Very Big and Very Small Numbers

Mathematicians, scientists and engineers (and your calculator) prefer to write and work with very large and very small numbers in standard form.

A number is in standard form when it is written like this:

This part is made up of a number from 1 up to (but not including) 10.

6.7×10^6

This part is written as a power of 10, and the power is a whole number.

You could think of 1000 as being 1 x 10 x 10 x 10 and write it as 1×10^3.

You could think of 10 000 as being 1 x 10 x 10 x 10 x 10 and write it as 1×10^4.

Complete the table below, the first three rows have been completed for you.

Number	Number in standard form
1 000 000	1×10^6
100 000	1×10^5
10 000	1×10^4
1 000	
100	
10	
1	
0.1	
0.01	
0.001	

The power of ten is the place value of the first significant figure.

As the number is less than one the power of ten is negative.

200 could be written as 2×10^2.

300 could be written as 3×10^2.

250 could be written as 2.5×10^2.

Complete the table on the left, the first three rows have been completed for you.

Number	Number in standard form
200	
230	
300	
399	
400	
415	
500	
550	
9870	

Complete the table below; the first three rows have been completed for you.

Number	Number in standard form
1 000 000 000	1×10^9
12 000 000	1.2×10^7 (not 12×10^6)
15 000	1.5×10^4 (not 15×10^3)
99 000	
12 000 000 000 000	
10 000 000 000 000 000	
99 000 000 000 000 000	
155 000 000	
1 380 000 000	
22 000 000	

Write as ordinary numbers:

Number in standard form	Ordinary number
2.34×10^3	
6.25×10^4	
9.03×10^5	
8×10^6	
3.56×10^7	
1.6×10^6	
4.4×10^{10}	
8.01×10^3	
1.11×10^2	
9.9×10^8	

Write in standard form:

Number	Number in standard form
0.008	8×10^{-3}
0.07	7×10^{-2}
0.55	5.5×10^{-1}
0.000052	
0.048	
0.0086	
0.00086	
0.000086	
0.0000000001	
0.000455	

Write as ordinary numbers:

Number in standard form	Ordinary number
8×10^{-3}	
6.2×10^{-4}	
9.3×10^{-3}	
8.82×10^{-4}	
3.56×10^{-5}	
1.6×10^{-7}	
4.4×10^{-4}	
8.01×10^{-3}	
1.11×10^{-8}	
9.9×10^{-2}	

The number 1×10^{100} is called a googol. Write the number 50 googols in standard form.

Dinosaurs roamed the Earth about 140 000 000 years ago. Write this in standard form.

Adding Very Big and Very Small Numbers

You could think of 30 000 as being

3000×10^1
or as
300×10^2
or as
30×10^3
or as
3×10^4
or as
0.3×10^5
or as
0.03×10^6
or as
0.003×10^7
and so on.

> This is 30 000 written in standard form.

To add numbers written in standard form you must write them to the same power of ten.
e.g.

$$3 \times 10^4 + 4 \times 10^5 = 3 \times 10^4 + 40 \times 10^4 = 43 \times 10^4 = 4.3 \times 10^5$$
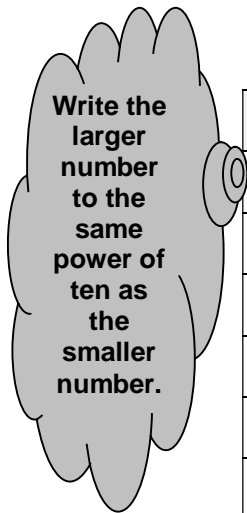
Numbers to add	Calculation	Answer in standard form
$5 \times 10^2 + 5 \times 10^3$		
$5 \times 10^2 + 5 \times 10^4$		
$5 \times 10^2 + 5 \times 10^5$		
$5 \times 10^3 + 5 \times 10^4$		
$5 \times 10^3 + 5 \times 10^5$		
$5 \times 10^3 + 5 \times 10^6$		
$4 \times 10^2 + 3.1 \times 10^3$		
$4.1 \times 10^2 + 3.1 \times 10^3$		
$5 \times 10^{-2} + 5 \times 10^{-3}$		
$5 \times 10^2 + 5 \times 10^{-2}$		

