Trigonometric Identities

Here is a list of many of the identities from trigonometry. These identities may be used to verify or establish other identities.

Reciprocal Identities

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

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

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

Ratio Identities

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

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

Negative-Angle Identities

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

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

$\tan tan\ (-\theta) = -\tan tan\ \theta$

$\csc csc\ (-\theta) = -\csc csc\ \theta$

$\sec sec\ (-\theta) = \sec sec\ \theta$

$\cot cot\ (-\theta) = -\cot cot\ \theta$

Co-function Identities

$\sin sin\ (90° - \theta) = \cos cos\ \theta$

$sec(90° - \theta) = \csc csc\ \theta$

$\cos cos\ (90° - \theta) = \sin sin\ \theta$

$csc(90° - \theta) = \sec sec\ \theta$

$\tan tan\ (90° - \theta) = \cot cot\ \theta$

$\cot cot\ (90° - \theta) = \tan tan\ \theta$

Pythagorean Identities

$\theta + \theta = 1$

$\theta + 1 = \theta$

$1 + \theta = \theta$

Sum & Difference Identities

$cos\ (\alpha + \beta) = cos\ \alpha\ cos\ \beta - sin\ \alpha\ sin\ \beta$

$cos\ (\alpha - \beta) = cos\ \alpha cos\ \beta + sin\ \alpha sin\ \beta$

$sin\ (\alpha + \beta) = sin\ \alpha\ cos\ \beta + cos\ \alpha\ sin\ \beta$

$sin\ (\alpha - \beta) = sin\ \alpha cos\ \beta - cos\ \alpha sin\ \beta$

$tan\ (\alpha + \beta) = \frac{tan\ \alpha + tan\ \beta}{1 - tan\ \alpha tan\ \beta}$

$tan\ (\alpha - \beta) = \frac{tan\ \alpha - tan\ \beta}{1 + tan\ \alpha tan\ \beta}$

Double-Angle Identities

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

$\cos cos\ (2\alpha) = cos^2\alpha - sin^2\alpha = 2cos^2\alpha - 1 = 1 - 2sin^2\alpha$

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

Half-Angle Identities

$sin\left(\frac{\alpha}{2}\right) = \pm\sqrt{\frac{1 - cos\ \alpha}{2}}$

$cos\left(\frac{\alpha}{2}\right) = \pm\sqrt{\frac{1 + cos\ \alpha}{2}}$

$tan\left(\frac{\alpha}{2}\right) = \pm\sqrt{\frac{1 - cos\ \alpha}{1 + cos\ \alpha}} = \frac{sin\ \alpha}{1 + cos\ \alpha} = \frac{1 - cos\ \alpha}{siin\ \alpha}$

