



# Simplifying Trigonometric Expressions

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## Learning Objectives

- Apply reciprocal identities to simplify trigonometric expressions
- Use Pythagorean identities to reduce expressions to simplest form
- Develop the habit of converting non-sine/cosine functions to sine and cosine

*Simplify each trigonometric expression using the reciprocal and Pythagorean identities, showing each step clearly.*

### 1. Simplify the expression.

$$\sec \theta \cdot \cos \theta$$

Answer: \_\_\_\_\_

### 2. Simplify the expression.

$$\cot \theta \cdot \sin \theta$$

Answer: \_\_\_\_\_

### 3. Simplify the expression.

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

Answer: \_\_\_\_\_

### 4. Simplify the expression.

$$\csc \theta \cdot \sin \theta$$

Answer: \_\_\_\_\_

### 5. Simplify the expression.

$$\tan \theta \cdot \cos \theta$$

Answer: \_\_\_\_\_

### 6. Simplify the expression.

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

Answer: \_\_\_\_\_

### 7. Simplify the expression.

$$\frac{\sec \theta}{\csc \theta}$$

Answer: \_\_\_\_\_



**8. Simplify the expression.**

$$\frac{1 - \cos^2 \theta}{\sin \theta}$$

Answer: \_\_\_\_\_

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**9. Simplify the expression.**

$$\sin \theta \cdot \sec \theta \cdot \cot \theta$$

Answer: \_\_\_\_\_

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**10. Simplify the expression.**

$$\cos \theta \cdot \csc \theta$$

Answer: \_\_\_\_\_





Encourage students to write identities by hand before solving and to always convert secant, cosecant, tangent, and cotangent into sine and cosine.

## Solutions

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1. Simplify the expression.

$$\sec \theta \cdot \cos \theta$$

→ Rewrite secant theta as one over cosine theta using the reciprocal identity.

→ Multiply one over cosine theta by cosine theta.

→ Cancel cosine theta in the numerator and denominator to get one.

**Answer:** 1

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2. Simplify the expression.

$$\cot \theta \cdot \sin \theta$$

→ Rewrite cotangent theta as cosine theta over sine theta.

→ Multiply cosine theta over sine theta by sine theta.

→ Cancel sine theta to leave cosine theta.

**Answer:**  $\cos \theta$

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3. Simplify the expression.

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

→ Recognize this as the fundamental Pythagorean identity.

→ Apply the identity that sine squared plus cosine squared equals one.

**Answer:** 1

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4. Simplify the expression.

$$\csc \theta \cdot \sin \theta$$

→ Rewrite cosecant theta as one over sine theta using the reciprocal identity.

→ Multiply one over sine theta by sine theta.

→ Cancel sine theta to obtain one.

**Answer:** 1

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5. Simplify the expression.

$$\tan \theta \cdot \cos \theta$$

→ Rewrite tangent theta as sine theta over cosine theta.

→ Multiply sine theta over cosine theta by cosine theta.

→ Cancel cosine theta to leave sine theta.

**Answer:**  $\sin \theta$

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6. Simplify the expression.

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

- Start from the Pythagorean identity sine squared plus cosine squared equals one.
- Subtract sine squared theta from both sides.
- The result is cosine squared theta.

**Answer:**  $\cos^2 \theta$

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7. Simplify the expression.

$$\frac{\sec \theta}{\csc \theta}$$

- Rewrite secant theta as one over cosine theta and cosecant theta as one over sine theta.
- Divide one over cosine theta by one over sine theta by multiplying by the reciprocal.
- Simplify to get sine theta over cosine theta, which is tangent theta.

**Answer:**  $\tan \theta$

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8. Simplify the expression.

$$\frac{1 - \cos^2 \theta}{\sin \theta}$$

- Replace one minus cosine squared theta with sine squared theta using the Pythagorean identity.
- Rewrite the expression as sine squared theta divided by sine theta.
- Cancel one factor of sine theta to obtain sine theta.

**Answer:**  $\sin \theta$

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9. Simplify the expression.

$$\sin \theta \cdot \sec \theta \cdot \cot \theta$$

- Rewrite secant theta as one over cosine theta and cotangent theta as cosine theta over sine theta.
- Multiply sine theta by one over cosine theta and by cosine theta over sine theta.
- Cancel cosine theta with cosine theta and sine theta with sine theta to get one.

**Answer:**  $1$

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10. Simplify the expression.

$$\cos \theta \cdot \csc \theta$$

- Rewrite cosecant theta as one over sine theta using the reciprocal identity.
- Multiply cosine theta by one over sine theta to get cosine theta over sine theta.
- Recognize cosine theta over sine theta as cotangent theta.

**Answer:**  $\cot \theta$

