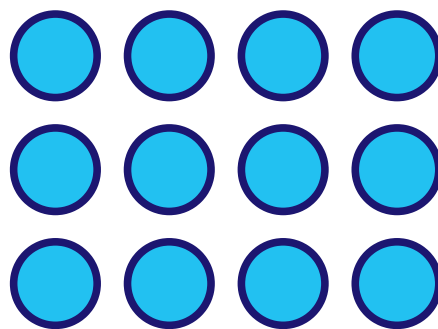


Multiplication Facts and Properties: math lesson, Grade 3 – download the PDF

You already know how to add the same number again and again. Multiplication is a faster way to do exactly that job. In this chapter you will learn the multiplication facts from 2 to 10, see how they connect to each other, and use three powerful properties that make a hard fact feel small.

1. What a multiplication fact tells you

A multiplication fact tells you **how many in all** when you have equal groups. If you see 3 rows with 4 dots in each row, you can add $4 + 4 + 4 = 12$, or you can multiply $3 \times 4 = 12$. A picture like this one, with rows and columns, is called an **array**.



3 rows of 4 = 12



Factors and product

In $3 \times 4 = 12$, the numbers 3 and 4 are the **factors**. They tell you the number of groups and the size of each group. The answer, 12, is the **product**. The sign $\times$ is read “times.”

You can also read 3×4 as “3 groups of 4.” When you know the facts by heart, you can solve problems about teams, boxes, shelves, and tickets in seconds.

2. Facts of 2, 5 and 10

These are the friendliest facts, so start here.

- **Facts of 2** are *doubles*. 2×7 means $7 + 7 = 14$. Every product of 2 is an even number.
- **Facts of 5** are skip counting by 5: 5, 10, 15, 20, 25... Every product ends in 0 or 5.
- **Facts of 10** are skip counting by 10. The product is the other factor with a 0 on the end: $10 \times 6 = 60$.

Factor	$\times 2$	$\times 5$	$\times 10$
3	6	15	30
6	12	30	60
8	16	40	80
9	18	45	90

E**Example 1**

A pet store sells fish food in packs. Each shelf holds 5 packs and there are 8 shelves. How many packs are there in all?

$8 \times 5 = 40$, because counting by 5 eight times gives 5, 10, 15, 20, 25, 30, 35, 40. There are **40 packs**.

3. Facts of 3 and 4

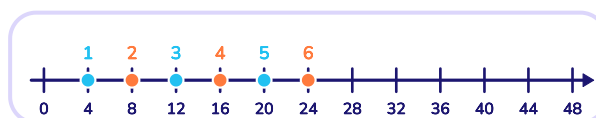
You can build the facts of 3 and 4 from facts you already know.

M**Method: build from doubles**

1. For $3 \times n$, find the double of n , then add one more group of n .
2. For $4 \times n$, double n , then double the answer again.

For example, 3×7 : the double of 7 is 14, and $14 + 7 = 21$. For 4×7 : $7 \rightarrow 14 \rightarrow 28$. So $4 \times 7 = 28$.

Skip counting also works well. The picture below shows 6 hops of size 4 on a number line. The frog lands on 4, 8, 12, 16, 20 and then 24, so $4 \times 6 = 24$.



E**Example 2**

A garage has 6 cars. Each car has 4 wheels on the road. How many wheels?

Double 6 is 12, and double 12 is 24. So $4 \times 6 = 24$. There are **24 wheels**.

4. Facts of 6, 7, 8 and 9

These facts feel harder, but you almost know them already. Most of them are the same fact in a different order, and the others can be built from the 5s and the 10s.

M**Three ways to find a hard fact**

1. **5s plus one more group.** 6×7 is $5 \times 7 = 35$ plus one more 7, so $35 + 7 = 42$.
2. **Doubling.** $8 \times n$ is the double of the double of the double of n . For 8×6 :
 $6 \rightarrow 12 \rightarrow 24 \rightarrow 48$.
3. **Tens minus one group (for 9s).** 9×7 is $10 \times 7 = 70$ minus one 7, so $70 - 7 = 63$.

!**Zyro's trick for the 9s**

On every product of 9, the two digits add up to 9: 18 (1 + 8), 27 (2 + 7), 36 (3 + 6)...
And the tens digit is always one less than the other factor, so $9 \times 8 = 72$ because 7 is one less than 8 and $7 + 2 = 9$.



Careful with 7×8

Many students mix up 54, 56 and 63. Remember the staircase 5, 6, 7, 8: **$56 = 7 \times 8$** .



Example 3

A choir stands in 7 rows with 9 singers in each row. How many singers?

$7 \times 9 = 70 - 7 = 63$. Check with the digits: $6 + 3 = 9$. There are **63 singers**.

