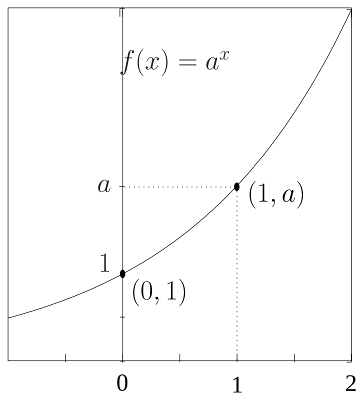
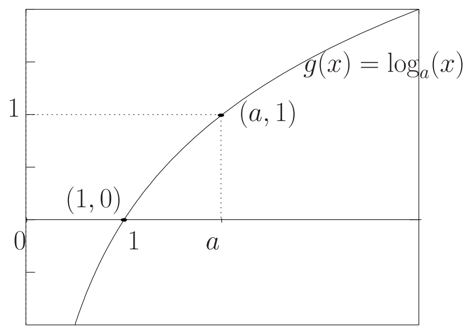
Exponent and Logarithm Properties

1 Graphs

Figure 1: The Graphs of $f(x) = a^x$ and $g(x) = \log_a(x)$ for $a > 1$.





2 Algebra

The Inverse Identities Exponents and Logarithms

$$e^{\ln(x)} = x \quad \text{and} \quad \ln(e^x) = x,$$

$$a^{\log_a(x)} = x \quad \text{and} \quad \log_a(a^x) = x.$$

$$e^A = B \quad \Leftrightarrow \quad \ln(B) = A,$$

$$a^A = B \quad \Leftrightarrow \quad \log_a(B) = A.$$

The Laws of Exponents (for $a > 0$ and $\alpha, \beta \in \mathbb{R}$)

$$a^0 = 1, \quad a^{-\alpha} = \frac{1}{a^\alpha}$$

$$a^\alpha \cdot a^\beta = a^{\alpha+\beta}$$

$$(a^\alpha)^\beta = a^{\alpha\cdot\beta}$$

$$\frac{a^\alpha}{a^\beta} = a^{\alpha-\beta}$$

$$\sqrt[r]{a^s} = a^{s/r} \text{ where } r > 0$$

The Laws of Logarithms (for $a, b, c, x, y > 0$ and $r \in \mathbb{R}$)

$$\log_a(1) = 0$$

$$\log_a(a) = 1$$

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

$$\log_a(x/y) = \log_a(x) - \log_a(y)$$

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

$$\log_a(b) = \frac{\log_c(b)}{\log_c(a)}$$