

Logarithms

Throughout the course, we will be working heavily with the **logarithm function**. Familiarize yourself with its definition, and make sure you are able to manipulate expressions and solve equations involving logarithms.

Convention

We will write $\log(x)$ for the base-2 logarithm of x . That is, $\log x = \frac{\ln(x)}{\ln(2)}$.

In particular, you should know the following facts:

$$\begin{aligned} \log(1) &= 0. \text{ For } 0 < x < 1 \text{ it holds that } \log(x) < 0, \text{ and for } x > 1, \text{ we have that } \log(x) > 0. \\ \log(2) &= 1. \\ \log(2^x) &= x. \\ 2^{\log(x)} &= x. \\ \log(x \cdot y) &= \log(x) + \log(y). \\ \log\left(\frac{x}{y}\right) &= \log(x) - \log(y). \\ \log(x^y) &= y \cdot \log(x). \\ x^{\log(y)} &= y^{\log(x)}. \end{aligned}$$

- The logarithm function is only defined on \mathbb{R}_+ .
- The logarithm function is strictly increasing: $\log(x) > \log(y)$ whenever $x > y$.
- $\log(x + y)$ and $\log(x - y)$ do not generally have a simpler form.