Subtracting Very Big and Very Small Numbers

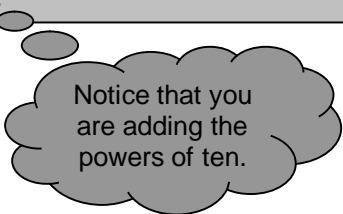To subtract numbers written in standard form you must write them to the same power of ten.

e.g.

$$3 \times 10^5 - 4 \times 10^4 = 30 \times 10^4 - 4 \times 10^4 = 26 \times 10^4 = 2.6 \times 10^5$$

Write the larger number to the same power of ten as the smaller number.

Numbers to add	Calculation	Answer in standard form
$5 \times 10^3 - 5 \times 10^2$		
$5 \times 10^4 - 5 \times 10^2$		
$5 \times 10^5 - 5 \times 10^2$		
$5 \times 10^4 - 5 \times 10^3$		
$5 \times 10^5 - 5 \times 10^3$		
$5 \times 10^6 - 5 \times 10^3$		
$4 \times 10^3 - 3.1 \times 10^2$		
$4.1 \times 10^3 - 3.1 \times 10^2$		
$5 \times 10^{-2} - 5 \times 10^{-3}$		
$5 \times 10^2 - 5 \times 10^{-1}$		

Multiplying Very Big and Very Small Numbers

e.g. $(5 \times 10^6) \times (6 \times 10^5) = 5 \times 6 \times 10^6 \times 10^5 = 30 \times 10^{6+5} = 30 \times 10^{11} = 3 \times 10^{12}$

Notice that you are adding the powers of ten.

$(1.2 \times 10^3) \times (1.2 \times 10^3)$	
$(1.2 \times 10^3) \times (1.2 \times 10^7)$	
$(1.2 \times 10^7) \times (1.2 \times 10^7)$	
$(1.2 \times 10^{-7}) \times (1.2 \times 10^{-7})$	
$(1.2 \times 10^{-7}) \times (1.2 \times 10^7)$	
$(1.2 \times 10^3) \times (1.2 \times 10^3)$	
$(1 \times 10^3) \times (8 \times 10^{-3})$	
$(1.2 \times 10^{12}) \times (1.5 \times 10^{12})$	
$(1.2 \times 10^{-12}) \times (1.5 \times 10^{-12})$	
$(7 \times 10^8) \times (9 \times 10^2)$	
$(2.5 \times 10^6) \times (2 \times 10^3)$	
$(3.8 \times 10^{14}) \times (7.6 \times 10^6)$	

Dividing Very Big and Very Small Numbers

e.g. $(6 \times 10^6) \div (5 \times 10^5) = 6 \div 5 \times 10^{6-5} = 1.2 \times 10^1$

Notice that you are subtracting the powers of ten.

$(1.2 \times 10^3) \div (1.2 \times 10^3)$	
$(1.2 \times 10^3) \div (1.2 \times 10^7)$	
$(1.2 \times 10^7) \div (1.2 \times 10^7)$	
$(1.2 \times 10^{-7}) \div (1.2 \times 10^{-7})$	
$(1.2 \times 10^{-7}) \div (1.2 \times 10^7)$	
$(1.2 \times 10^3) \div (1.2 \times 10^3)$	
$(1 \times 10^3) \div (4 \times 10^{-3})$	
$(1.2 \times 10^{12}) \div (4 \times 10^{12})$	
$(3 \times 10^{-12}) \div (1.5 \times 10^{-12})$	
$(7 \times 10^8) \div (3.5 \times 10^2)$	
$(2.5 \times 10^6) \div (2 \times 10^3)$	
$(7.6 \times 10^{14}) \div (3.8 \times 10^6)$	