TRIGONOMETRIC IDENTITIES

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An equation involving trigonometric ratios of an angle is said to be a trigonometric identity if it is satisfied for all values of that angle for which the given trigonometric ratios are defined. Trigonometric identities are equalities that involve

Pythagorean Identities	
$\sin^2\theta + \cos^2\theta = 1$	
$1 + \tan^2\theta = \sec^2\theta$	$1 + \cot^2\theta = \csc^2\theta$

trigonometric functions and are true for every single value of the occurring variables.

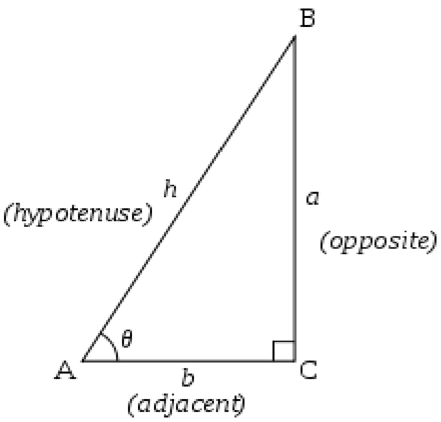
We have three main trigonometric identities:

- Sin^2 ? + Cos^2 ? = 1
- Sec^2 ? = 1 + Tan^2 ?
- Cot^2 ? + 1 = Cosec^2 ?

Let’s discuss each of the above trigonometric identity in detail:

Sin^2 ? + Cos^2 ? = 1

In the adjoining figure, we have ? ABC right angled at C.



According to Pythagoras theorem:

$AB^2 = AC^2 + BC^2$ … (i)

Divide each term of above equation (i) by AB^2

$$\frac{AB^2}{AB^2} = \frac{AC^2}{AB^2} + \frac{BC^2}{AB^2} \quad \ldots \text{(ii)}$$

As we know, Sin ? = Opposite / Hypotenuse

Sin ? = BC / AB

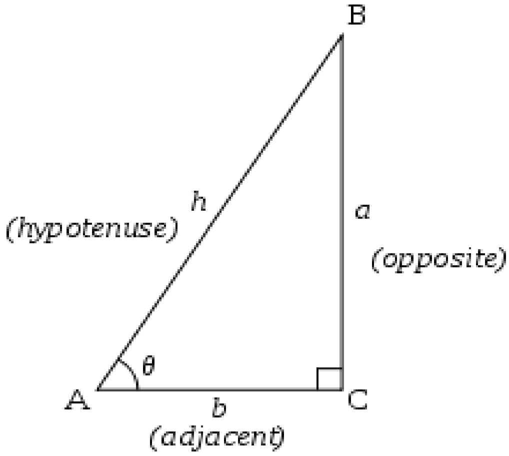
And, Cos ? = Adjacent / Hypotenuse
Cos ? = AC / AB

Putting the values of Sin ? and Cos ? in equation (ii)
1 = Cos^2 ? + Sin^2 ?

This is true for all ? such that 0° ? ? ? 90°. So, this is a trigonometric identity.

Sec^2 ? = 1 + Tan^2 ?

In the adjoining figure, we have ? ABC right angled at C.



According to Pythagoras theorem:
$AB^2 = AC^2 + BC^2$ … (i)

To prove next identity we will divide equation (i) by AC^2

$$\frac{AB^2}{AC^2} = \frac{AC^2}{AC^2} + \frac{BC^2}{AC^2} \quad \ldots \text{(iii)}$$

As we know, Secant ? = Hypotenuse / Adjacent
Secant ? = AB / AC
And, Tangent ? = Opposite / Adjacent
Tangent ? = BC / AC

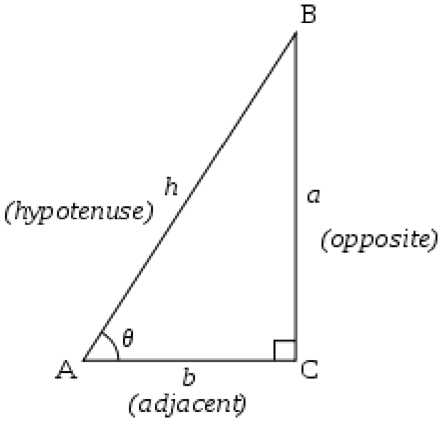
Putting the values of Secant ? (Sec ?) and Tangent ? (Tan ?) in equation (iii)
Sec^2 ? = 1 + Tan^2 ?

Tan ? and Sec ? are not defined for ? = 90°

So the above equation is true for all ? such that 0° ? ? < 90°

Cot^2 ? + 1 = Cosec^2 ?

In the adjoining figure, we have ? ABC right angled at C.



According to Pythagoras theorem:

$AB^2 = AC^2 + BC^2$ … (i)

Next we will divide equation (i) by BC^2

$$\frac{AB^2}{BC^2} = \frac{AC^2}{BC^2} + \frac{BC^2}{BC^2} \quad \ldots \text{(iv)}$$

As we know, Cotangent ? = Adjacent / Opposite

Cotangent ? = AC / BC

And, Cosecant ? = Hypotenuse / Opposite

Cosecant ? = AB / BC

Putting the values of Cosecant ? (Cosec ?) and Cotangent ? (Cot ?) in equation (iv)

Cosec^2 ? = Cot^2 ? + 1

Cot ? and Cosec ? are not defined for ? = 0°

So the above equation is true for all ? such that 0° < ? ? 90°

Using these identities, we can convert each trigonometric ratio in terms of other trigonometric ratios, that is, if any one of the ratios is known, we can also find the values of othertrigonometric ratios.

Now try it yourself! Should you still need any help,click here to schedule live online session with e Tutor!

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Reference Links:

- http://www.purplemath.com/modules/basirati.htm
- http://en.wikipedia.org/wiki/List_of_trigonometric_identities
- http://en.wikipedia.org/wiki/Pythagorean_theorem
- http://en.wikipedia.org/wiki/Sine
- http://en.wikipedia.org/wiki/Trigonometric_functions#Sine.2C_cosine.2C_and_tangent

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