

DERIVATIVE RULES

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

$$\frac{d}{dx}(uv) = uv' + vu'$$

$$\frac{d}{dx}\left[\frac{u}{v}\right] = \frac{vu' - uv'}{v^2}$$

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

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

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

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

$$\frac{d}{dx} \cot x = -\csc^2 x$$

$$\frac{d}{dx} \csc x = -\csc x \cot x$$

$$\frac{d}{dx} \sin^{-1} u = \frac{1}{\sqrt{1-u^2}} \frac{du}{dx}, |u| < 1$$

$$\frac{d}{dx} \cos^{-1} u = -\frac{1}{\sqrt{1-u^2}} \frac{du}{dx}, |u| < 1$$

$$\frac{d}{dx} \tan^{-1} u = \frac{1}{1+u^2} \frac{du}{dx}$$

$$\frac{d}{dx} \cot^{-1} u = -\frac{1}{1+u^2} \frac{du}{dx}$$

$$\frac{d}{dx} \csc^{-1} u = -\frac{1}{u\sqrt{u^2-1}} \frac{du}{dx}$$

$$\frac{d}{dx} \sec^{-1} u = \frac{1}{u\sqrt{u^2-1}} \frac{du}{dx}$$

$$\frac{d}{dx} e^u = e^u \frac{du}{dx}$$

$$\frac{d}{dx} a^u = a^u \ln a \frac{du}{dx}$$

$$\frac{d}{dx} \ln u = \frac{1}{u} \frac{du}{dx}$$

$$\frac{d}{dx} \log_a u = \frac{1}{u \ln a} \frac{du}{dx}$$

2006 Calculus Challenge Formula Sheet

SOME VALUES OF THE TRIGONOMETRIC FUNCTIONS

θ	0	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$	$2\pi/3$	$3\pi/4$	$5\pi/6$
$\sin \theta$	0	1/2	$1/\sqrt{2}$	$\sqrt{3}/2$	1	$\sqrt{3}/2$	$1/\sqrt{2}$	1/2
$\cos \theta$	1	$\sqrt{3}/2$	$1/\sqrt{2}$	1/2	0	-1/2	$-1/\sqrt{2}$	$-\sqrt{3}/2$

TRIGONOMETRIC IDENTITIES

$$\sin(\pi + \theta) = -\sin \theta = \sin(-\theta) \quad \cos(\pi + \theta) = -\cos \theta = -\cos(-\theta)$$

$$\sin^2 \theta + \cos^2 \theta = 1 \quad \tan^2 \theta + 1 = \sec^2 \theta$$

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta = 2\cos^2 \theta - 1 = 1 - 2\sin^2 \theta$$

$$\csc \theta = 1/\sin \theta, \quad \sec \theta = 1/\cos \theta, \quad \tan \theta = \sin \theta / \cos \theta, \quad \cot \theta = \cos \theta / \sin \theta$$

BASIC INTEGRATION AND DIFFERENTIATION FORMULAS

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

$$\int \frac{1}{x} dx = \ln|x| + C$$

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

$$\int \sin x dx = -\cos x + C$$

$$\int \cos x dx = \sin x + C$$

$$\int \sec^2 x dx = \tan x + C$$

$$\int \csc^2 x dx = -\cot x + C$$

$$\int \sec x \tan x dx = \sec x + C$$

$$\int \csc x \cot x dx = -\csc x + C$$

$$\int \frac{1}{1+x^2} dx = \arctan x + C$$

$$\int (1-x^2)^{-1/2} dx = \arcsin x + C$$

$$\frac{d}{dx} x^n = nx^{n-1}$$

$$\frac{d}{dx} \ln|x| = \frac{1}{x}$$

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

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

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

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

$$\frac{d}{dx} \cot x = -\csc^2 x$$

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

$$\frac{d}{dx} \csc x = -\csc x \cot x$$

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

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

A SUMMARY OF BASIC IDENTITIES AND FORMULAE

Pythagorean Identities:

$$\sin^2 \theta + \cos^2 \theta = 1 \qquad 1 + \tan^2 \theta = \sec^2 \theta \qquad 1 + \cot^2 \theta = \csc^2 \theta$$

Reciprocal and Quotient Identities:

$$\sec \theta = \frac{1}{\cos \theta} \qquad \csc \theta = \frac{1}{\sin \theta} \qquad \cot \theta = \frac{1}{\tan \theta}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta} \qquad \cot \theta = \frac{\cos \theta}{\sin \theta}$$

Addition Identities:

$$\begin{aligned} \cos(\alpha + \beta) &= \cos \alpha \cos \beta - \sin \alpha \sin \beta & \sin(\alpha + \beta) &= \sin \alpha \cos \beta + \cos \alpha \sin \beta \\ \cos(\alpha - \beta) &= \cos \alpha \cos \beta + \sin \alpha \sin \beta & \sin(\alpha - \beta) &= \sin \alpha \cos \beta - \cos \alpha \sin \beta \end{aligned}$$

Double-Angle Identities:

$$\begin{aligned} \cos 2\theta &= \cos^2 \theta - \sin^2 \theta & \sin 2\theta &= 2 \sin \theta \cos \theta \\ &= 2 \cos^2 \theta - 1 \\ &= 1 - 2 \sin^2 \theta \end{aligned}$$

Formulae:

$$t_n = ar^{n-1} \qquad S_n = \frac{a(1-r^n)}{1-r} \qquad S_n = \frac{a-r^n}{1-r} \qquad S = \frac{a}{1-r} \qquad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Probability and Statistics:

$${}_n P_r = \frac{n!}{(n-r)!} \qquad {}_n C_r = \binom{n}{r} = \frac{n!}{r!(n-r)!} \qquad t_{k+1} = {}_n C_k a^{n-k} b^k$$

$$P(\bar{A}) = 1 - P(A) \qquad P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} \qquad P(A \text{ and } B) = P(A) \times P(B|A)$$

$$P(x) = {}_n C_x p^x q^{n-x} \qquad (q = 1 - p)$$

$$\mu = \frac{\sum x_i}{n} \qquad \sigma = \sqrt{\frac{\sum (x_i - \mu)^2}{n}} \qquad \mu = np \qquad \sigma = \sqrt{npq} \qquad z = \frac{x - \mu}{\sigma}$$

Note: Graphing calculators will contain many of these formulae as pre-programmed functions.

You may detach this page for convenient reference.
Exercise care when tearing along perforations.