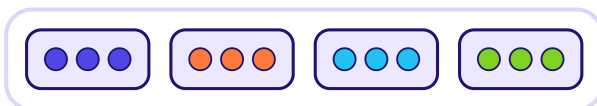


Understanding Multiplication: math lesson, Grade 3 – download the PDF

Imagine you are setting up chairs for a school play. You could count them one by one, but there is a much faster way: **multiplication**. In this chapter you will learn what multiplication really means, how to picture it with groups, arrays, and number lines, and how to use a few clever rules to multiply with confidence.

1. Equal groups

Multiplication starts with **equal groups**. Equal groups means every group has the same number of items. Four boxes with three crayons in each box are equal groups. Four boxes with 3, 2, 5, and 3 crayons are not.



In the picture there are 4 groups and 3 dots in each group. We say “4 groups of 3.” To find the total, we can count every dot: there are 12.

D

Definition: multiplication

Multiplication is a fast way to find the total when you have **equal groups**. The sentence “4 groups of 3” is written 4×3 , and we read it “4 times 3.”

2. Repeated addition

Because every group is the same size, you can add the same number again and again. This is called **repeated addition**.

$$3 + 3 + 3 + 3 = 12 \quad \text{is the same as} \quad 4 \times 3 = 12$$

The number you add is the size of one group. The number of times you add it is the number of groups. Multiplication is a shortcut: instead of writing a long addition, you write one short equation.

E Example 1: from addition to multiplication

Write $7 + 7 + 7 + 7 + 7$ as a multiplication and find the total.

The number 7 is added 5 times, so there are 5 groups of 7. We write 5×7 . Counting by sevens gives 7, 14, 21, 28, 35. So $5 \times 7 = 35$.

3. Multiplication equations

A multiplication equation has three important parts. The numbers you multiply are called **factors**. The answer is called the **product**.

$$\underbrace{4}_{\text{factor}} \times \underbrace{3}_{\text{factor}} = \underbrace{12}_{\text{product}}$$

D Vocabulary

A **factor** is a number that is multiplied. The **product** is the result. The symbol $\times$ means “times” or “groups of.”

M**Method: writing a multiplication equation from a story**

1. Find the number of groups.
2. Find how many are in each group.
3. Write *number of groups* $\times$ *number in each group*.
4. Find the product and answer with a full sentence.

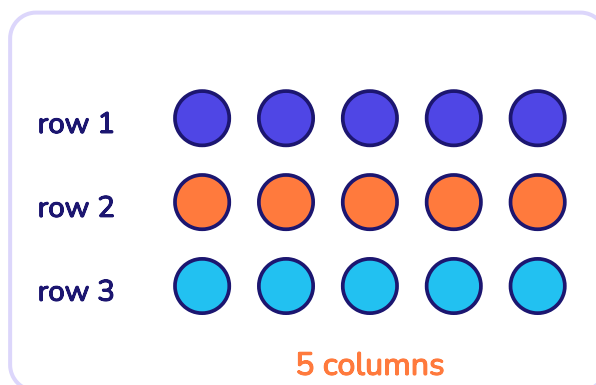
E**Example 2: a word problem**

A bakery puts 6 muffins in each tray. There are 3 trays. How many muffins are there?

There are 3 groups with 6 in each group, so we write $3 \times 6 = 18$. There are 18 muffins.

4. Arrays

An **array** shows objects in equal **rows** and equal **columns**. Rows go across, and columns go up and down. Egg cartons, muffin pans, window panes, and the seats in a movie theater are all arrays.



This array has 3 rows with 5 dots in each row. It shows $3 \times 5 = 15$. Each row is one group, so an array is just equal groups lined up neatly.

E**Example 3: an array in real life**

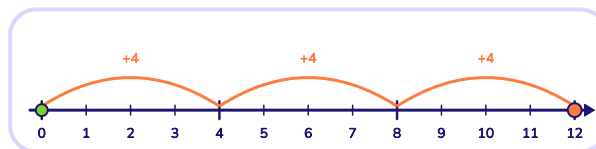
A garden has 4 rows of tomato plants, with 6 plants in each row. How many plants are there?

