1 Exponentials

| General Base $a > 0$ | Special Case: Base $e = 2.71828 \cdots$ |
|---|---|
| $a^b a^c = a^{b+c}$ | $e^b e^c = e^{b+c}$ |
| $\frac{a^b}{a^c} = a^{b-c}$ | $\frac{e^b}{e^c}=e^{b-c}$ |
| $(a^b)^c = a^{bc}$ | $(e^b)^c=e^{bc}$ |
| $\frac{d}{dx}\left[a^{x}\right]=a^{x}\ln\left(a\right)$ | $\frac{d}{dx}\left[e^{x}\right]=e^{x}$ |

Derivative:

Laws:

2 Logarithms

Definiton: $\log_a(b)$ is the power to which *a* is raised to give *b*.

Definiton: $\ln(b) = \log_e(b)$, the power to which *e* is raised to give *b*.

General Base a > 0

 $\log_a(bc) = \log_a(b) + \log_a(c)$

Special Case: Base $e = 2.71828 \cdots$

 $\ln(bc) = \ln(b) + \ln(c)$

Laws:

$$\log_{a}\left(\frac{b}{c}\right) = \log_{a}(b) - \log_{a}(c) \qquad \qquad \ln\left(\frac{b}{c}\right) = \ln(b) - \ln(c)$$
$$\log_{a}(b^{c}) = c\log_{a}(b) \qquad \qquad \qquad \ln(b^{c}) = c\ln(b)$$

Change of Base:
$$\log_b(c) = \frac{\log_a(c)}{\log_a(b)}$$
 $\log_b(c) = \frac{\ln(c)}{\ln(b)}$

Derivative:
$$\frac{d}{dx} [\log_a(x)] = \frac{1}{x \ln(a)}$$
 $\frac{d}{dx} [\ln(x)] = \frac{1}{x}$

3 Inverse Properties

General Base
$$a > 0$$
Special Case: Base $e = 2.71828 \cdots$ $a^{\log_a(x)} = x$ $e^{\ln (x)} = x$ $\log_a(a^x) = x$ $\ln (e^x) = x$