

SOME USEFUL FORMULAS

<u>DIFFERENTIATION:</u>		
$\frac{d}{dx}(u+v) = \frac{du}{dx} + \frac{dv}{dx}$	$\frac{d}{dx}(\log_a x) = \frac{1}{x \log a}$	$\frac{d}{dx}(\sin^{-1} x) = \frac{1}{\sqrt{1-x^2}}$
$\frac{d}{dx}(uv) = u \frac{dv}{dx} + v \frac{du}{dx}$	$\frac{d}{dx}(\sqrt{x}) = \frac{1}{2\sqrt{x}}$	$\frac{d}{dx}(\cos^{-1} x) = -\frac{1}{\sqrt{1-x^2}}$
$\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v(du/dx) - u(dv/dx)}{v^2}$	$\frac{d}{dx}(x^x) = x^x(1 + \log_e x)$	$\frac{d}{dx}(\tan^{-1} x) = \frac{1}{1+x^2}$
$\frac{dy}{dx} = \frac{dy}{du} \cdot \frac{du}{dx}$ (<i>Chain Rule</i>)	$\frac{d}{dx}(x) = 1$	$\frac{d}{dx}(\cot^{-1} x) = -\frac{1}{1+x^2}$
$\frac{d}{dx}(x^n) = nx^{n-1}$	$\frac{d}{dx}(\sin x) = \cos x$	$\frac{d}{dx}(\sec^{-1} x) = \frac{1}{ x \sqrt{x^2-1}}$
$\frac{d}{dx}(e^x) = e^x$	$\frac{d}{dx}(\cos x) = -\sin x$	$\frac{d}{dx}(\operatorname{cosec}^{-1} x) = -\frac{1}{ x \sqrt{x^2-1}}$
$\frac{d}{dx}(a^x) = a^x \log a$	$\frac{d}{dx}(\tan x) = \sec^2 x$	$\frac{d}{dx}(\sinh x) = \cosh x$
$\frac{d}{dx}\left(\frac{1}{x}\right) = \left(-\frac{1}{x^2}\right)$	$\frac{d}{dx}(\cot x) = -\operatorname{cosec}^2 x$	$\frac{d}{dx}(\cosh x) = \sinh x$
$\frac{d}{dx}(k) = 0$ (<i>k is constant</i>)	$\frac{d}{dx}(\sec x) = \sec x \tan x$	$\frac{d}{dx}(\tanh x) = \sec^2 h x$
$\frac{d}{dx}(\log x) = \frac{1}{x}$	$\frac{d}{dx}(\operatorname{cosec} x \cot x) = -\operatorname{cosec} x \cot x$	$\frac{d}{dx}(\coth x) = -\operatorname{cosec}^2 h x$
<u>INTEGRAL CALCULUS:</u>		
$\int x^n dx = \frac{x^{n+1}}{n+1} (n \neq -1) + c$	$\int \operatorname{cosec} x \cot x dx = -\operatorname{cosec} x + c$	
$\int 1 dx = x + c$	$\int \frac{dx}{a^2 + x^2} = \frac{1}{a} \tan^{-1} \frac{x}{a} + c$	
$\int \frac{1}{x} dx = \log x + c$	$\int \frac{dx}{a^2 - x^2} = \frac{1}{2a} \log \frac{a+x}{a-x} + c$	
$\int e^x dx = e^x + c$	$\int \frac{dx}{x^2 - a^2} = \frac{1}{2a} \log \frac{x-a}{x+a} + c$	
$\int a^x dx = a^x / \log a + c$	$\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1} \frac{x}{a} + c$	
$\int 1 dx = x + c$	$\int \frac{dx}{\sqrt{x^2 + a^2}} = \log \left x + \sqrt{x^2 + a^2} \right + c$	
$\int \sin x dx = -\cos x + c$	$\int \frac{dx}{\sqrt{x^2 - a^2}} = \log \left x + \sqrt{x^2 - a^2} \right + c$	
$\int \cos x dx = \sin x + c$	$\int \sqrt{a^2 - x^2} dx = \frac{x\sqrt{a^2 - x^2}}{2} + \frac{a^2}{2} \sin^{-1} \frac{x}{a} + c$	
$\int \tan x dx = -\log \cos x = \log \sec x + c$	$\int e^{ax} \sin bx dx = \frac{e^{ax}}{a^2 + b^2} (a \sin bx - b \cos bx) + c$	
$\int \cot x dx = \log \sin x + c$	$\int e^{ax} \cos bx dx = \frac{e^{ax}}{a^2 + b^2} (a \cos bx + b \sin bx) + c$	
$\int \sec^2 x dx = \tan x + c$		
$\int \operatorname{cosec}^2 x dx = -\cot x + c$		
$\int \operatorname{cosec} x dx = \log(\operatorname{cosec} x - \cot x) + c$		
$\int \sec x \tan x dx = \sec x + c$		

