Logarithms and Exponentials

- A function in the form $y = a^x$ is called an exponential function
- e^x is called the exponential function to the base e.
- $y = a^x \Rightarrow \log_a y = x$ – "the base number stays the same, and the other two terms flip over"

Laws of Logs

- $\log_a x + \log_a y = \log_a xy$ (Squash)
- $\log_a x - \log_a y = \log_a \frac{x}{y}$ (Split)
- $\log_a x^n = n\log_a x$ (Fly)
- $\log_a a = 1$ eg $\log_8 8 = 1$
- $\log_e x$ is the same as $\ln x$ and is called the natural logarithm
- 'log' on a calculator stands for $\log_{10}$ and 'ln' stands for $\log_e$
- To solve an equation where the unknown is a power, you must take logs of both sides and use the 'fly' rule. It does not matter if you use $\log_{10}$ or ln but if the equation involves an e then ln could be easier.

Examples

$$5^x = 11$$
$$\log_{10} 5^x = \log_{10} 11$$
$$x\log_{10} 5 = \log_{10} 11$$
$$x = \frac{\log_{10} 11}{\log_{10} 5}$$
$$= 1.49 \text{ (to 2 d.p.)}$$

$$e^x = 14$$
$$\ln e^x = \ln 14$$
$$x\ln e = \ln 14$$
$$x = \ln 14 \text{ (since } \ln e = \log_e e = 1)$$
$$= 2.64 \text{ (to 2 d.p.)}$$

Experimental Data

Must use the laws of logs to write in the form $y = mx + c$.
See the notes for more detail.

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