**The law of logarithms and worked examples**

When the rules of indices are expressed in logarithm form, we produce the very important laws of logarithms. These laws enable us to solve many complex equations.

**The Laws of Logarithms**



* 1. = 0

Using your calculator, verify, each of the following:



The rules of logs apply to any base, however, the two most widely-used bases in logs are the base 10 and base e (2.718)

Base ten logs e.g. are used for calculation purposes and are referred to as common logs.

Base e *(=2.718*) e.g. , is used when dealing with naturally-occurring events, e.g. earthquakes, growth of colonies and hence are called natural logs and are written .

So, lets work through some examples applying some of the laws of logarithms.

**Worked example 1:**

Without using a calculator, simplify the following:

This law was used here:

This law was used here:

This law was used here:

This law was used here:

**Worked example 2**

Without using a calculator, simplify the following:

This law was used here:

*Since the bases are different, these logs cannot be added!*

*So, let*

*Also, let,*

*Therefore:*

**Worked example 3**

Without using a calculator, simplify the following:

Note both terms have different bases!

We need to change base 2 to base c (or visa versa!)

Taking just one term,

we use this law

Insert this back in the original statement

Using this law again!

**Worked example 4**

**Solve for**

This law was used here: