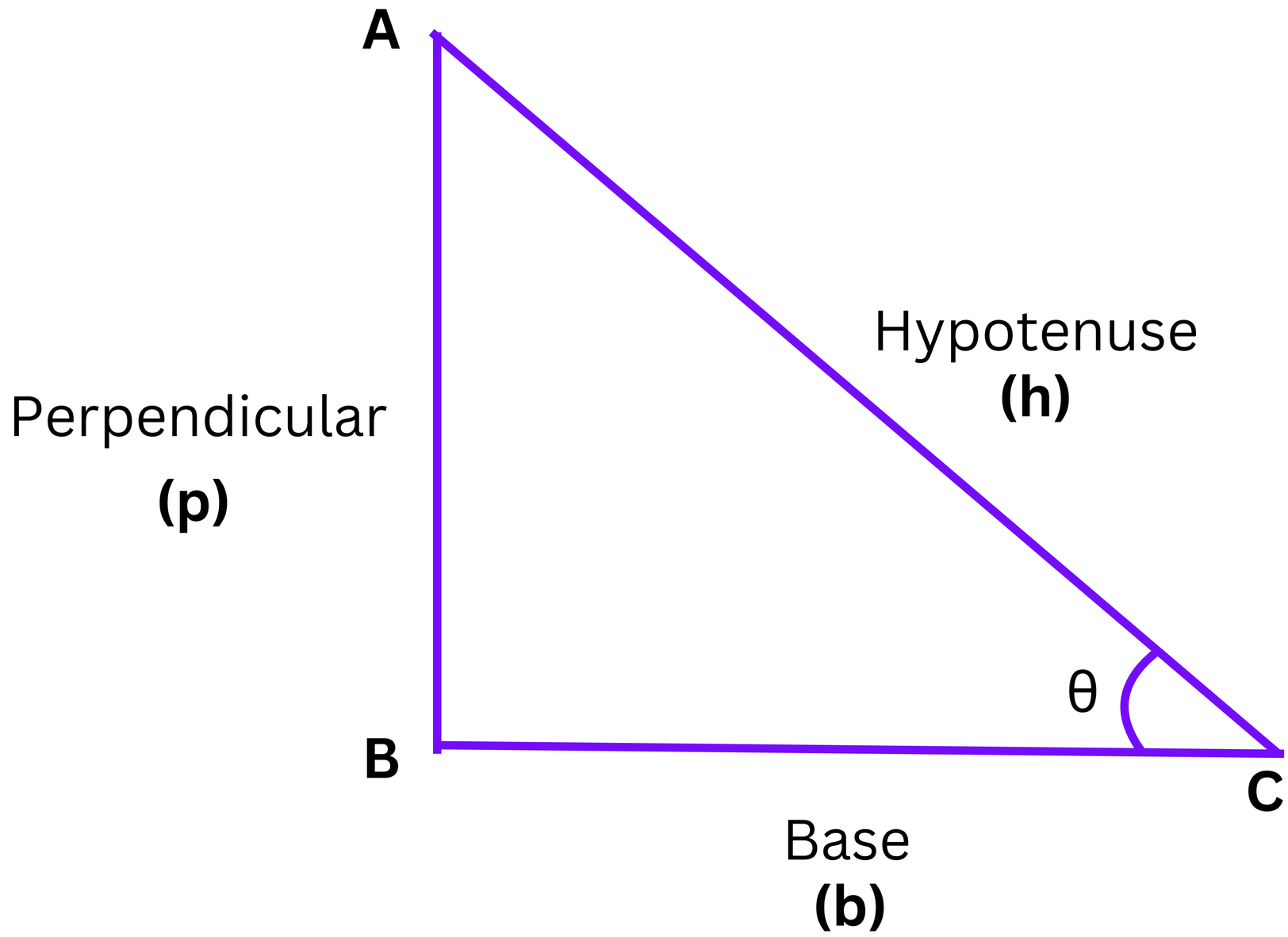
Trigonometry Formulas

Basic Trigonometry Formulas



Ratio Formulas

$\sin \theta = \text{Perpendicular}/\text{Hypotenuse}$

$\cos \theta = \text{Base}/\text{Hypotenuse}$

$\tan \theta = \text{Perpendicular}/\text{Base}$

$\sec \theta = \text{Hypotenuse}/\text{Base}$

$\text{cosec } \theta = \text{Hypotenuse}/\text{Perpendicular}$

$\cot \theta = \text{Base}/\text{Perpendicular}$

Trigonometry Formulas

Basic Trigonometry Formulas

Reciprocal Identities

$\text{cosec}\ \theta = 1/\sin\theta$; $\cos\theta = 1/\sec\theta$

$\sin\theta = 1/\text{cosec}\ \theta$ $\cot\theta = 1/\tan\theta$;

