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Trigonometry Identity and Formula Sheet

Sum Identities

$$\sin(\alpha+\beta)=\sin(\alpha)\cos(\beta)+\cos(\alpha)\sin(\beta)$$

$$\cos(\alpha+\beta)=\cos(\alpha)\cos(\beta)-\sin(\alpha)\sin(\beta)$$

$$\tan(\alpha+\beta)=\frac{\tan\alpha+\tan\beta}{1-\tan\alpha\tan\beta}$$

Half-Angle Identities

$$\sin\left(\frac{x}{2}\right)=\pm\sqrt{\frac{1-\cos x}{2}}$$

$$\cos\left(\frac{x}{2}\right)=\pm\sqrt{\frac{1+\cos x}{2}}$$

$$\tan\left(\frac{x}{2}\right)=\pm\sqrt{\frac{1-\cos x}{1+\cos x}}=\frac{\sin x}{1+\cos x}=\frac{1-\cos x}{\sin x}$$

Product-to-Sum Identities

$$\sin A\cos B=\frac{1}{2}[\sin(A+B)+\sin(A-B)]$$

$$\sin A\sin B=\frac{1}{2}[\cos(A-B)-\cos(A+B)]$$

$$\cos A\sin B=\frac{1}{2}[\sin(A+B)-\sin(A-B)]$$

$$\cos A\cos B=\frac{1}{2}[\cos(A-B)+\cos(A+B)]$$

Sum-to-Product Identities

$$\sin x+\sin y=2\sin\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)$$

$$\sin x-\sin y=2\cos\left(\frac{x+y}{2}\right)\sin\left(\frac{x-y}{2}\right)$$

$$\cos x+\cos y=2\cos\left(\frac{x+y}{2}\right)\cos\left(\frac{x-y}{2}\right)$$

$$\cos x-\cos y=2\sin\left(\frac{x+y}{2}\right)\sin\left(\frac{x-y}{2}\right)$$

Law of Cosines

$$c^2=a^2+b^2-2ab\cos\gamma$$

Identities for Some Inverse Trig Functions

$$\csc^{-1}(x)=\sin^{-1}\left(\frac{1}{x}\right)\ \ for\ |x|\geq 1$$

$$\sec^{-1}(x)=\cos^{-1}\left(\frac{1}{x}\right)\ \ for\ |x|\geq 1$$

$$\cot^{-1}(x)=\frac{\pi}{2}-\tan^{-1}(x)$$

Reduction Formula

If α is an angle in standard position whose terminal side contains (a,b) and x is a real number then

$$a\sin x+b\cos x=\sqrt{a^2+b^2}\sin(x+\alpha).$$

Heron's Formula

$$A=\sqrt{S(S-a)(S-b)(S-c)}$$

where $S=\frac{a+b+c}{2}$

Area of a Triangle

$$A=\frac{1}{2}ab\sin\gamma$$

Angle Between Two Vectors

$$\cos\alpha=\frac{\vec{A}\cdot\vec{B}}{|\vec{A}||\vec{B}|}$$