

Two-Step Problems and Patterns: math lesson, Grade 3 – download the PDF

Some problems need more than one step. In this chapter you will learn to solve two-step word problems, to use a letter for a number you do not know yet, to check whether an answer makes sense, and to discover the patterns hiding in the addition and multiplication tables.

1. Order of operations in context

When a calculation has more than one operation, everybody must follow the same rules so that everybody gets the same answer.

D Order of operations

1. Do what is inside parentheses first. 2. Then multiply and divide, from left to right. 3. Then add and subtract, from left to right.

E Example 1: tickets and a snack

Three friends each pay 4 dollars for a ticket, and one of them buys a 2-dollar snack. The total is $3 \times 4 + 2$. Multiplication comes first: $3 \times 4 = 12$, then $12 + 2 = 14$. The friends spend 14 dollars.



Careful

Do not simply read from left to right. $2 + 3 \times 4 = 2 + 12 = 14$, but $(2 + 3) \times 4 = 5 \times 4 = 20$. Parentheses change the answer!

2. Two-step word problems

A two-step problem hides a first question that nobody asks out loud. You have to answer it before you can answer the real question.



Method

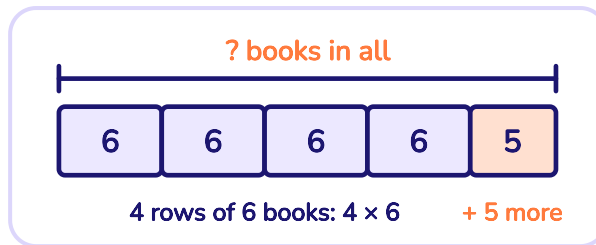
1. Read the problem twice and find the real question.
2. Decide what you must find first (the hidden question).
3. Solve step one, then use its answer to solve step two.
4. Write a complete sentence, with the unit.
5. Check that the answer makes sense.



Example 2: books on a shelf

A shelf has 4 rows of 6 books. Then 5 more books are added. How many books are on the shelf?

Step one: $4 \times 6 = 24$ books. Step two: $24 + 5 = 29$ books. The shelf holds 29 books.



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Example 3: marbles

Jo has 3 bags with 9 marbles in each bag. He gives 7 marbles to his sister. Step one: $3 \times 9 = 27$. Step two: $27 - 7 = 20$. Jo has 20 marbles left.

3. Equations with a letter for the unknown

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Equation and unknown

An equation is a number sentence with an equal sign. When one number is missing, we write a letter such as n , m or t in its place. The letter stands for the *unknown* number.

To find the unknown, use the opposite operation. Addition and subtraction undo each other. Multiplication and division undo each other.

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Example 4: finding the unknown

$n + 14 = 50$ means $n = 50 - 14 = 36$. Check: $36 + 14 = 50$. Also $9 \times m = 63$ means $m = 63 \div 9 = 7$.

Two steps: $3 \times n + 2 = 20$. First undo the addition: $3 \times n = 20 - 2 = 18$. Then undo the multiplication: $n = 18 \div 3 = 6$. Check: $3 \times 6 + 2 = 20$.

A letter also lets you write a whole problem as an equation. Maya has 5 packs of 6 cards and finds 3 more cards. If t is the total, then $t = 5 \times 6 + 3 = 33$.

4. Estimating to check an answer

An estimate is a quick answer that is close to the exact one. To estimate, round each number to the nearest ten (or to an easy number) and then calculate in your head.

Example 5: is the answer reasonable?

Is $48 + 37 = 85$ reasonable? Round: $50 + 40 = 90$. The exact answer 85 is close to 90, so it is reasonable. For 6×28 , round 28 to 30: $6 \times 30 = 180$. The exact answer is 168, which is close, so it is reasonable. An answer of 268 would be far too big!

Careful

An estimate is not the exact answer. Use it to catch mistakes, not to replace the calculation.

5. Patterns in the addition table

The addition table lists the sum of a row number and a column number. Look closely at the orange diagonal below: every cell shows 7.

+	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

- Moving one cell to the right in a row adds 1 to the sum.
- Moving one cell down a column also adds 1.
- Cells on the same diagonal, going from top right to bottom left, have the same sum.
- The table is symmetric: $2 + 5 = 5 + 2$. Order does not matter in addition.

6. Patterns in the multiplication table

×	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9
2	2	4	6	8	10	12	14	16	18
3	3	6	9	12	15	18	21	24	27
4	4	8	12	16	20	24	28	32	36
5	5	10	15	20	25	30	35	40	45
6	6	12	18	24	30	36	42	48	54
7	7	14	21	28	35	42	49	56	63
8	8	16	24	32	40	48	56	64	72
9	9	18	27	36	45	54	63	72	81

- Multiples of 5 always end in 0 or 5. Multiples of 10 always end in 0.
- Multiples of 2 are always even, and each multiple of 4 is double the multiple of 2:
 $4 \times 7 = 2 \times (2 \times 7) = 2 \times 14 = 28$.

- For 9: the digits of 9×1 to 9×10 always add up to 9, and the tens digit is one less than the number you multiply by. So $9 \times 6 = 54$ (5 is one less than 6, and $5 + 4 = 9$).
- The table is symmetric: $6 \times 7 = 7 \times 6 = 42$.
- The orange diagonal holds the square numbers $1, 4, 9, 16, \dots, 81$.

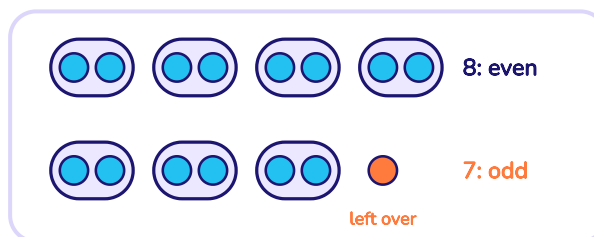
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Example 6: break a fact into easier facts

$$6 \times 7 = 6 \times 5 + 6 \times 2 = 30 + 12 = 42.$$

7. Even and odd numbers

A number is **even** if you can split it into pairs with nothing left over. It is **odd** if one is left alone. Even numbers end in 0, 2, 4, 6 or 8. Odd numbers end in 1, 3, 5, 7 or 9.



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Rules for sums and products

Operation	Result	Example
even + even	even	$6 + 8 = 14$
odd + odd	even	$7 + 9 = 16$
even + odd	odd	$6 + 9 = 15$
even $\times$ any whole number	even	$4 \times 7 = 28$
odd $\times$ odd	odd	$3 \times 5 = 15$

!

Zyro's tip

On my planet we sort everything into pairs. To know if a number is even or odd, just look at its last digit. The other digits do not matter!

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Example 7: sorting

346 ends in 6, so it is even. 1,275 ends in 5, so it is odd. $17 + 25$: odd + odd is even, and indeed $17 + 25 = 42$.

Key takeaways

- Parentheses first, then multiplication and division, then addition and subtraction.
- In a two-step problem, find the hidden question and solve it first.
- A letter stands for an unknown number; use opposite operations to find it, and check.
- Round to estimate and see whether an answer is reasonable.
- Addition and multiplication tables are symmetric and full of patterns.
- Even numbers make pairs; odd numbers do not. Look at the last digit.



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