$\sec\theta = 1/\cos\theta$; $\tan\theta = 1/\cot\theta$

Pythagorean Identities

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

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

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

Trigonometry Formulas

Trigonometry Identities Formulas

Reciprocal Identities

$\sin(\pi/2 - A) = \cos A$ & $\cos(\pi/2 - A) = \sin A$

$\sin(\pi/2 + A) = \cos A$ & $\cos(\pi/2 + A) = -\sin A$

$\sin(3\pi/2 - A) = -\cos A$ & $\cos(3\pi/2 - A) = -\sin A$

$\sin(3\pi/2 + A) = -\cos A$ & $\cos(3\pi/2 + A) = \sin A$

$\sin(\pi - A) = \sin A$ & $\cos(\pi - A) = -\cos A$

$\sin(\pi + A) = -\sin A$ & $\cos(\pi + A) = -\cos A$

$\sin(2\pi - A) = -\sin A$ & $\cos(2\pi - A) = \cos A$

$\sin(2\pi + A) = \sin A$ & $\cos(2\pi + A) = \cos A$

Cofunction Identities (in Degrees):

$\sin(90^\circ - x) = \cos x$	$\cot(90^\circ - x) = \tan x$
$\cos(90^\circ - x) = \sin x$	$\sec(90^\circ - x) = \operatorname{cosec} x$
$\tan(90^\circ - x) = \cot x$	$\operatorname{cosec}(90^\circ - x) = \sec x$

