Eleven Express Cheat Sheet

Book 2, Mission 1 · Multiply by 11 in your head

Patterns and Proofs

1 Multiply any two-digit number by 11

$$53 \times 11 = 583$$

The outside digits **5** and **3** stay put. Their sum, **8**, goes in the middle.

The idea in one line

Keep the two digits on the outside, and put their **sum** in the middle.

Other examples: 23 × 11 = 253, 42 × 11 = 462, 61 × 11 = 671.

The steps

1. **Split the number.** 53 becomes **5** and **3**, with a gap between them: 5 _ 3.
2. **Add the digits.** 5 + 3 = **8**.
3. **Fill the gap.** Put the sum in the middle: 583. Done!

When the digits add to 10 or more

Try 78 × 11. The digits add to 7 + 8 = **15**, which is too big for one gap.

Write the **5** in the middle and **carry the 1** to the front digit: 7 + 1 = **8**.

$$78 \times 11 = 858$$

More carries: 57 × 11 = 627 (5 + 7 = 12) · 99 × 11 = 1089 (9 + 9 = 18)

Watch out. The last digit never changes, and only the **front** digit takes the carry. A common slip for 78 × 11 is writing 7158. If your answer has four digits but the number was under 91, check the carry.

Quick check

The answer is always a little more than 10 times the number. 53 × 10 = 530, and 53 × 11 = 583 is just 53 more. If your answer is far from that, look again.

Why it works

Multiplying by 11 is the same as multiplying by 10, then adding the number once more, because **11 = 10 + 1**.

23 × 10	2	3	0
+ 23 × 1		2	3
= 23 × 11	2	5	3

Write 23 × 10 = 230 and 23 underneath it, lined up by place value.

The **2** on the left drops straight down. The **3** on the right drops straight down.

In the middle column, the two digits **meet and add**: 3 + 2 = **5**. That is exactly the "sum in the middle".

And the carry?

For 78 × 11: 780 + 78. The middle column is 8 + 7 = 15, so you write 5 and carry 1 into the hundreds, just like any column addition: 780 + 78 = **858**.

In algebra

Let the number be 10a + b (a is the tens digit, b is the units digit). Then

$$(10a + b) \times 11 = (10a + b) \times 10 + (10a + b)$$
$$= 100a + 10(a + b) + b$$

So a sits in the hundreds, b sits in the units, and **a + b** lands in the tens place: the middle.

Bonus: three-digit numbers

Keep the outside digits and fill **each** gap with the sum of its two neighbours.

$$123 \times 11 = 1\ (1+2)\ (2+3)\ 3 = 1353$$

The same carry rule applies: 352 × 11 = 3 (3+5) (5+2) 2 = 3872.

Try it yourself

No calculator. The first four need no carry, the next four do, and the last two are three-digit bonus questions.

34 × 11 = _____	62 × 11 = _____
45 × 11 = _____	81 × 11 = _____
57 × 11 = _____	69 × 11 = _____
88 × 11 = _____	99 × 11 = _____
241 × 11 = _____	352 × 11 = _____

Spot the slip

A classmate did these in their head. Which are right, and which are wrong? Fix the wrong ones.

a) 64 × 11 = 6104 b) 35 × 11 = 385 c) 86 × 11 = 846

Game: Beat the Calculator

Someone at home picks any two-digit number and says it out loud. They multiply it by 11 on a calculator while you do it in your head. First to say the full answer scores a point. Play five rounds.

Show-off move: ask them for 99. Nobody expects 1089 in two seconds.

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Answers: 34 × 11 = 374, 62 × 11 = 682, 45 × 11 = 495, 81 × 11 = 891, 57 × 11 = 627, 69 × 11 = 759, 88 × 11 = 968, 99 × 11 = 1089, 241 × 11 = 2651, 352 × 11 = 3872. Spot the slip: a) wrong, 6 + 4 = 10 so carry: 704. b) right. c) wrong, 8 + 6 = 14 so carry: 946.