The garden is an array with 4 rows and 6 columns. $4 \times 6 = 24$. There are 24 tomato plants.

5. Skip counting and number line models

Skip counting means counting forward by the same number each time. If you skip count by 4, you say 4, 8, 12, 16, and so on. Each number you say is one more group of 4.

You can also show multiplication on a **number line**. Start at 0. Make equal jumps, one jump for each group. The number of jumps is the number of groups, and the length of each jump is the size of a group. Where you land is the product.



Here, 3 jumps of 4 land on 12, so $3 \times 4 = 12$.

**Zyro's tip**

On planet Zyro we count our tentacle rings in fives: 5, 10, 15, 20! Skip counting by 5, 10, or 2 is a great way to check a product quickly.

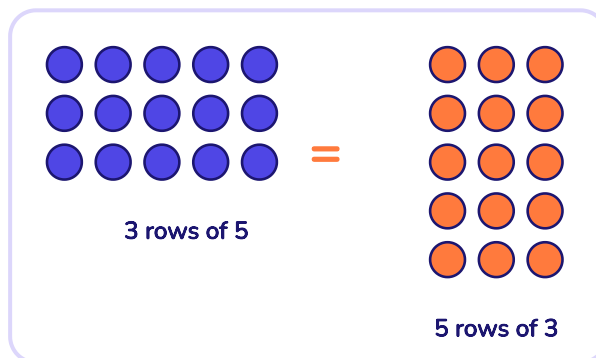
E**Example 4: using skip counting**

Find 6×5 by skip counting.

Count by fives six times: 5, 10, 15, 20, 25, 30. So $6 \times 5 = 30$.

6. The commutative property

Look at these two arrays. One has 3 rows of 5, and the other has 5 rows of 3. If you turn the first array on its side, you get the second one. Both show 15 dots.

**P****Commutative property of multiplication**

You can multiply two factors in any order and the product stays the same.

$$3 \times 5 = 5 \times 3 = 15$$

This is a big help. If you know $2 \times 9 = 18$, then you also know $9 \times 2 = 18$. You only need to learn about half of the facts.



Careful

The order changes the *story* but not the product. “3 bags of 5 apples” and “5 bags of 3 apples” are different pictures, but both give 15 apples. Be careful: this works for multiplication, but not for subtraction. $9 - 4$ is not the same as $4 - 9$.

7. Multiplying by 0 and by 1

Two special numbers make multiplication easy.



Rules for 1 and 0

Any number times 1 is that same number: $8 \times 1 = 8$.

Any number times 0 is 0: $8 \times 0 = 0$.

Why? 8×1 means 8 groups with 1 item in each group, so there are 8 items. And 8×0 means 8 groups with nothing in them, so there is nothing at all. By the commutative property, $1 \times 8 = 8$ and $0 \times 8 = 0$ too.



Careful

Do not mix up adding and multiplying. $5 + 0 = 5$, but $5 \times 0 = 0$. Also $5 + 1 = 6$, but $5 \times 1 = 5$.

8. Choosing the best model

You now have many ways to think about the same product. Take $4 \times 6 = 24$:

- **Equal groups:** 4 baskets with 6 apples in each basket.
- **Repeated addition:** $6 + 6 + 6 + 6 = 24$.
- **Array:** 4 rows of 6 chairs.
- **Skip counting:** 6, 12, 18, 24.
- **Number line:** 4 jumps of 6 from 0 to 24.

Pick the model that makes the problem clearest. Use an array for things in rows, a number line for jumps and distances, and equal groups for items in bags, boxes, or plates.

Key takeaways

- Multiplication finds the total of **equal groups**: 4×3 means 4 groups of 3.
- It is a shortcut for **repeated addition**: $3 + 3 + 3 + 3 = 4 \times 3$.
- The numbers multiplied are **factors**, and the answer is the **product**.
- An **array** has equal rows and columns. A **number line** uses equal jumps from 0.
- **Skip counting** by the group size gives the product.
- Commutative property: $a \times b = b \times a$.
- Any number times 1 is itself. Any number times 0 is 0.



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