Integral Formulas:

1.) $\int \frac{1}{u}\ du = \ln|u| + C$

2.) $\int e^u\ du = e^u + C$

3.) $\int a^u\ du = \frac{a^u}{\ln a} + C$

4.) $\int \frac{1}{\sqrt{1-u^2}}\ du = \sin^{-1} u + C$

5.) $\int \frac{1}{1+u^2}\ du = \tan^{-1} u + C$

6.) $\int \frac{1}{u\sqrt{u^2-1}}\ du = \sec^{-1}|u| + C$

Derivative Formulas:

1.) $D_x[\ln x] = D_x[\ln|x|] = \frac{1}{x}$

Chain rule: $D_x[\ln u] = D_x[\ln|u|] = \frac{D_x[u]}{x}$

2.) $D_x[\log_a x] = \frac{1}{x \ln a}$

Chain rule: $D_x[\log_a u] = \frac{D_x[u]}{u \ln a}$

3.) $D_x[e^x] = e^x$

Chain rule: $D_x[e^u] = e^u \cdot D_x[u]$

4.) $D_x[a^x] = a^x \ln a$ for any positive number a

Chain rule: $D_x[a^u] = (a^u \ln a) \cdot D_x[u]$

5.) $D_x[\sin^{-1} x] = \frac{1}{\sqrt{1-x^2}}$ for $-1 < x < 1$

Chain rule: $D_x[\sin^{-1} u] = \frac{D_x[u]}{\sqrt{1-u^2}}$

6.) $D_x[\tan^{-1} x] = \frac{1}{1+x^2}$

Chain rule: $D_x[\tan^{-1} u] = \frac{D_x[u]}{1+u^2}$

7.) $D_x[\sec^{-1} x] = \frac{1}{|x|\sqrt{x^2-1}}$ for $x < -1$ or $x > 1$

Chain rule: $D_x[\sec^{-1} u] = \frac{D_x[u]}{|u|\sqrt{u^2-1}}$

Switching between logarithmic and exponential equations:

Let a be any positive number other than 1. Then

$$a^y = x \Leftrightarrow \log_a x = y$$

A good way to memorize this is to think about

$$(\text{Base})^{(\text{Exponent})} = \text{Number} \Leftrightarrow \log_{(\text{Base})}(\text{Number}) = \text{Exponent}.$$

Look at first letters; "BEN $\Leftrightarrow$ BNE". Say it; "Ben is equivalent to Benny".

Logarithmic change of base formula:

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

Law of exponential growth/decay:

$$y = y_0 e^{kt}$$

y is the amount at time t, y_0 is the amount you start out with, t is the time, and k is a constant of proportionality. If $k < 0$, we have exponential decay. If $k > 0$, we have exponential growth.