

True or False

A GUIDE

Become an equation judge: decide whether a number sentence tells the truth — often without doing any big calculating at all.

Every Equation Makes a Claim

An equals sign is not a command to "find the answer." It is a claim: the stuff on the left is worth exactly the same as the stuff on the right. Some claims are true. Some are false.

Your job is to be the judge. You read both sides, think about what each one is worth, and give your verdict: true or false. Sometimes you will work both sides out. But the best judges often spot the verdict without computing anything — and that is the skill this guide teaches you.

$$8 + 5 = 13$$

Worked example True or false: $9 + 6 = 14$

1. Work out the left side: $9 + 6 = 15$.
2. Compare it to the right side, which is 14.
3. 15 and 14 are not the same amount, so the claim fails.

Answer: False

The Swap Trick for Adding

Imagine you have 22 marbles and a friend hands you 3 more. Now imagine you started with 3 and got 22. Either way, you end up holding the exact same pile of marbles. Adding does not care about order.

This move has a fancy name — the commutative property — but you can just call it the swap trick. If the two sides of an equation use the same numbers, joined only by +, and they are just in a different order, the equation is true. No adding required. You judged it by reasoning, not by arithmetic.

$$22 + 3 = 3 + 22$$

Worked example True or false: $47 + 18 = 18 + 47$

1. Look at the numbers on each side: both sides use 47 and 18.
2. Check the operation: both sides only add, and adding lets you swap.
3. Since it is the same pair of numbers being added, both sides must be worth the same. Verdict reached — and you never had to add.

Answer: True

Subtraction Refuses to Swap

Here is where careless judges get fooled. Subtraction looks like addition's twin, but it plays by a different rule. Having 9 cookies and eating 4 is a very different day from having 4 cookies and trying to eat 9.

In subtraction, the first number is what you start with and the second is what you take away. Swap them and you change the story, so you change the answer. $9 - 4$ is 5, but $4 - 9$ is not 5 — it dives below zero. So when you see a swapped subtraction, be suspicious.

$$9 - 4 \neq 4 - 9$$

Worked example True or false: $30 - 12 = 12 - 30$

1. Spot the operation: this is subtraction, and subtraction cares about order.
2. The left side starts at 30 and takes away 12, landing at 18.
3. The right side starts at 12 and tries to take away 30 — it cannot land at 18; it drops below zero.
4. Different values on each side means the claim is false.

Answer: **False**

Counting Copies: From + to $\times$

Look at $6 + 6 + 6$. That is three copies of the same number. Instead of adding one copy at a time, you can just count the copies: three sixes is 3×6 . Multiplication is really a shortcut for repeated addition.

This gives you another judging superpower. When one side of an equation is a number added to itself again and again, count the copies. If the other side is (number of copies) $\times$ (that number), the equation is true. If the count is off — say four copies but the other side says $3 \times$ — it is false.

$$6 + 6 + 6 = 3 \times 6$$

Worked example True or false: $7 + 7 + 7 + 7 = 4 \times 7$

1. Count the copies of 7 on the left side: one, two, three, four.
2. Four copies of 7 means the left side is worth 4×7 .
3. The right side says exactly 4×7 , so both sides match.

Answer: **True**

Remember

- ★ Before computing anything, look for a shortcut: same numbers, same operation, just reordered?
- ★ Addition swaps freely, but subtraction never does — order changes the story, so it changes the answer.
- ★ When a number repeats with plus signs, count the copies: $a + a + a$ is exactly $3 \times a$.
- ★ If you do have to calculate, you only need to find one mismatch to shout "false."

Now you try

- 1) True or false: $4 + 9 = 9 + 4$
Answer: _____
- 2) True or false: $12 - 5 = 5 - 12$
Answer: _____
- 3) True or false: $6 + 6 + 6 = 3 \times 6$
Answer: _____
- 4) Fill in the missing number: $48 + 25 = 25 + X$
Answer: _____
- 5) True or false: $100 - 40 = 40 - 100$
Answer: _____
- 6) Find N: $9 + 9 + 9 + 9 = N \times 9$
Answer: _____
- 7) True or false: $5 \times 7 = 7 + 7 + 7 + 7 + 7$
Answer: _____
- 8) The letter a stands for the same number every time it appears. True or false: $a + a + a + a = 4 \times a$
Answer: _____

Answers — check yourself

1. True
2. False
3. True
4. $X = 48$
5. False
6. $N = 4$
7. True
8. True