

# Trigonometric Identities

## Negative Angle Identities

$$\sin(-x) = -\sin(x)$$

$$\cos(-x) = \cos(x)$$

$$\tan(-x) = -\tan(x)$$

$$\csc(-x) = -\csc(x)$$

$$\sec(-x) = \sec(x)$$

$$\cot(-x) = -\cot(x)$$

## Complimentary Angle Identities

$$\sin(90-x) = \cos(x)$$

$$\cos(90-x) = \sin(x)$$

$$\tan(90-x) = \cot(x)$$

$$\csc(90-x) = \sec(x)$$

$$\sec(90-x) = \csc(x)$$

$$\cot(90-x) = \tan(x)$$

## Reciprocal Identities

$$\sin(x) = 1/\csc(x)$$

$$\cos(x) = 1/\sec(x)$$

$$\tan(x) = 1/\cot(x)$$

$$\csc(x) = 1/\sin(x)$$

$$\sec(x) = 1/\cos(x)$$

$$\cot(x) = 1/\tan(x)$$

## Special

$$\tan(x) = \sin(x)/\cos(x)$$

$$\cot(x) = \cos(x)/\sin(x)$$

## Pythagorean Identities

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

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

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

## Sum and Difference Identities

$$\sin(a + b) = \sin(a)\cos(b) + \cos(a)\sin(b)$$

$$\sin(a - b) = \sin(a)\cos(b) - \cos(a)\sin(b)$$

$$\cos(a + b) = \cos(a)\cos(b) - \sin(a)\sin(b)$$

$$\cos(a - b) = \cos(a)\cos(b) + \sin(a)\sin(b)$$

$$\tan(a + b) = [\tan(a) + \tan(b)]/[1 - \tan(a)\tan(b)]$$

$$\tan(a - b) = [\tan(a) - \tan(b)]/[1 + \tan(a)\tan(b)]$$

$$\sin(a) + \sin(b) = 2\sin[(a + b)/2]\cos[(a - b)/2]$$

$$\sin(a) - \sin(b) = 2\cos[(a + b)/2]\sin[(a - b)/2]$$

$$\cos(a) + \cos(b) = 2\cos[(a + b)/2]\cos[(a - b)/2]$$

$$\cos(a) - \cos(b) = -2\sin[(a + b)/2]\sin[(a - b)/2]$$



### **Double Angle Identities**

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

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

$$\tan(2a) = [2\tan(a)]/[1 - \tan^2(a)]$$

$$\cos(a/2) = \pm \sqrt{\{ [1 + \cos(x)]/2 \}}$$

$$\sin(a/2) = \pm \sqrt{\{ [1 - \cos(x)]/2 \}}$$

$$\cos^2(a) = [1 + \cos(2a)]/2$$

$$\sin^2(a) = [1 - \cos(2a)]/2$$

### **Product Identities**

$$\sin(a)\cos(b) = .5[\sin(a + b) + \sin(a - b)]$$

$$\cos(a)\sin(b) = .5[\sin(a + b) - \sin(a - b)]$$

$$\cos(a)\cos(b) = .5[\cos(a + b) + \cos(a - b)]$$

$$\sin(a)\sin(b) = .5[\cos(a - b) - \cos(a + b)]$$

