

YEAR 8 - DEVELOPING NUMBER...

Standard Form

What do I need to be able to do?

By the end of this unit you should be able to:

- Write numbers in standard form and as ordinary numbers
- Order numbers in standard form
- Add/ Subtract with standard form
- Multiply/ Divide with standard form
- Use a calculator with standard form

Keywords

Standard (index) Form: A system of writing very big or very small numbers

Commutative: an operation is commutative if changing the order does not change the result.

Base: The number that gets multiplied by a power

Power: The exponent — or the number that tells you how many times to use the number in multiplication

Exponent: The power — or the number that tells you how many times to use the number in multiplication

Indices: The power or the exponent

Negative: A value below zero.

Positive powers of 10

1 billion = 1 000 000 000

$$10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 10^9$$

Addition rule for indices $10^a \times 10^b = 10^{a+b}$

Subtraction rule for indices $10^a \div 10^b = 10^{a-b}$

Standard form with numbers > 1

Any number between 1 and less than 10 $\rightarrow A \times 10^n$ ← Any integer

Example

$$3.2 \times 10^4$$

$$= 3.2 \times 10 \times 10 \times 10 \times 10$$

$$= 32000$$

Non-example

0.8×10^4

5.3×10^{07}

Negative powers of 10

0.001	10	1	•	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
$1 \times \frac{1}{1000}$	10^1	10^0	•	10^{-1}	10^{-2}	10^{-3}
1×10^{-3}	0	0	•	0	0	1

Any value to the power 0 always = 1

Negative powers do not indicate negative solutions

Numbers between 0 and 1

0.054	1	•	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
$= 5.4 \times 10^{-2}$	10^0	•	10^{-1}	10^{-2}	10^{-3}
	0	•	0	5	4

A negative power does not mean a negative answer — it means a number closer to 0

Order numbers in standard form

6.4×10^{-2}	2.4×10^2	3.3×10^0	1.3×10^{-1}
0.064	240	1	0.13

Look at the power first will the number be = > or < than 1

Use a place value grid to compare the numbers for ordering

Mental calculations

$6.4 \times 10^2 \times 1000$ Not in Standard Form

$= 6.4 \times 10^2 \times 10^3$

Use addition for indices rule

$= 6.4 \times 10^5$

$(2 \times 10^3) \div 4$

Divide the values

$= (2 \div 4) \times 10^3$

$= 0.5 \times 10^3$

$8 \times 10^5 \times 3$

$= 24 \times 10^5$ Not in Standard Form

$= 2.4 \times 10^1 \times 10^5$ Use addition for indices rule

$= 2.4 \times 10^6$

Remember the layout for standard form

Any number between 1 and less than 10 $\rightarrow A \times 10^n$ ← Any integer

Addition and Subtraction

Tip: Convert into ordinary numbers first and back to standard form at the end

$6 \times 10^5 + 8 \times 10^5$

Method 1

$= 600000 + 800000$

$= 1400000$

$= 1.4 \times 10^6$

Method 2

$= (6 + 8) \times 10^5$

$= 14 \times 10^5$

$= 1.4 \times 10^1 \times 10^5$

$= 1.4 \times 10^6$

This is not the final answer

More robust method
Less room for misconceptions
Easier to do calculations with negative indices
Can use for different powers

Only works if the powers are the same

Multiplication and division

For multiplication and division you can look at the values for A and the powers of 10 as two separate calculations

$\frac{1.5 \times 10^5}{0.3 \times 10^3}$ ← Division questions can look like this

$(1.5 \times 10^5) \div (0.3 \times 10^3)$

$15 \div 0.3 \times 10^5 \div 10^3$

$= 5 \times 10^2$

Addition law for indices
 $a^m \times a^n = a^{m+n}$

Subtraction law for indices
 $a^m \div a^n = a^{m-n}$

Revisit addition and subtraction laws for indices — they are needed for the calculations

Using a calculator

$14 \times 10^5 \times 3.9 \times 10^3$

Use a calculator to work out this question to a suitable degree of accuracy

Input 14 and press $\times 10^1$ Then press 5 (for the power)

Press \times

Input 3.9 and press $\times 10^3$ Then press 3 (for the power)

Press $=$

This gives you the solution



Click calculator for video tutorial

To put into standard form and a suitable degree of accuracy

Press **SHIFT** **SETUP** and then press 7 for sci mode

Choose a degree of accuracy so in most cases press 2

Answer: 5.5×10^8