Trigonometry Formulas

Trigonometry Identities Formulas

Sum & Difference Identities

$$\sin(x+y) = \sin(x)\cos(y)+\cos(x)\sin(y)$$

$$\cos(x+y) = \cos(x)\cos(y)-\sin(x)\sin(y)$$

$$\tan(x+y) = (\tan x+\tan y) / (1-\tan x.\tan y)$$

$$\sin(x-y) = \sin(x)\cos(y)-\cos(x)\sin(y)$$

$$\cos(x-y) = \cos(x)\cos(y) + \sin(x)\sin(y)$$

$$\tan(x-y) = (\tan x - \tan y) (1+\tan x.\tan y)$$

Triple Angle Identities

$$\text{Sin } 3x = 3\sin x - 4\sin^3 x$$

$$\text{Cos } 3x = 4\cos^3 x-3\cos x$$

$$\text{Tan } 3x = (3\tan x - \tan^3 x)/(1-3\tan^2 x)$$

Trigonometry Formulas

Trigonometry Identities Formulas

Double Angle Identities

$$sin(2x) = 2\sin x \cdot \cos x = \frac{2\tan x}{1+\tan^2 x}$$

$$cos(2x) = \cos^2 x - \sin^2 x = \frac{1-\tan^2 x}{1+\tan^2 x}$$

$$cos(2x) = 2\cos^2(x) - 1 = 1 - 2\sin^2(x)$$

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

$$sec(2x) = \frac{\sec^2 x}{2-\sec^2 x}$$

$$cosec(2x) = \frac{(\sec x \cdot cosec x)}{2}$$

Triple Angle Identities

$$\sin(3x) = 3\sin x - 4\sin^3 x$$

$$\cos(3x) = 4\cos^3 x - 3\cos x$$

$$\tan(3x) = \frac{3\tan x - \tan^3 x}{1-3\tan^2 x}$$

Trigonometry Formulas

Trigonometry Identities Formulas

Half Angle Identities

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

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

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

Product identities

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

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

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

Trigonometry Formulas

Trigonometry Identities Formulas

Sum to Product Identities

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

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

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

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

Inverse Trigonometry Formulas

$$\sin^{-1}(-x) = -\sin^{-1} x \qquad \csc^{-1}(-x) = -\csc^{-1} x$$

$$\cos^{-1}(-x) = \pi - \cos^{-1} x \qquad \sec^{-1}(-x) = \pi - \sec^{-1} x$$

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

Trigonometry Formulas

Trigonometric Ratio Table

Angles (In Degrees)	0°	30°	45°	60°	90°	180°	270°	360°
Angles (In Radians)	0	π/6	π/4	π/3	π/2	π	3π/2	2π
sin	0	1/2	1/√2	√3/2	1	0	-1	0
cos	1	√3/2	1/√2	1/2	0	-1	0	1
tan	0	1/√3	1	√3	∞	0	∞	0
cosec	∞	2	√2	2/√3	1	∞	-1	∞
sec	1	2/√3	√2	2	∞	-1	∞	1
cot	∞	√3	1	1/√3	0	∞	0	∞

Trigonometry Formulas

Sum and Difference of Two Angles

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

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

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

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

$$\tan(A + B) = [(\tan A + \tan B)/(1 - \tan A \tan B)]$$

$$\tan(A - B) = [(\tan A - \tan B)/(1 + \tan A \tan B)]$$

Double Angle Formulas

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

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

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

Triple Angle Formulas

$$\sin 3A = 3 \sin A - 4 \sin^3 A$$

$$\cos 3A = 4 \cos^3 A - 3 \cos A$$

$$\tan 3A = \frac{3 \tan A - \tan^3 A}{1 - 3 \tan^2 A}$$

Trigonometry Formulas

Properties of Inverse Trigonometric Functions

$$\sin^{-1}\left(\frac{1}{a}\right) = \csc^{-1}(a), \quad a \geq 1 \text{ or } a \leq -1$$

$$\cos^{-1}\left(\frac{1}{a}\right) = \sec^{-1}(a), \quad a \geq 1 \text{ or } a \leq -1$$

$$\tan^{-1}\left(\frac{1}{a}\right) = \cot^{-1}(a), \quad a > 0$$

$$\sin^{-1}(-a) = -\sin^{-1}(a), \quad a \in [-1, 1]$$

$$\tan^{-1}(-a) - \tan^{-1}(a), \quad a \in \mathbb{R}$$

$$\csc^{-1}(-a) = -\csc^{-1}(a), \quad |a| \geq 1$$

$$\cos^{-1}(-a) = \pi - \cos^{-1}(a), \quad a \in [-1, 1]$$

$$\sec^{-1}(-a) = \pi - \sec^{-1}(a), \quad |a| \geq 1$$

$$\cot^{-1}(-a) = \pi - \cot^{-1}(a), \quad a \in \mathbb{R}$$

Trigonometry Formulas

Addition Properties of Inverse Trigonometry functions

$$\sin^{-1} a + \cos^{-1} a = \frac{\pi}{2}, \quad a \in [-1, 1]$$

$$\tan^{-1} a + \cot^{-1} a = \frac{\pi}{2}, \quad a \in \mathbb{R}$$

$$\csc^{-1} a + \sec^{-1} a = \frac{\pi}{2}, \quad |a| \geq 1$$

$$\tan^{-1} a + \tan^{-1} b = \tan^{-1}\left(\frac{a+b}{1-ab}\right), \quad ab < 1$$

$$\tan^{-1} a - \tan^{-1} b = \tan^{-1}\left(\frac{a-b}{1+ab}\right), \quad ab > -1$$

$$\tan^{-1} a - \tan^{-1} b = \pi + \tan^{-1}\left(\tfrac{a+b}{1-ab}\right), \quad ab > 1;\ a, b > 0$$

Twice of Inverse of Tan Function

$$2\tan^{-1} a = \sin^{-1}\left(\frac{2a}{1+a^2}\right), \quad |a| \leq 1$$

$$2\tan^{-1} a = \cos^{-1}\left(\frac{1-a^2}{1+a^2}\right), \quad a \geq 0$$

$$2\tan^{-1} a = \tan^{-1}\left(\tfrac{2a}{1-a^2}\right), \quad -1 < a < 1$$