REFERENCE FORMULAS FOR CALCULUS

ALGEBRA FORMULAS

THE QUADRATIC FORMULA gives all solutions of the quadratic equation $ax^2 + bx + c = 0$:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

THE BINOMIAL FORMULA (n is a positive integer):

$$(x+y)^n = x^n + nx^{n-1}y + \frac{n(n-1)}{1\cdot 2}x^{n-2}y^2 + \frac{n(n-1)(n-2)}{1\cdot 2\cdot 3}x^{n-3}y^3 + \ldots + nxy^{n-1} + y^n,$$

For even n: $(x-y)^n = x^n - nx^{n-1}y + \frac{n(n-1)}{1\cdot 2}x^{n-2}y^2 - \frac{n(n-1)(n-2)}{1\cdot 2\cdot 3}x^{n-3}y^3 + \ldots - nxy^{n-1} + y^n,$

For odd n: $(x-y)^n = x^n - nx^{n-1}y + \frac{n(n-1)}{1\cdot 2}x^{n-2}y^2 - \frac{n(n-1)(n-2)}{1\cdot 2\cdot 3}x^{n-3}y^3 + \ldots + nxy^{n-1} - y^n.$

NOTE: The last two formulas for even and odd values of n follow from the first one by replacing y by $-y$ on both sides of the first formula, that is,

$$(x-y)^n = x^n + nx^{n-1}(-y) + \frac{n(n-1)}{1\cdot 2}x^{n-2}(-y)^2 + \frac{n(n-1)(n-2)}{1\cdot 2\cdot 3}x^{n-3}(-y)^3 + \ldots + nx(-y)^{n-1} + (-y)^n.$$

TRIGONOMETRIC IDENTITIES

$\sin(\pi-\theta) = \sin\theta$	$\cos(\pi-\theta) = -\cos\theta$	$\tan(\pi-\theta) = -\tan\theta$
$\csc(\pi-\theta) = \csc\theta$	$\sec(\pi-\theta) = -\sec\theta$	$\cot(\pi-\theta) = -\cot\theta$
$\sin(\pi+\theta) = -\sin\theta$	$\cos(\pi+\theta) = -\cos\theta$	$\tan(\pi+\theta) = \tan\theta$
$\csc(\pi+\theta) = -\csc\theta$	$\sec(\pi+\theta) = -\sec\theta$	$\cot(\pi+\theta) = \cot\theta$

NOTE: The third and fourth rows follow from the first and second rows, respectively, by replacing θ with $-\theta$ on both sides of each formula.

GENERALIZED DERIVATIVE FORMULAS for $u = f(x)$

$$\frac{d}{dx}[u^n] = n\,u^{n-1}\frac{du}{dx} \qquad \frac{d}{dx}[\sqrt{u}] = \frac{1}{2\sqrt{u}}\frac{du}{dx}$$

$$\frac{d}{dx}[\ln u] = \frac{1}{u}\frac{du}{dx} \qquad \frac{d}{dx}[e^u] = e^u\frac{du}{dx}$$

$$\frac{d}{dx}[\sin u] = \cos u\frac{du}{dx} \qquad \frac{d}{dx}[\cos u] = -\sin u\frac{du}{dx}$$

$$\frac{d}{dx}[\tan u] = \sec^2 u\frac{du}{dx} \qquad \frac{d}{dx}[\cot u] = -\csc^2 u\frac{du}{dx}$$

$$\frac{d}{dx}[\sec u] = \sec u\tan u\frac{du}{dx} \qquad \frac{d}{dx}[\csc u] = -\csc u\cot u\frac{du}{dx}$$

NOTE: The two derivatives given in the first row are special cases of $\frac{d}{dx}[u^a] = a\,u^{a-1}\frac{du}{dx}$, where a is any real number (in the first case, $a = n$, where n is an integer, and in the second case, $a = \frac{1}{2}$, since $\sqrt{u} = u^{\frac{1}{2}}$ and $\frac{1}{\sqrt{u}} = u^{-1/2}$).