

# Exponent and Logarithm Facts & Fcns

## Exponential Facts & Standard Functions

### Exponent Facts

$$a^m \cdot a^n = a^{m+n} \quad \text{e.g., } a^2 \cdot a^3 = a^5$$

$$\frac{a^m}{a^n} = a^{m-n} \quad \text{e.g., } a^5 / a^3 = a^2$$

$$(a^m)^n = a^{mn} \quad \text{e.g., } (a^2)^3 = a^6$$

$$a^{1/n} = \sqrt[n]{a} \quad \text{e.g., } a^{1/3} = \sqrt[3]{a}$$

$$a^{-n} = \frac{1}{a^n} \quad \text{e.g., } a^{-3} = 1/a^3$$

$$a^0 = 1$$

$$a^1 = a$$

$$a^{\log_a(b)} = b \quad \text{e.g., } e^{\ln 6} = 6$$

### Exponent Functions

#### Growth & Decay

Linear:  $A = rt + A_0$

Exponential growth:  $A = A_0 e^{rt}$

Exponential decay:  $A = A_0 e^{-rt}$

$A_0$  – initial value;  $A$  – final value;  $t$  – time;  $r$  – rate.

#### Compound Interest

Compounded  $n$  times/year:  $A = P(1 + \frac{r}{n})^{nt}$

Compounded continuously:  $A = Pe^{rt}$

$P$  – Principle (starting amount);  $r$  – interest rate;  $t$  – time

#### Half Life

$$A = A_0(2^{-t/h}) = A_0(\frac{1}{2})^{t/h}$$

$A$  – Amount at time  $t$ ;  $A_0$  – Original amount;  $t$  – time;  $h$  – half-life

## Logarithms

### Values

$$\log 1 = 0$$

$$\log_a a = 1$$

$$\log_a a^b = b \quad \text{e.g., } \log_3 3^5 = 5$$

$$\log(1/n) = -\log n$$

### Combining Values

$$\log(a \cdot b) = \log a + \log b \quad \text{e.g., } \log 15 = \log 3 + \log 5$$

$$\log(a/b) = \log a - \log b \quad \text{e.g., } \log 7 = \log 14 - \log 2$$

$$\log(a^b) = b \cdot \log a \quad \text{e.g., } \log 25 = 2 \log 5$$

$$\log_a b = \frac{\log b}{\log a} \quad \text{e.g., } \log_6 8 = \frac{\log 8}{\log 6}$$