

## Exponential functions

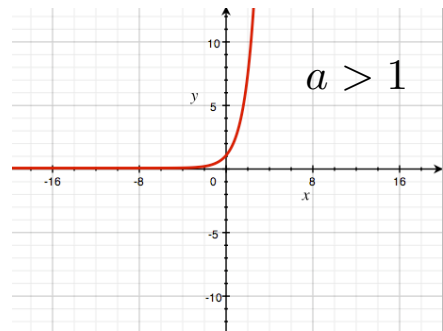
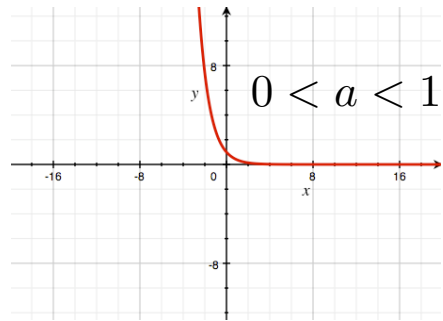
$$y = a^x$$

domain:  $\mathbb{R}$

range:  $(0, \infty)$

intercept:  $(0, 1)$

asymptote:  $y = 0$



## Logarithm functions

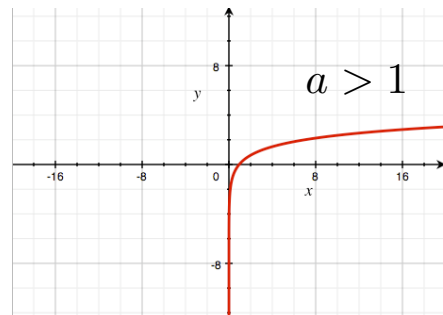
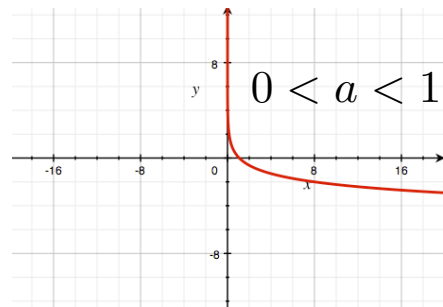
$$y = \log_a(x)$$

domain:  $(0, \infty)$

range:  $\mathbb{R}$

intercept:  $(1, 0)$

asymptote:  $x = 0$



## Properties of exponential and logarithms

$$y = a^x \iff x = \log_a(y)$$

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

$$a^0 = 1 \quad \log_a(1) = 0$$

$$a^1 = a \quad \log_a(a) = 1$$

$$a^{x+y} = a^x a^y \quad \log_a(xy) = \log_a(x) + \log_a(y)$$

$$a^{x-y} = a^x / a^y \quad \log_a(x/y) = \log_a(x) - \log_a(y)$$

$$(a^x)^y = a^{xy} \quad \log_a(x^r) = r \log_a(x)$$