

# Factsheet: Laws of logarithms

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## Summary

A list of laws of logarithms.

*The associated study guide for this factsheet is [Guide: Introduction to logarithms](#). If you would like to know more about logarithms, please read the guide.*

Throughout this factsheet,  $a, k, x$ , and  $y$  are positive real numbers, and  $n$  is a real number, with  $a, k \neq 1$ .

## Laws of logarithms

### Law 1 - Product Rule:

$$\log_a(x) + \log_a(y) = \log_a(xy)$$

### Law 2 - Quotient Rule:

$$\log_a(x) - \log_a(y) = \log_a\left(\frac{x}{y}\right)$$

### Law 3 - Power Rule:

$$\log_a(x^n) = n \log_a(x)$$

### Law 4 - Zero Rule:

$$\log_a(1) = 0$$

### Law 5 - Identity Rule:

$$\log_a(a) = 1$$

### Law 6 - Change of Base Rule:

$$\log_a(x) = \frac{\log_k(x)}{\log_k(a)}$$

or alternatively

$$\log_k(a) \log_a(x) = \log_k(x)$$

For more on the subject, please go to [Guide: Introduction to logarithms](#).

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## **Version history**

v1.0: created in 02/25 by Millie Pike as part of a University of St Andrews VIP project.

- v1.1: updated 11/25 by tdhc.

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