ACTUARIAL SCIENCE
FIRST YEAR CALCULUS - FORMULA SHEET
Standard Derivatives

$\frac{d}{dx}(x^n) = nx^{n-1} \qquad (n \neq 0)$

$\frac{d}{dx}(\ln x) = \frac{1}{x}$

$\frac{d}{dx}(e^x) = e^x$

$\frac{d}{dx}(\sin x) = \cos x$

$\frac{d}{dx}(\operatorname{cosec} x) = -\operatorname{cosec} x \cot x$

$\frac{d}{dx}(\cos x) = -\sin x$

$\frac{d}{dx}(\sec x) = \sec x \tan x$

$\frac{d}{dx}(\tan x) = \sec^2 x$

$\frac{d}{dx}(\cot x) = -\operatorname{cosec}^2 x$

$\frac{d}{dx}(\sinh x) = \cosh x$

$\frac{d}{dx}(\operatorname{cosech} x) = -\operatorname{cosech} x \coth x$

$\frac{d}{dx}(\cosh x) = \sinh x$

$\frac{d}{dx}(\operatorname{sech} x) = -\operatorname{sech} x \tanh x$

$\frac{d}{dx}(\tanh x) = \operatorname{sech}^2 x$

$\frac{d}{dx}(\coth x) = -\operatorname{cosech}^2 x$

$\frac{d}{dx}(\arcsin x) = \frac{1}{\sqrt{1-x^2}}$

$\frac{d}{dx}(\operatorname{arsinh} x) = \frac{1}{\sqrt{x^2+1}}$

$\frac{d}{dx}(\arccos x) = -\frac{1}{\sqrt{1-x^2}}$

$\frac{d}{dx}(\operatorname{arcosh} x) = \frac{1}{\sqrt{x^2-1}}$

$\frac{d}{dx}(\arctan x) = \frac{1}{1+x^2}$

$\frac{d}{dx}(\operatorname{artanh} x) = \frac{1}{1-x^2}$

ACTUARIAL SCIENCE
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Standard Integrals

$\int x^n dx = \frac{x^{n+1}}{n+1} \qquad (n \neq -1)$

$\int \frac{1}{x} dx = \ln x$

$\int \frac{1}{x} dx = \ln x$

$\int e^x dx = e^x$

$\int \sin x \, dx = -\cos x$

$\int \operatorname{cosec} x \cot x dx = -\operatorname{cosec} x$

$\int \cos x \, dx = \sin x$

$\int \sec x \tan x \, dx = \sec x$

$\int \tan x \, dx = -\ln(\cos x)$

$\int \cot x \, dx = \ln(\sin x)$

$\int \sec^2 x \, dx = \tan x$

$\int \operatorname{cosec}^2 x \, dx = -\cot x$

$\int \sinh x \, dx = \cosh x$

$\int \cosh x \, dx = \sinh x$

$\int \frac{dx}{a^2-x^2} = \frac{1}{2a} \ln\left(\frac{a+x}{a-x}\right) \qquad (|x| < a)$

$\int \sec x \, dx = \ln(\sec x + \tan x)$

$\int \frac{dx}{x^2-a^2} = \frac{1}{2a} \ln\left(\frac{x-a}{x+a}\right) \qquad (|x| > a > 0)$

$\int \operatorname{cosec} x dx = -\ln(\operatorname{cosec} x + \cot x)$

$\int \frac{dx}{x^2+a^2} = \frac{1}{a} \arctan\left(\frac{x}{a}\right)$

$\int \frac{dx}{\sqrt{a^2-x^2}} = \arcsin\left(\frac{x}{a}\right)$

$\int \frac{dx}{\sqrt{x^2+a^2}} = \operatorname{arsinh}\left(\frac{x}{a}\right) = \ln\left(\frac{x+\sqrt{x^2+a^2}}{a}\right)$

$\int \frac{dx}{\sqrt{x^2-a^2}} = \operatorname{arcosh}\left(\frac{x}{a}\right) = \ln\left(\frac{x+\sqrt{x^2-a^2}}{a}\right)$

$\int e^{ax} \sin bx \, dx = \frac{e^{ax}(a \sin bx - b \cos bx)}{a^2+b^2}$

$\int e^{ax} \cos bx \, dx = \frac{e^{ax}(a \cos bx + b \sin bx)}{a^2+b^2}$

Wallis' formula $\int_0^{\frac{\pi}{2}} \sin^m x \cos^n x \, dx = \frac{(m-1)(m-3)...(n-1)(n-3)...}{(m+n)(m+n-2)...} p$

(m and n are positive integers) where $p = \frac{1}{2}\pi$ if m, n both even and $p = 1$ otherwise.