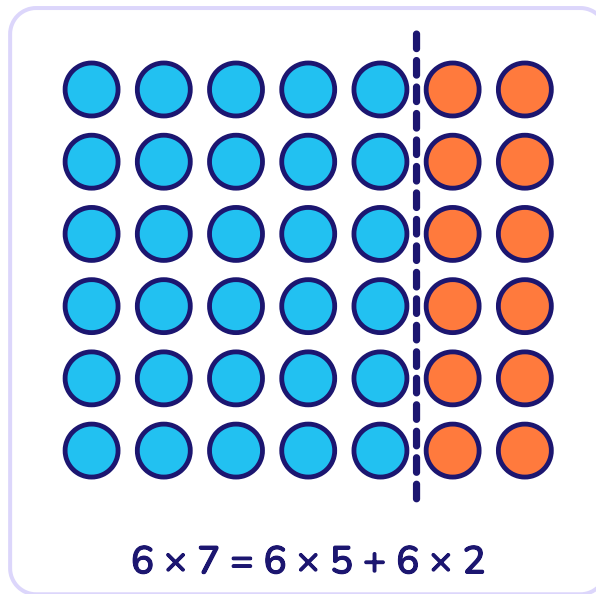
5. The commutative and distributive properties



Commutative property

You can swap the factors and the product stays the same: **$a \times b = b \times a$** . For example, **$4 \times 9 = 9 \times 4 = 36$** . This cuts the number of facts you must learn almost in half.

The **distributive property** lets you break one factor into two easier parts. Look at the array below. It has 6 rows and 7 columns. Cut the 7 columns into 5 blue columns and 2 orange columns.



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Distributive property

Multiplying a number by a sum gives the same result as multiplying by each part and adding: $a \times (b + c) = a \times b + a \times c$.

So $6 \times 7 = 6 \times (5 + 2) = 6 \times 5 + 6 \times 2 = 30 + 12 = 42$. You can break either factor, and you should split into the facts you know best, such as 5 or 2.

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Example 4

Find 8×7 by breaking 7 into $5 + 2$.

$$8 \times 7 = 8 \times 5 + 8 \times 2 = 40 + 16 = 56.$$

6. The associative property, zero and one

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Associative property

When you multiply three numbers, you can group them in any way and the product stays the same: $(a \times b) \times c = a \times (b \times c)$.

Parentheses tell you which multiplication to do first. Try $3 \times 2 \times 5$. Grouping as $(3 \times 2) \times 5 = 6 \times 5 = 30$, or as $3 \times (2 \times 5) = 3 \times 10 = 30$. Both give 30, but the second is faster because it uses a ten. Look for pairs that make 10.

Two special facts are worth keeping in mind. **Any number times 1 is that same number:** $8 \times 1 = 8$. **Any number times 0 is 0:** $8 \times 0 = 0$, because zero groups, or groups with nothing in them, hold nothing.

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Example 5

Find $4 \times 5 \times 2$ in the easiest way.

Group $5 \times 2 = 10$ first. Then $4 \times 10 = 40$. The product is 40.

7. Multiplying by multiples of 10

A multiple of 10 is a number like 20, 30, 40 or 90. To multiply by a multiple of 10, think in **tens**. The number 30 is 3 tens, so 4×30 is 4 groups of 3 tens, which is 12 tens, or 120.



Method

1. Cover the 0 and say the basic fact: $4 \times 3 = 12$.
2. Put the 0 back: 12 tens is 120.

You are using the associative property:

$$4 \times 30 = 4 \times (3 \times 10) = (4 \times 3) \times 10 = 12 \times 10 = 120.$$



Do not forget the zero

6×50 is 30 tens, which is 300, not 30. When the basic fact ends in 0, such as $6 \times 5 = 30$, you get *two* zeros in the answer.

8. Patterns in the multiplication table

The table below shows every product from 1×1 to 10×10 . Use it to spot patterns; patterns are a great way to check your answers.

	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

- The table is a mirror along the diagonal, which is the commutative property at work. 3×8 and 8×3 both give 24.
- The blue diagonal shows the products of a number times itself: 1, 4, 9, 16, 25, 36, 49, 64, 81, 100.
- Products in the row or column of 2 are always even. Products of 5 end in 0 or 5. Products of 10 end in 0.
- An even number times any whole number is even. An odd number times an odd number is odd.
- In the orange 9s, the tens digit goes up by 1 and the ones digit goes down by 1.

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Example 6

Is 47 a product of 5? Is 45?

Products of 5 end in 0 or 5. Since 47 ends in 7, it is not. Since 45 ends in 5, it is:
 $5 \times 9 = 45$.

Key takeaways

- A multiplication fact tells how many in all when there are equal groups; the numbers multiplied are factors and the answer is the product.
- Facts of 2 are doubles, facts of 5 end in 0 or 5, and facts of 10 end in 0.
- Build facts of 3 and 4 from doubles, and facts of 6, 7, 8 and 9 from the 5s, doubling, or ten groups minus one.
- Commutative: $a \times b = b \times a$. Associative: group three factors any way you like. Distributive: split one factor into easier parts.
- To multiply by a multiple of 10, do the basic fact first, then write the tens: $4 \times 30 = 120$.
- Use patterns in the table, such as even products and the digits of the 9s, to check your answers.



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