Must Know Derivative and Integral Rules!

Table I: General Rules

Derivative Rule	**Integration Rule**
Sum/Difference Rule $\frac{d}{dx}\big[f(x) \pm g(x)\big] = f'(x) \pm g'(x)$	Sum/Difference Rule $\int \big[f(x) \pm g(x)\big]dx = \int f(x)dx \pm \int g(x)dx$
Constant Multiple Rule $\frac{d}{dx}\big[cf(x)\big] = cf'(x)$	Constant Multiple Rule $\int cf(x)dx = c\int f(x)dx$
Product Rule $\frac{d}{dx}\big[f(x)g(x)\big] = f'(x)g(x) + f(x)g'(x)$	Integration by Parts $\int f'(x)g(x)dx = f(x)g(x) - \int f(x)g'(x)dx$
Quotient Rule $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{f'(x)g(x)-f(x)g'(x)}{[g(x)]^2}$	(no simple rule corresponds)
Chain Rule $\frac{d}{dx}\big[f(g(x))\big] = f'(g(x))g'(x)$	U-Substitution $\int f(g(x))g'(x)dx = \int f(u)du$ where $u = g(x)$

Table II: Rules for Specific Functions

Derivative Rule	**Integration Rule**
Constant Rule $\frac{d}{dx}[c] = 0$	Constant Rule $\int c\,dx = cx + C$
Power Rule $\frac{d}{dx}[x^p] = px^{p-1}$	Power Rule $\int x^p dx = \frac{1}{p+1}x^{p+1} + C$ for $p \neq -1$
$\frac{d}{dx}\ln\|x\| = \frac{1}{x}$	$\int \frac{dx}{x} = \ln\|x\| + C$
$\frac{d}{dx}\log_b\|x\| = \frac{1}{x\ln b}$	same as above
$\frac{d}{dx}e^x = e^x$	$\int e^x dx = e^x + C$
$\frac{d}{dx}b^x = (\ln b)b^x$	$\int b^x dx = \frac{1}{\ln b}b^x + C$
$\frac{d}{dx}\sin(x) = \cos(x)$	$\int \cos(x)dx = \sin(x) + C$
$\frac{d}{dx}\cos(x) = -\sin(x)$	$\int \sin(x)dx = -\cos(x) + C$
$\frac{d}{dx}\tan(x) = \sec^2(x)$	$\int \sec^2(x)dx = \tan(x) + C$
$\frac{d}{dx}\sec(x) = \sec(x)\tan(x)$	$\int \sec(x)\tan(x)dx = \sec(x) + C$
$\frac{d}{dx}\csc(x) = -\csc(x)\cot(x)$	$\int \csc(x)\cot(x)dx = -\csc(x) + C$
$\frac{d}{dx}\cot(x) = -\csc^2(x)$	$\int \csc^2(x)dx = -\cot(x) + C$
$\frac{d}{dx}\arctan(x) = \frac{1}{1+x^2}$	$\int \frac{dx}{1+x^2} = \arctan(x) + C$
$\frac{d}{dx}\arcsin(x) = \frac{1}{\sqrt{1-x^2}}$	$\int \frac{dx}{\sqrt{1-x^2}} = \arcsin(x) + C$
$\frac{d}{dx}\arccos(x) = -\frac{1}{\sqrt{1-x^2}}$	same as above (NOTE: $\arccos(x) = \frac{\pi}{2} - \arcsin(x)$)

Table III: Additional Integrals

$\int \sin^2(x)dx = \frac{x}{2} - \frac{\sin(2x)}{4} + C$
$\int \cos^2(x)dx = \frac{x}{2} + \frac{\sin(2x)}{4} + C$
$\int \tan(x)dx = \ln\|\sec(x)\| + C$
$\int \cot(x)dx = \ln\|\sin(x)\| + C$
$\int \sec(x)dx = \ln\|\sec(x) + \tan(x)\| + C$
$\int \csc(x)dx = -\ln\|\csc(x) + \cot(x)\| + C$
$\int \ln(x)dx = x\ln(x) - x + C$
$\int \log_b(x)dx = \frac{1}{\ln b}(x\ln(x) - x) + C$

Table IV: Useful Integrals

$\int \arctan(x)dx = x\arctan(x) - \frac{1}{2}\ln(1+x^2) + C$
$\int \arcsin(x)dx = x\arcsin(x) + \sqrt{1-x^2} + C$
$\int \arccos(x)dx = x\arccos(x) - \sqrt{1-x^2} + C$