05 Scientific Notation (Standard Form of Number)

Scientific Notation is often used when dealing with either very large numbers or very small numbers. A number that is expressed in scientific notation is composed of two parts that are multiplied together. The two parts are:

- A decimal number whose size is between 1 and 10
- An integer power of 10

In general a number in the scientific notation is of the form $a \times 10^n$ where $1 \le a < 10$ and n is an integer.

Example:

$$236 = 2.36 \times 100 = 2.36 \times 10^2$$

Note that for large numbers (bigger than 10) the power of 10 is a positive integer and for a small number (less than 1) the power of 10 is negative.

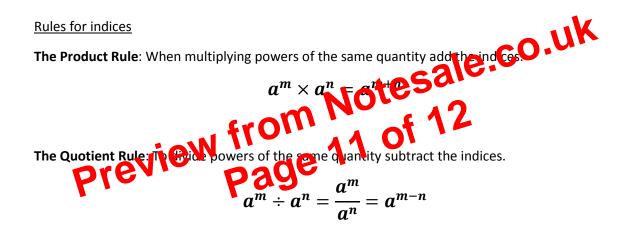
A similar example is, find x when $5^{3x+1} = 5^{x-7}$. The same base is raised to a power each side, therefore the powers must be the same, i.e. 3x + 1 = x - 7.

We have reduced the problem from an exponent equation to a linear equation. The solution is then:

$$3x + 1 = x - 7$$
$$2x = -8$$
$$x = -4$$

A slightly more complicated example is $2^x = 4^2$. The solution is not x = 2 because different base values appear on each side. To solve this equation we must write 4 as a power of 2 and then simplify:

$$2^{x} = 4^{2}$$
$$2^{x} = (2^{2})^{2} = 2^{4}$$
$$x = 4$$



The Power Rule: When raising on power of a quantity to another power, multiply the indices.

$$(a^m)^n = a^{m \times n}$$

The Zero Index: Any quantity raised to the power zero equals 1.

$$a^0 = 1$$