x =$ _____

Try this!

Question 4: Distribute, then solve: $3(x - 2) = 12$

$x =$ _____

Try this!

Question 5: Word problem: "Tom has 24 marbles. He gives the same number to each of his 4 friends. Now he has 8 left. How many did each friend get?"

Equation: _____ Each friend got: _____

Answers

1) $x = 5$ 2) $7x + 3 = 24$, $x = 3$ 3) $x = 4$ 4) $3x - 6 = 12$, $x = 6$ 5) $24 - 4m = 8$, $m = 4$ marbles each

You're ready for Part 3!

Coming next: graphs, function machines, and inequalities.