



Present

# The Twisted World of Trigonometry (Part 2)

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## I. Graphing

- A. the Unit Circle
- B. Sine, Cosine, and Tangent Curves
  - 1. Setting Up a Table of Values
  - 2. Plotting Points on a Graph
  - 3. the Sine Curve
  - 4. the Period
  - 5. the Amplitude
  - 6. the Cosine Curve
  - 7. the Tangent Curve

## II. Identities

- A. Sum and Difference Formulas
  - 1. the Cosine Formulas
    - a. Using the Sum Formula
    - b. Using the Difference Formula
  - 2. the Sine Formulas
    - a. Using the Sum Formula
    - b. Using the Difference Formula
  - 3. the Tangent Formula
    - a. Using the Sum Formula

b. Using the Difference Formula

## B. Double-Angle Formulas

- 1. Finding the Double-Angle Formulas
- 2. Using the Sine Formula
- 3. Using the Cosine Formula
- 4. Using the Tangent Formula

## C. Half-Angle Identities

- 1. Choosing the Plus or Minus Symbol
- 2. Finding the Quadrant for Your Half-Angle
- 3. Using the Sine Formula
- 4. Using the Cosine Formula
- 5. Using the Tangent Formula

## D. Sum-to-Product and Product-to-Sum Formulas

- 1. Using the Product-to-Sum Formulas
- 2. Using the Sum-to-Product Formulas

## E. Verifying an Identity

- 1. Verifying One Identity
- 2. Verifying Another Identity

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Algebra *Part 2*  
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Macroeconomics  
Statistics *Part 1*  
Statistics *Part 2*  
Statistics *Part 3*  
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## PART 2

### Formulas

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#### Graphing A Trig Function

- 1st — Choose some radian or degree amounts
- 2nd — Find the trig function values for these radian or degree amounts
- 3rd — Use radian/degree amounts as T values and trig function values as Y values to plot points on a graph
- 4th — Connect the points with a smooth curve
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#### Basic Trig Identities

##### Quotient Identities:

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

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

##### Reciprocal Identities:

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

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

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

##### Pythagorean Identities:

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

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

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


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#### Sum and Difference Formulas:

##### Cosine:

$$\cos(\theta + \phi) = \cos(\theta)\cos(\phi) - \sin(\theta)\sin(\phi)$$

$$\cos(\theta - \phi) = \cos(\theta)\cos(\phi) + \sin(\theta)\sin(\phi)$$

##### Sine:

$$\sin(\theta + \phi) = \sin(\theta)\cos(\phi) + \cos(\theta)\sin(\phi)$$

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

##### Tangent:

$$\tan(\theta + \phi) = \frac{\tan(\theta) + \tan(\phi)}{1 - \tan(\theta)\tan(\phi)}$$

$$\tan(\theta - \phi) = \frac{\tan(\theta) - \tan(\phi)}{1 + \tan(\theta)\tan(\phi)}$$


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#### Double-Angle Formulas:

$$\sin(2\theta) = 2\sin(\theta)\cos(\theta)$$

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

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


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#### Half-Angle Identities

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

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

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


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#### Key for When to Use the Plus or Minus Symbol in Half-Angle Identities

Quad I:  $\sin(\theta/2) > 0$   
 $\cos(\theta/2) > 0$   
 $\tan(\theta/2) > 0$

Quad II:  $\sin(\theta/2) > 0$   
 $\cos(\theta/2) < 0$   
 $\tan(\theta/2) < 0$

Quad III:  $\sin(\theta/2) < 0$   
 $\cos(\theta/2) < 0$   
 $\tan(\theta/2) > 0$

Quad IV:  $\sin(\theta/2) < 0$   
 $\cos(\theta/2) > 0$   
 $\tan(\theta/2) < 0$

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#### Product-To-Sum Formulas

$$\sin(\theta)\sin(\phi) = \frac{1}{2}[\cos(\theta - \phi) - \cos(\theta + \phi)]$$

$$\cos(\theta)\cos(\phi) = \frac{1}{2}[\cos(\theta - \phi) + \cos(\theta + \phi)]$$

$$\sin(\theta)\cos(\phi) = \frac{1}{2}[\sin(\theta + \phi) + \sin(\theta - \phi)]$$

$$\cos(\theta)\sin(\phi) = \frac{1}{2}[\sin(\theta + \phi) - \sin(\theta - \phi)]$$


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#### Sum-To-Product Formulas

$$\sin(\theta) + \sin(\phi) = 2\left[\sin\left(\frac{\theta + \phi}{2}\right)\cos\left(\frac{\theta - \phi}{2}\right)\right]$$

$$\sin(\theta) - \sin(\phi) = 2\left[\cos\left(\frac{\theta + \phi}{2}\right)\sin\left(\frac{\theta - \phi}{2}\right)\right]$$

$$\cos(\theta) + \cos(\phi) = 2\left[\cos\left(\frac{\theta + \phi}{2}\right)\cos\left(\frac{\theta - \phi}{2}\right)\right]$$

$$\cos(\theta) - \cos(\phi) = -2\left[\sin\left(\frac{\theta + \phi}{2}\right)\sin\left(\frac{\theta - \phi}{2}\right)\right]$$


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