

## Logarithms and indices

Rearrange the instructions to prove two of the basic rules for logs

**Warning:** *there is a mistake in one line of the instructions. Find it and correct it*

Which rearrange to give  $\log_a x = b$  and  $\log_a y = c$

Substituting for b and c gives  $\log_a xy = \log_a x - \log_a y$

Rearranging gives  $\log_a xy = b + c$

Consider  $a^b \times a^c = x \times y$

Substituting for b and c gives  $\log_a xy = \log_a x + \log_a y$

Using the laws of indices gives  $a^{b+c} = xy$

Consider  $a^b \div a^c = x \div y$

Using the laws of indices gives  $a^{b-c} = x \div y$

Rearranging gives  $\log_a (x/y) = b - c$

Hence proving the rule for subtracting logs to any base

Fact: If  $a^b = x$ , then  $\log_a x = b$

Proving these rules requires  $a^b = x$  and  $a^c = y$

Hence proving the rule for adding logs to any base