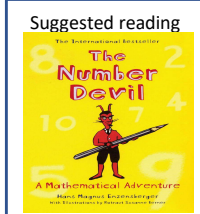


Year 8 – Developing Number Standard Form



Want to know more? Scan the QR code to visit the curriculum overview for Year 8 Maths, including topic summaries, key words, and books that you may want to read in your own time



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
 3.2×10^4
 $= 3.2 \times 10 \times 10 \times 10 \times 10$
 $= 32000$

Non-example
 0.8×10^4
 5.3×10^{07}

Negative powers of 10

10	1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
10^1	10^0	10^{-1}	10^{-2}	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

1	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$
10^0	10^{-1}	10^{-2}	10^{-3}
0	0	5	4

$0.054 = 5.4 \times 10^{-2}$

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

Order numbers in standard form

10^2	10^1	10^0	10^{-1}	10^{-2}	10^{-3}	10^{-4}
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
 $= (2 \div 4) \times 10^3$
 $= 0.5 \times 10^3$

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

Method 1
 $6 \times 10^5 + 8 \times 10^5$
 $= 600000 + 800000$
 $= 1400000$
 $= 1.4 \times 10^6$

Method 2
 $= (6 + 8) \times 10^5$
 $= 14 \times 10^5$
 $= 1.4 \times 10^1 \times 10^5$
 $= 1.4 \times 10^6$

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

Division questions can look like this

$\frac{1.5 \times 10^5}{0.3 \times 10^3}$

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

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

$= 5 \times 10^2$

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

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

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

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

Using a calculator

$14 \times 10^5 \times 3.9 \times 10^{-3}$

Input 14 and press $\times 10^5$ 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

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: 5.5×10^6

Click calculator for video tutorial