

Definitions

SOH-CAH-TOA $\sin \theta = \frac{\text{opp}}{\text{hyp}}, \cos \theta = \frac{\text{adj}}{\text{hyp}}, \tan \theta = \frac{\text{opp}}{\text{adj}}$

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

Quotient $\tan \theta = \frac{\sin \theta}{\cos \theta}, \cot \theta = \frac{\cos \theta}{\sin \theta}$

Unit circle $(x, y) = (\cos \theta, \sin \theta)$

Radians $180^\circ = \pi, \text{ rad} = \text{deg} \times \frac{\pi}{180}$

Exact values

θ	0	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$
sin	0	1/2	$\sqrt{2}/2$	$\sqrt{3}/2$	1
cos	1	$\sqrt{3}/2$	$\sqrt{2}/2$	1/2	0
tan	0	$\sqrt{3}/3$	1	$\sqrt{3}$	—

Signs (ASTC) I: all, II: sin, III: tan, IV: cos positive

Pythagorean identities

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

$$1 + \tan^2 \theta = \sec^2 \theta$$

$$1 + \cot^2 \theta = \csc^2 \theta$$

Even-odd and cofunction

Even-odd $\sin(-\theta) = -\sin \theta, \cos(-\theta) = \cos \theta$

Cofunction $\sin(\frac{\pi}{2} - \theta) = \cos \theta, \cos(\frac{\pi}{2} - \theta) = \sin \theta$

Sum and difference

Sine $\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B$

Cosine $\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B$

Tangent $\tan(A \pm B) = \frac{\tan A \pm \tan B}{1 \mp \tan A \tan B}$

Double and half angle

Double sine $\sin 2\theta = 2 \sin \theta \cos \theta$

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

Double tangent $\tan 2\theta = \frac{2 \tan \theta}{1 - \tan^2 \theta}$

Power reducing $\sin^2 \theta = \frac{1 - \cos 2\theta}{2}, \cos^2 \theta = \frac{1 + \cos 2\theta}{2}$

Half angle $\sin \frac{\theta}{2} = \pm \sqrt{\frac{1 - \cos \theta}{2}}, \cos \frac{\theta}{2} = \pm \sqrt{\frac{1 + \cos \theta}{2}}$

Product to sum

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

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

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

Any triangle

Law of sines $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Law of cosines $c^2 = a^2 + b^2 - 2ab \cos C$

Area $\frac{1}{2} ab \sin C$

Inverse trig ranges $\arcsin \in [-\frac{\pi}{2}, \frac{\pi}{2}], \arctan \in (-\frac{\pi}{2}, \frac{\pi}{2}), \arccos \in [0, \pi]$