Math 31 Formula Sheet

Equation of a line: $m(x-x_1)=y-y_1$

Surface Area and Volume

Sphere: $SA=4\pi r^2$ $V=\frac{4}{3}\pi r^3$ **Cube:** $SA=6s^2$ $V=s^3$

Rectangular solid:
$SA=2(Lw+hw+Lh)$
$V=Lwh$

Right Circular Cylinder:
$SA=2\pi r^2+2\pi rh$
$V=\pi r^2 h$

Right Circular Cone:
$SA=2\pi rs+\pi r^2$
$V=\frac{1}{3}\pi r^2 h$

Factoring

$a^3+b^3=(a+b)(a^2-ab+b^2)$

$a^3-b^3=(a-b)(a^2+ab+b^2)$

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

Geometric Series

$S_n=\frac{a(r^n-1)}{r-1}$ $S=\frac{a}{1-r}$ $0<r<1$

Solving Oblique Triangles

Sine Law: $\frac{\sin A}{a}=\frac{\sin B}{b}=\frac{\sin C}{c}$

Cosine Law: $\cos C=\frac{a^2+b^2-c^2}{2ab}$

Trigonometric Formulas

Fundamental Identities: $\sin\theta=\frac{opp}{hyp}$ $\cos\theta=\frac{adj}{hyp}$ $\tan\theta=\frac{opp}{adj}$

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

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

Addition and Subtraction Formulas:

$\sin(A+B)=\sin A\cos B+\cos A\sin B$

$\sin(A-B)=\sin A\cos B-\cos A\sin B$

$\tan(A+B)=\frac{\tan A+\tan B}{1-\tan A\tan B}$

$\cos(A+B)=\cos A\cos B-\sin A\sin B$

$\cos(A-B)=\cos A\cos B+\sin A\sin B$

$\tan(A-B)=\frac{\tan A-\tan B}{1+\tan A\tan B}$

Double Angle Formulas:

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

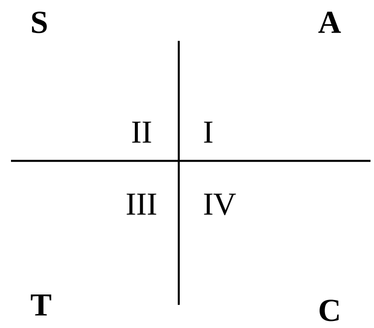
$\cos 2A=2\cos^2 A-1$ $\tan 2A=\frac{2\tan A}{1-\tan^2 A}$

Formulas Related to the CAST Rule:

$\sin(90 - A) = \cos A$ $\quad$ $\sin(-A) = -\sin A$

$\cos(90 - A) = \sin A$ $\quad$ $\cos(-A) = \cos A$

$\tan(90 - A) = \cot A$ $\quad$ $\tan(-A) = -\tan A$



Laws of Logarithms

Common Logarithms

$$\log_{10} x = \log x$$

Natural Logarithms

$$\log_e x = \ln x$$

If $M > 0,\ N > 0,\ n \in R,$ then

$$\log_a(MN) = \log_a(M) + \log_a(N) \qquad \ln(MN) = \ln(M) + \ln(N)$$

$$\log_a\left(\frac{M}{N}\right) = \log_a(M) - \log_a(N) \qquad \ln\left(\frac{M}{N}\right) = \ln(M) - \ln(N)$$

$$\log_a\left(\frac{1}{N}\right) = -\log_a(N) \qquad \ln\left(\frac{1}{N}\right) = -\ln(N)$$

$$\log_a(M^n) = n\log_a(M) \qquad \ln(M^n) = n\ln(M)$$

$$\log_a\left(\sqrt[n]{M}\right) = \frac{1}{n}\log_a(M) \qquad \ln\left(\sqrt[n]{M}\right) = \frac{1}{n}\ln(M)$$

$$\log_a n = \frac{\log_b n}{\log_b a} \qquad \ln n = \frac{\log_b n}{\log_b e}$$

$$a^{\log_a n} = n \qquad e^{\ln x} = x \quad (x \in R)$$

Derivatives

First Principals: $f'(x)=\lim_{h\to 0}\dfrac{f(x+h)-f(x)}{h}$

$$\frac{d}{dx}\left[f(x)g(x)\right]=f'(x)g(x)+g'(x)f(x)$$

$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right]=\frac{f'(x)g(x)-g'(x)f(x)}{\left[g(x)\right]^2}$$

$$\frac{d}{dx}\left[f\left(g(x)\right)\right]=f'\left(g(x)\right)g'(x)$$

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

$$\frac{d}{dx}\left(g(x)^n\right)=n\left[g(x)\right]^{n-1}g'(x)$$

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

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

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

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

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

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

$$\frac{d}{dx}\left(e^{g(x)}\right)=e^{g(x)}g'(x)$$

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

$$\frac{d}{dx}b^x=b^x\ln b$$

$$\frac{d}{dx}\log_b x=\frac{1}{x\ln b}$$

Limits

$$\lim_{n\to\infty}\left(1+\frac{1}{n}\right)^n=e$$

$$\lim_{h\to 0}\frac{\left(b^h-1\right)}{h}=1$$

$$\lim_{x\to 0}(1+x)^{\frac{1}{x}}=e$$

Integrals

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

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

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

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

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

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

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

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

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

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

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

$$\int\frac{1}{\sqrt{1-x^2}}dx=\sin^{-1}x+C$$