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$\int uv dx = u \int v dx - \int \left[\frac{du}{dx} \int v dx \right] dx + c$ $\int uv = uv_1 - u'v_2 + u''v_3 - u'''v_4 + \dots$ $\int \frac{f'(x)}{f(x)} dx = \log f(x) + c$ $\int [f(x)]^n f'(x) dx = \frac{[f(x)]^{n+1}}{n+1} + c$ <p>If $f(-x) = \begin{cases} f(x); & \text{then } f \text{ is even function} \\ -f(x); & \text{then } f \text{ is odd function.} \end{cases}$</p> <p>QUADRATIC EQUATION:</p> $ax^2 + bx + c = 0 \text{ Has a root } \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}.$ <p>BINOMIAL THEOREM:</p> <p>(1) When n is positive integer</p> $(1+x)^n = 1 + {}^n C_1 x + {}^n C_2 x^2 + {}^n C_3 x^3 + \dots + {}^n C_n x^n.$ <p>(2) When n is a negative integer or a fraction</p> $(1+x)^n = 1 + nx + \frac{n(n-1)}{2!} x^2 + \frac{n(n-1)(n-2)}{3!} x^3 + \dots$ <p>TRIGONOMETRY:</p> $\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta$ $\cos(\alpha \pm \beta) = \cos \alpha \cos \beta \mp \sin \alpha \sin \beta$ $\sin 2\alpha = 2 \sin \alpha \cos \alpha = \frac{2 \tan \alpha}{1 + \tan^2 \alpha}$ $\sin 3\alpha = 3 \sin \alpha - 4 \sin^3 \alpha$ $\cos 3\alpha = 4 \cos^3 \alpha - 3 \cos \alpha$ $\tan 3\alpha = \frac{3 \tan \alpha - \tan^3 \alpha}{1 - 3 \tan^2 \alpha}$	$\cos 2\alpha = \begin{cases} \cos^2 \alpha - \sin^2 \alpha \\ 1 - 2 \sin^2 \alpha \\ 2 \cos^2 \alpha - 1 \\ \frac{1 - \tan^2 \alpha}{1 + \tan^2 \alpha} \end{cases}$ $\tan(\alpha \pm \beta) = \frac{\tan \alpha \pm \tan \beta}{1 \mp \tan \alpha \tan \beta}$ $\tan 2\alpha = \frac{2 \tan \alpha}{1 - \tan^2 \alpha}$ $2 \sin \alpha \cos \beta = \sin(\alpha + \beta) + \sin(\alpha - \beta)$ $2 \cos \alpha \sin \beta = \sin(\alpha + \beta) - \sin(\alpha - \beta)$ $2 \cos \alpha \cos \beta = \cos(\alpha + \beta) + \cos(\alpha - \beta)$ $2 \sin \alpha \sin \beta = \cos(\alpha - \beta) - \cos(\alpha + \beta)$ $\sin \theta + \sin \phi = 2 \sin \frac{\theta + \phi}{2} \cos \frac{\theta - \phi}{2}$ $\sin \theta - \sin \phi = 2 \cos \frac{\theta + \phi}{2} \sin \frac{\theta - \phi}{2}$ $\cos \theta + \cos \phi = 2 \cos \frac{\theta + \phi}{2} \cos \frac{\theta - \phi}{2}$ $\cos \theta - \cos \phi = -2 \sin \frac{\theta + \phi}{2} \sin \frac{\theta - \phi}{2}$ <p>STANDARD LIMITS:</p> $\lim_{x \rightarrow \infty} x^{\frac{1}{x}} = 1 \quad \lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$ $\lim_{x \rightarrow 0} (1+x)^{\frac{1}{x}} = e \quad \lim_{x \rightarrow a} \frac{a^x - 1}{x} = \log_e a$
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