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:

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

- 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.

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