

Trig Identities — Reference Sheet

Every identity you need for Algebra 2 and Precalculus, on one page

RECIPROCAL

Algebra 2

$$\csc \theta = 1 / \sin \theta$$

$$\sec \theta = 1 / \cos \theta$$

$$\cot \theta = 1 / \tan \theta$$

QUOTIENT

Algebra 2

$$\tan \theta = \sin \theta / \cos \theta$$

$$\cot \theta = \cos \theta / \sin \theta$$

PYTHAGOREAN

Algebra 2

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

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

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

Divide the first by $\cos^2 \theta$ or $\sin^2 \theta$ to get the other two — only the first is worth memorising.

EVEN-ODD

Algebra 2

$$\sin(-\theta) = -\sin \theta$$

$$\cos(-\theta) = \cos \theta$$

$$\tan(-\theta) = -\tan \theta$$

$$\csc(-\theta) = -\csc \theta$$

$$\sec(-\theta) = \sec \theta$$

$$\cot(-\theta) = -\cot \theta$$

Only cosine and secant are even; the other four flip sign.

COFUNCTION

Precalculus

$$\sin(\pi/2 - \theta) = \cos \theta$$

$$\cos(\pi/2 - \theta) = \sin \theta$$

$$\tan(\pi/2 - \theta) = \cot \theta$$

SUM & DIFFERENCE

Precalculus

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

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

$$\tan(A \pm B) = (\tan A \pm \tan B) / (1 \mp \tan A \tan B)$$

$\mp$ is the opposite of whichever $\pm$ you take on the left.

DOUBLE ANGLE

Precalculus

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

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

$$\tan 2\theta = 2 \tan \theta / (1 - \tan^2 \theta)$$

POWER REDUCING

Precalculus

$$\sin^2 \theta = (1 - \cos 2\theta) / 2$$

$$\cos^2 \theta = (1 + \cos 2\theta) / 2$$

$$\tan^2 \theta = (1 - \cos 2\theta) / (1 + \cos 2\theta)$$

Use these to turn a squared function into a first-power one.

HALF ANGLE

Precalculus

$$\sin(\theta/2) = \pm \sqrt{(1 - \cos \theta) / 2}$$

$$\cos(\theta/2) = \pm \sqrt{(1 + \cos \theta) / 2}$$

$$\tan(\theta/2) = (1 - \cos \theta) / \sin \theta = \sin \theta / (1 + \cos \theta)$$

Take the $\pm$ sign from the quadrant of $\theta/2$, not of θ . Tangent needs no $\pm$.

How to verify an identity

1. Work on one side only — the messier side. Never move terms across the equals sign.
2. Rewrite everything in sin and cos, then simplify.
3. Look for a Pythagorean identity, a common denominator, or a difference of squares.
4. An identity holds only where both sides are defined — note any excluded values.

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