

Exponential Functions

Defn An exponential function is any function of the form $f(x) = b^x$

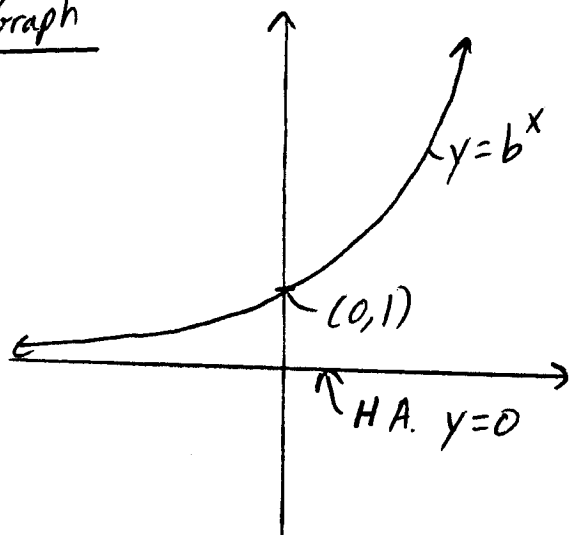
where b is a constant not equal to 1.

Notes: 1) Domain: All real numbers

2) Range: $y > 0$

3) b^x has a horizontal asymptote at $y=0$.

Graph



Rules

$$1) b^m b^n = b^{m+n}$$

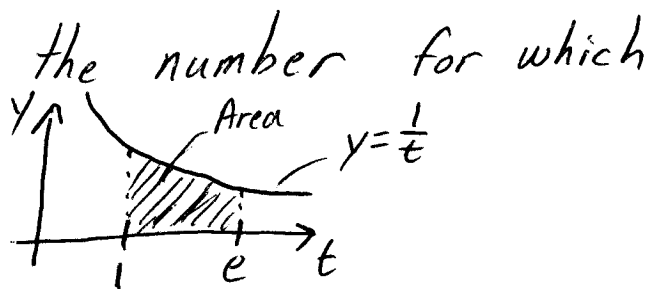
$$2) \frac{b^m}{b^n} = b^{m-n}$$

$$3) (b^m)^n = b^{mn}$$

$$4) \frac{1}{b^m} = b^{-m}$$

Facts: 1) The constant e is the number for which

$$\text{Area} = \int_1^e \frac{1}{t} dt = \ln e = 1$$



$$2) \lim_{n \rightarrow \infty} \left(1 + \frac{x}{n}\right)^n = e^x$$

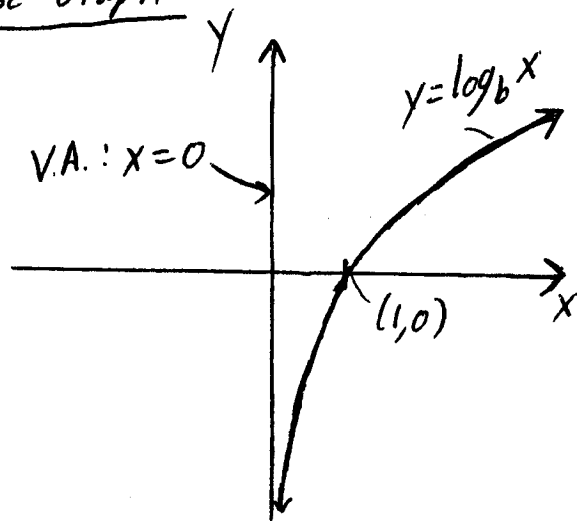
Logarithmic FunctionsDefn

The logarithm base b of x equals y , written $\log_b x = y$, is equivalent to expression $x = b^y$.
(i.e. $\log_b x = y \Leftrightarrow x = b^y$)

Notes: 1) Domain: $x > 0$

2) Range: All real numbers

3) $\log_b x$ has a vertical asymptote at $x = 0$.

Base GraphRules

$$1) \log_b 1 = 0$$

$$2) \log_b b = 1$$

$$3) \log_b b^x = x$$

$$4) b^{\log_b x} = x$$

$$5) \log_b (x \cdot y) = \log_b x + \log_b y$$

$$6) \log_b \left(\frac{x}{y}\right) = \log_b x - \log_b y$$

$$7) \log_b x^y = y \log_b x$$

$$8) \log_b x = \frac{\log_c x}{\log_c b} \quad (\text{Change of Base Formula})$$

Notation: 1) $\log x := \log_{10} x$

2) $\ln x := \log_e x$