-- Log, Exponential, and Trig Functions --

Formulas

Log/Exponential

$\frac{d}{dx}\, a^{\upsilon} = (\ln a)a^{\upsilon}\upsilon'$	$\int a^{\upsilon}d\upsilon = \left(\frac{1}{\ln a}\right)a^{\upsilon} + C$
$\frac{d}{dx}\, e^{\upsilon} = e^{\upsilon}\upsilon'$	$\int e^{\upsilon}d\upsilon = e^{\upsilon} + C$
$\frac{d}{dx}\, \ln\upsilon = \frac{1}{u}\,\upsilon'$	$\int \frac{1}{u}\,d\upsilon = \ln\lvert\upsilon\rvert + C$
$\frac{d}{dx}\, \log_a \upsilon = \frac{1}{(\ln a)u}\,\upsilon'$	

* while memorizing your trig formulas notice that there are many patterns. sin + cos, sec + csc, and tan + cot are opposites of each other in most cases. The latter of the three patterns also don't have their own arc integration.

Trig

	$\frac{d}{dx}\, \sin^{-1}\upsilon = \frac{1}{\sqrt{1-u^2}}\,\upsilon'$	$\int \frac{1}{\sqrt{a^2-u^2}}\,d\upsilon = \sin^{-1}\frac{u}{a} + C$
	$\frac{d}{dx}\, \cos^{-1}\upsilon = \frac{-1}{\sqrt{1-u^2}}\,\upsilon'$	
$\int \sec\upsilon d\upsilon = \ln\lvert\sec\upsilon + \tan\upsilon\rvert + C$	$\frac{d}{dx}\, \sec^{-1}\upsilon = \frac{1}{\lvert u\rvert\sqrt{u^2-1}}$	$\int \frac{1}{u\sqrt{u^2-a2}}\,d\upsilon = \frac{1}{a}\sec^{-1}\frac{\lvert u\rvert}{a} + C$
$\int \csc\upsilon d\upsilon = -\ln\lvert\csc\upsilon + \cot\upsilon\rvert + C$	$\frac{d}{dx}\, \csc^{-1}\upsilon = \frac{-1}{\lvert u\rvert\sqrt{u^2-1}}$	
$\int \tan\upsilon d\upsilon = -\ln\lvert\cos\upsilon\rvert + C$	$\frac{d}{dx}\, \tan^{-1}\upsilon = \frac{1}{1+u^2}\,\upsilon'$	$\int \frac{1}{a^2+u2}\,d\upsilon = \frac{1}{a}\tan^{-1}\frac{u}{a} + C$
$\int \cot\upsilon d\upsilon = \ln\lvert\sin\upsilon\rvert + C$	$\frac{d}{dx}\, \cot^{-1}\upsilon = \frac{-1}{1+u^2}\,\upsilon'$	

Common Problems

Advice	$\int \frac{4}{\sqrt{25-x^2}}\,dx$	$\int \frac{4x}{\sqrt{25-x^2}}\,dx$	$\int \frac{4x+4}{\sqrt{25-x^2}}\,dx$
determine how you're going to solve the integral before proceeding. you can ask yourself if it resembles a trig integral or if the numerator has a variable to the right degree to use u-substitution.	this equation resembles the arcsin integral $4\int \frac{1}{\sqrt{25-x^2}}\,dx$ $\upsilon = x \quad d\upsilon = 1dx \quad a = 5$ $4\int \frac{1}{\sqrt{(5)^2-u^2}}\,d\upsilon$ $4\arcsin\frac{x}{5} + C$	this integral can be simplified using basic u-substitution $\upsilon = 25 - x^2 \quad d\upsilon = -2xdx$ $-2\int \frac{-2x}{\sqrt{25-x^2}}\,dx$ $-2\int \frac{1}{\sqrt{u}}\,d\upsilon \rightarrow -2\int \upsilon^{-1/2}d\upsilon$ $-4\sqrt{25-x^2} + C$	split this into two parts $\int \frac{4x}{\sqrt{25-x^2}}\,dx + 4\int \frac{1}{\sqrt{25-x^2}}\,dx$ regular u-sub arcsin $\upsilon_1 = 25-x^2 \quad d\upsilon_1 = -2xdx \quad \upsilon_2 = x \quad d\upsilon_2 = 1dx \quad a = 5$ $-2\int \frac{1}{\sqrt{u}}\,d\upsilon + 4\int \frac{1}{\sqrt{(5)^2-u^2}}\,d\upsilon$ $-4\sqrt{25-x^2} + 4\arcsin\frac{x}{5} + C$

Interest Functions

$A = P(1 + \frac{r}{n})^{nt}$	$N(t) = N_0(\frac{1}{2})^{\frac{t}{HL}}$	$A = Pe^{rt}$
* use if the interest is compounded on a specific timeline * quarterly: n=4 * semi-annually: n=2 * monthly: n=12 * daily: n=365	* use this in half-life problems	* use this when it says compounded continuously

Inverse Functions

How to Find It	Confirming	The Derivative
* switch the x and y * solve for y and that is the inverse	* plug in one function into the x's in the other function (aka f(g(x))). if it simplifies to x, then they're inverses	* if f(x) and g(x) are inverse functions, then $g'(x) = \frac{1}{f'(g(x))}$