Exponential Function

$f(x) = a^x \quad a > 0, a \neq 1$

Domain: $(-\infty, \infty)$
Range: $(0, \infty)$
x-intercept: None
y-intercept: (0,1)
Vert. Asympt. : None
Horz. Asympt. : y = 0
One-to-one function
Increasing function if a > 1
Decreasing function if 0 < a < 1

Exponential Identities

$a^0 = 1 \quad a^1 = a$
$a^x a^y = a^{x+y}$
$\frac{a^x}{a^y} = a^{x-y}$
$(a^x)^y = a^{xy}$
$a^{-x} = \frac{1}{a^x}$

Applications: Compound Interest And Continuous Interest

$A = P\left(1 + \frac{r}{n}\right)^{nt} \qquad A = Pe^{rt}$

A: Amount
P: Principal
r: annual interest rate
n: number of compounds per year
t: number of years

Logarithmic Function

A logarithm is an exponent

$g(x) = \log_a x \quad a > 0, a \neq 0$

Domain: $(0, \infty)$
Range: $(-\infty, \infty)$
x-intercept: (1,0)
y-intercept: None
Vert. Asympt. : x = 0
Horz. Asympt. : None
One-to-one function
Increasing function if a > 1
Decreasing function if 0 < a < 1

Logarithmic Identities

$\log_a a = 1 \qquad \log_a 1 = 0$
$\log_a (a)^x = x \quad a^{\log_a x} = x$
$\log_a (u \cdot v) = \log_a (u) + \log_a (v)$
$\log_a \left(\frac{u}{v}\right) = \log_a (u) - \log_a (v)$
$\log_a u^n = n \cdot \log_a (u)$

$\log_{10} x = \log x \qquad \log_e x = \ln x$

$\ln e = 1 \qquad \ln 1 = 0$
$\ln (e)^x = x \qquad e^{\ln x} = x$
$\ln (u \cdot v) = \ln (u) + \ln (v)$
$\ln \left(\frac{u}{v}\right) = \ln (u) - \ln (v)$
$\ln (u)^n = n \ln (u)$

Change of Base

$\log_a x = \frac{\log_b x}{\log_b a} = \frac{\log x}{\log a} = \frac{\ln x}{\ln a}$