



# Math Virtual Learning

## Precalculus with Trigonometry

Students will verify equations using Fundamental Trig Identities including Pythagorean, Quotient, and Reciprocal Identities.

**April 24, 2020**



# Precalculus with Trigonometry

## Lesson: April 24th, 2020

### **Objective/Learning Target:**

Students will verify equations using Fundamental Trig Identities including Pythagorean, Quotient, and Reciprocal Identities.

Before you begin, make sure you remember the following identities from the previous lesson:

## Let's Get Started:

Watch Video: [Verifying Trigonometric Identities - How To Do It The Easy Way!](#)

**Watch from the beginning till 6:06**

**Optional:** For extra examples keep watching from 6:06 - 10:17 and keep watching after that for even more advanced problems.

### Trigonometric Identities

#### Reciprocal Identities

$$\cot \theta = \frac{1}{\tan \theta}$$

$$\csc \theta = \frac{1}{\sin \theta}$$

$$\sec \theta = \frac{1}{\cos \theta}$$

#### Quotient Identities

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\cot \theta = \frac{\cos \theta}{\sin \theta}$$

#### Pythagorean Identities

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

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

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

## Trigonometric Identities

Please note that many of the identities can be written in more than one way.

### Reciprocal Identities

$$\cot \theta = \frac{1}{\tan \theta} \quad \tan \theta = \frac{1}{\cot \theta}$$

$$\csc \theta = \frac{1}{\sin \theta} \quad \sin \theta = \frac{1}{\csc \theta}$$

$$\sec \theta = \frac{1}{\cos \theta} \quad \cos \theta = \frac{1}{\sec \theta}$$

### Quotient Identities

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\cot \theta = \frac{\cos \theta}{\sin \theta}$$

### $\sin^2 \theta = 1 - \cos^2 \theta$ Pythagorean Identities

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

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

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

## Helpful Tips

1. Be on the lookout for any of the Pythagorean Identities
2. Converting to sine or cosine usually leads to other identities
3. Look at the format. Are there fractions on 1 side, but not the other? Are there more terms on 1 side? Use that as a clue as to what steps you may need to take.
4. Fractions, Fractions, Fractions. Remember how to divide fractions and that you need a common denominator to add fractions.
5. Use your Algebra “Tricks” such as factoring and conjugates

## Trigonometric Identities

<b>Reciprocal Identities</b> $\cot \theta = \frac{1}{\tan \theta}$ $\csc \theta = \frac{1}{\sin \theta}$ $\sec \theta = \frac{1}{\cos \theta}$	<b>Quotient Identities</b> $\tan \theta = \frac{\sin \theta}{\cos \theta}$ $\cot \theta = \frac{\cos \theta}{\sin \theta}$
<b>Pythagorean Identities</b> $\sin^2 \theta + \cos^2 \theta = 1$ $\tan^2 \theta + 1 = \sec^2 \theta$ $1 + \cot^2 \theta = \csc^2 \theta$	

# Practice

Use the Fundamental Trigonometric Identities to verify the following equations.

1.  $\sin x \sec x = \tan x$

2.  $\sec^2 x - \csc^2 x = \tan^2 x - \cot^2 x$

3.  $\csc^2 x \cos^2 x = \csc^2 x - 1$

4.  $\frac{1}{\sin x \cot x} = \frac{1}{\cos x}$

# Practice - ANSWERS

Use the Fundamental Trigonometric Identities to verify the following equations.

1.  $\sin x \sec x = \tan x$

$$\sin x \sec x = \tan x$$

$$\Rightarrow \sin x \frac{1}{\cos x} = \tan x$$

$$\Rightarrow \sin x \frac{1}{\cos x} = \tan x$$

$$\Rightarrow \frac{\sin x}{\cos x} = \tan x$$

$$\Rightarrow \frac{\sin x}{\cos x} = \tan x$$

$$\Rightarrow \tan x = \tan x$$

2.  $\sec^2 x - \csc^2 x = \tan^2 x - \cot^2 x$

$$\Rightarrow \sec^2 x - \csc^2 x = \tan^2 x - \cot^2 x$$

$$\Rightarrow \sec^2 x - (\cot^2 x + 1) = \tan^2 x - \cot^2 x$$

$$\Rightarrow \sec^2 x - \cot^2 x - 1 = \tan^2 x - \cot^2 x$$

$$\Rightarrow \sec^2 x - \cot^2 x - 1 = \tan^2 x - \cot^2 x$$

$$\Rightarrow \sec^2 x - 1 - \cot^2 x = \tan^2 x - \cot^2 x$$

$$\Rightarrow \sec^2 x - 1 - \cot^2 x = \tan^2 x - \cot^2 x$$

$$\Rightarrow \tan^2 x - \cot^2 x = \tan^2 x - \cot^2 x$$

# Practice - ANSWERS

Use the Fundamental Trigonometric Identities to verify the following equations.

$$3. \csc^2 x \cos^2 x = \csc^2 x - 1$$

$$\csc^2 x \cos^2 x = \csc^2 x - 1$$

$$\csc x \csc x \cos^2 x = \csc^2 x - 1$$

$$\frac{1}{\sin x} \frac{1}{\sin x} \cos^2 x = \csc^2 x - 1$$

$$\frac{1}{\sin^2 x} \cos^2 x = \csc^2 x - 1$$

$$\frac{1}{\sin^2 x} \cos^2 x = \csc^2 x - 1$$

$$\frac{\cos^2 x}{\sin^2 x} = \csc^2 x - 1$$

$$\frac{\cos^2 x}{\sin^2 x} = \csc^2 x - 1$$

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

$$\csc^2 x - 1 = \csc^2 x - 1$$

$$4. \frac{1}{\sin x \cot x} = \frac{1}{\cos x}$$

$$\frac{1}{\sin x \cot x} = \frac{1}{\cos x}$$

$$\frac{1}{\sin x \frac{\cos x}{\sin x}} = \frac{1}{\cos x}$$

$$\frac{1}{\cancel{\sin x} \frac{\cos x}{\cancel{\sin x}}} = \frac{1}{\cos x}$$

$$\frac{1}{\cos x} = \frac{1}{\cos x}$$



# Additional Practice and Resources:

Additional Resource Videos:

[Verifying Trigonometric Identities](#)

(Watch the first 4:38. After that are more advanced problems)

[Verifying a trigonometric Identities](#)

Additional Practice:

[Review Trig. Identities \(basic\) & Answers - Kuta](#)

[Trig Identities WS 3.4](#) & [Answers to WS 3.4](#) (scroll down 3 pgs)