Product to Sum Identities

$sin\ \alpha cos\ \beta = \frac{sin\ (\alpha+\beta) + sin(\alpha-\beta)}{2}$

$sin\ \alpha sin\ \beta = \frac{cos\ (\alpha-\beta) - cos(\alpha+\beta)}{2}$

$cos\ \alpha cos\ \beta = \frac{cos\ (\alpha+\beta) + cox(\alpha-\beta)}{2}$

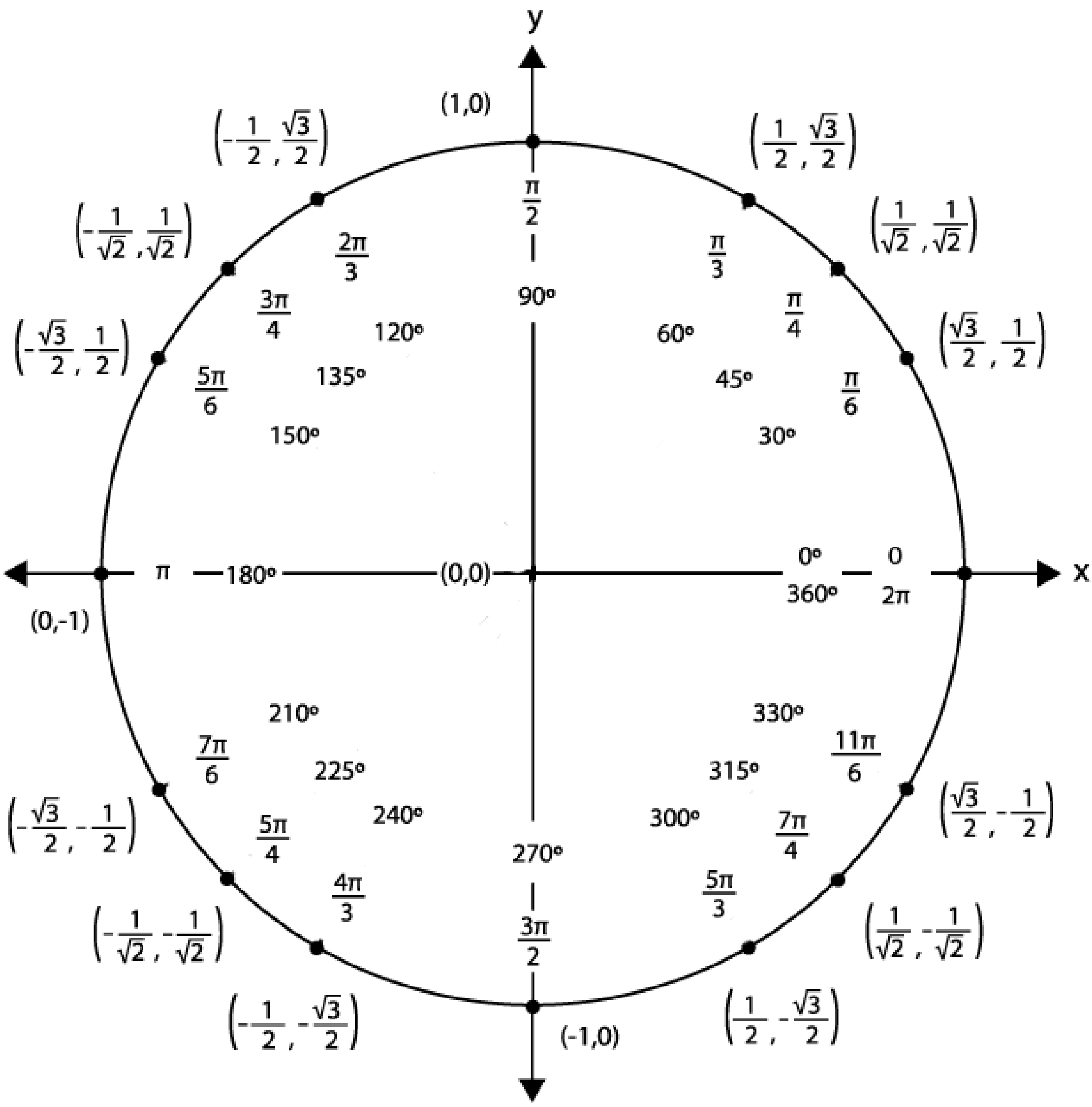
Sum to Product Identities

$sin\ \alpha + sin\ \beta = 2\ sin\left(\frac{a+b}{2}\right) cos\left(\frac{\alpha-\beta}{2}\right)$

$sin\ \alpha - sin\ \beta = 2\ cos\left(\frac{\alpha+\beta}{2}\right) sin\left(\frac{\alpha-\beta}{2}\right)$

$cos\ \alpha + cos\ \beta = 2\ cos\left(\frac{\alpha+\beta}{2}\right) cos\left(\frac{\alpha-\beta}{2}\right)$

$cos\ \alpha - cos\ \beta = -2\ sin\left(\frac{\alpha+\beta}{2}\right) sin\left(\frac{\alpha-\beta}{2}\right)$


y
x
(1,0)
(0,-1)
(-1,0)
(0,0)
π/2
90°
π/3
60°
π/4
45°
π/6
30°
2π/3
120°
3π/4
135°
5π/6
150°
π
180°
0°
360°
0
2π
7π/6
210°
5π/4
225°
4π/3
240°
3π/2
270°
5π/3
300°
7π/4
315°
11π/6
330°
(1/2, √3/2)
(1/√2, 1/√2)
(√3/2, 1/2)
(-1/2, √3/2)
(-1/√2, 1/√2)
(-√3/2, 1/2)
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