

# TRIGONOMETRIC IDENTITIES



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## IDENTITY

Is an equality that is true for **every** value of the variable.

Symbol: “ $\equiv$ ” ✓

It reads: “identical to”.

## FUNDAMENTAL TRIGONOMETRIC IDENTITIES

### • RECIPROCAL TRIGONOMETRIC IDENTITIES

$$\sin(u) \csc(u) \equiv 1 \quad \checkmark$$

$$\cos(u) \sec(u) \equiv 1 \quad \checkmark$$

$$\tan(u) \cot(u) \equiv 1 \quad \checkmark$$

### • RATIO TRIGONOMETRIC IDENTITIES

$$\tan(u) \equiv \frac{\sin(u)}{\cos(u)} \quad \checkmark \qquad \cot(u) \equiv \frac{\cos(u)}{\sin(u)} \quad \checkmark$$

### • SQUARED TRIGONOMETRIC IDENTITIES

$$\sin^2(u) + \cos^2(u) \equiv 1 \quad \checkmark$$

$$1 + \tan^2(u) \equiv \sec^2(u) \quad \checkmark$$

$$1 + \cot^2(u) \equiv \csc^2(u) \quad \checkmark$$

**EXAMPLE:** Verify the following identity:

$$\csc(\theta) \equiv \sin(\theta) (1 + \cot^2(\theta))$$

**SOLUTION:** 1) Select a side:

$$\csc(\theta) \equiv \sin(\theta) (1 + \cot^2(\theta))$$

2) Transform to sines and cosines:

$$\bullet \cot(u) \equiv \frac{\cos(u)}{\sin(u)}$$

$$\csc(\theta) \equiv \sin(\theta) \left( 1 + \left( \frac{\cos(\theta)}{\sin(\theta)} \right)^2 \right)$$

$$\csc(\theta) \equiv \sin(\theta) \left( 1 + \frac{\cos^2(\theta)}{\sin^2(\theta)} \right)$$

$$\csc(\theta) \equiv \sin(\theta) \left( \frac{\sin^2(\theta) + \cos^2(\theta)}{\sin^2(\theta)} \right)$$

3) Simplify:

$$\bullet \sin^2(u) + \cos^2(u) \equiv 1$$

$$\csc(\theta) \equiv \sin(\theta) \left( \frac{1}{\sin^2(\theta)} \right)$$

$$\csc(\theta) \equiv \frac{\sin(\theta)}{\sin^2(\theta)}$$

$$\csc(\theta) \equiv \frac{1}{\sin(\theta)}$$

$$\bullet \sin(u) \csc(u) \equiv 1$$

$$\Rightarrow \csc(u) \equiv \frac{1}{\sin(u)}$$

$$\csc(\theta) \equiv \csc(\theta) \quad \checkmark$$



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