

Grade 5 · Place Value and Powers of 10 · Lesson

Common Core 5.NBT.A.1, 5.NBT.A.2 · mathovore.fr

In our base-ten system, each place is worth 10 times the place to its right and $\frac{1}{10}$ of the place to its left. A power of 10 such as 10^3 means 10 used as a factor 3 times, or 1,000. Multiplying by 10^n moves digits n places left; dividing moves them n places right.

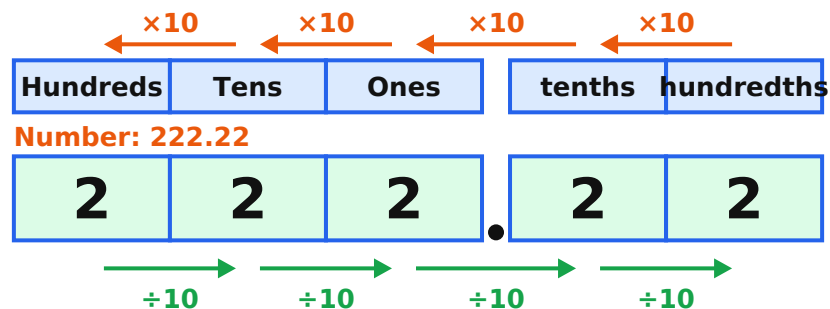
Grade 5 Common Core: 5.NBT.A.1 · 5.NBT.A.2

Key facts:

- Each place is 10 times the place to its right and $\frac{1}{10}$ of the place to its left.
- 10^n means n factors of 10, and it has n zeros: $10^3 = 1,000$.
- Multiplying by 10^n moves every digit n places to the left.
- Dividing by 10^n moves every digit n places to the right.
- Use zeros to hold empty places after moving digits.

How are the places in a number related?

In the base-ten system, every place is worth **10 times** the place to its right and $\frac{1}{10}$ of the place to its left. In 222.22 the digits are all 2, yet they are worth 200, 20, 2, 0.2 and 0.02. Moving one place left multiplies by 10. Moving one place right divides by 10.



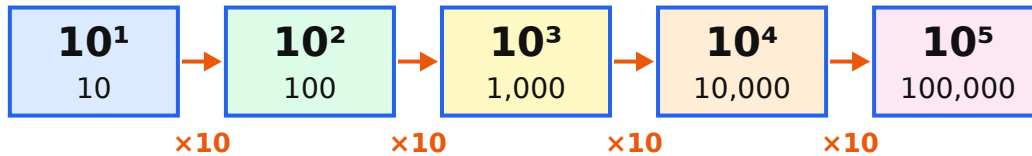
Each 2 is 10 times the 2 to its right and $\frac{1}{10}$ of the 2 to its left.

Place value rule

A digit in one place is worth 10 times as much as the same digit in the place to its right. For example, $10 \times 0.3 = 3$ and $0.3 \div 10 = 0.03$.

What is a power of 10?

A **power of 10** uses an exponent to show how many times 10 is used as a factor. The exponent counts the factors of 10, so $10^3 = 10 \times 10 \times 10 = 1,000$. The exponent also equals the number of zeros in the answer.



Each step to the right multiplies by 10, so the exponent goes up by 1.

How do you multiply by a power of 10?

When you multiply by 10^n , every digit moves **n places to the left**, which makes the number larger. Equivalently, the decimal point moves n places to the right. Use zeros to fill empty places.

Hundreds	Tens	Ones	tenths	hundredths
Start: 3.45				
		3	4	5
After $\times 10^2$: 345				
3	4	5		

$3.45 \times 10^2 = 345$: the digits 3, 4 and 5 each move 2 places left.

How do you divide by a power of 10?

When you divide by 10^n , every digit moves **n places to the right**, which makes the number smaller.

Hundreds	Tens	Ones	tenths	hundredths
Start: 520				
5	2	0		
After $\div 10^2$: 5.2				
		5	2	

$520 \div 10^2 = 5.2$: the 5 moves from hundreds to ones.

Method with an example: Find 0.074×10^3 .

1. Read the exponent: it is 3, so the digits move 3 places left.
2. Move each digit 3 places: 0.074 becomes 74 because the 7 goes from hundredths to tens.
3. Check the size: a number times 1,000 should be much larger, and 74 is larger than 0.074.

So $0.074 \times 10^3 = 74$. Use the same steps for division, but move the digits right.

Place Value and Powers of 10: frequently asked questions

Why does a digit become 10 times larger when it moves one place left?

Each place is defined to be worth 10 times the place to its right. A 4 in the tens place is 40, and a 4 in the ones place is 4, so the tens 4 is worth 10 times as much.

What does the exponent in 10^4 tell you?

It tells how many times 10 is used as a factor. So $10^4 = 10 \times 10 \times 10 \times 10 = 10,000$. The exponent is also the number of zeros after the 1.

Do I move the decimal point or the digits?

Both ideas give the same answer. The digits move left when you multiply by a power of 10, and the decimal point appears to move right. Picture the digits moving in a place-value chart to understand why.

What do I do when there are no digits left to fill a place?

Write a zero in each empty place. For example, $6.3 \times 10^3 = 6,300$, because the 6 and 3 move three places left and two zeros fill the gap.

How can I check that my answer makes sense?

Multiplying by a power of 10 must make the number greater, and dividing must make it smaller. Estimate the size too: 0.5×10^2 should be about 50, not 5 or 500.