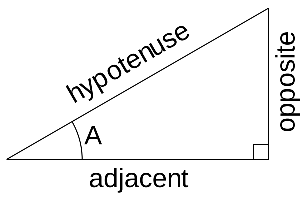
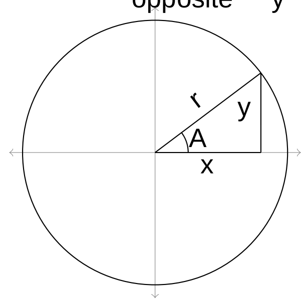
# De nitions

$$\cos A = \frac{\text{adjacent}}{\text{hypotenuse}} = \frac{x}{r} \qquad \sec A = \frac{\text{hypotenuse}}{\text{adjacent}} = \frac{r}{x}$$

$$\sin A = \frac{\text{opposite}}{\text{hypotenuse}} = \frac{y}{r} \qquad \csc A = \frac{\text{hypotenuse}}{\text{opposite}} = \frac{r}{y}$$

$$\tan A = \frac{\text{opposite}}{\text{adjacent}} = \frac{y}{x} \qquad \cot A = \frac{\text{adjacent}}{\text{opposite}} = \frac{x}{y}$$




| | 0 | 30 | 45 | [redacted] | 90 |
|---|---|---|---|---|---|
| | 0 | $\frac{}{6}$ | $\frac{}{4}$ | [redacted] | $\frac{}{2}$ |
| sin | 0 | $\frac{1}{2}$ | $\frac{\sqrt{2}}{2}$ | [redacted] $\frac{3}{2}$ | 1 |
| cos | 1 | $\frac{\sqrt{3}}{2}$ | $\frac{\sqrt{2}}{2}$ | $\frac{1}{2}$ | 0 |
| tan | 0 | | | | |

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## Sum and Di erence Identities

$\cos(A \quad B) = \cos A \cos B \quad \sin A \sin B$

$\sin(A \quad B) = \sin A \cos B \quad \cos A \sin B$

$\tan(A \quad B) = \frac{\tan A \quad \tan B}{1 \quad \tan A \tan B}$

## Double Angle Identities

$\cos 2A = \cos^2 A \quad \sin^2 A$ $\qquad \sin 2A = 2\cos A \sin A$

$\cos 2A = 2\cos^2 A \quad 1$

$\cos 2A = 1 \quad 2\sin^2 A$ $\qquad \tan 2A = \frac{2\tan A}{1 \quad \tan^2 A}$

## Half Angle Identities

$\cos\frac{A}{2} = \quad \sqrt{\frac{1+\cos A}{2}}$

$\sin\frac{A}{2} = \quad \sqrt{\frac{1 \quad \cos A}{2}}$

$\tan\frac{A}{2} = \frac{1 \quad \cos A}{\sin A} = \frac{\sin A}{1+\cos A}$

## Power Reduction Identities

$\cos^2 A = \frac{1+\cos 2A}{2}$

$\sin^2 A = \frac{1 \quad \cos 2A}{2}$

$\tan^2 A = \frac{1 \quad \cos 2A}{1+\cos 2A}$

## Sum-to-Product Identities

$\sin A + \sin B = 2\sin\frac{A+B}{2}\cos\frac{A \quad B}{2}$

$\sin A \quad \sin B = 2\cos\frac{A+B}{2}\sin\frac{A \quad B}{2}$

$\cos A + \cos B = 2\cos\frac{A+B}{2}\cos\frac{A \quad B}{2}$

$\cos A \quad \cos B = \quad 2\sin\frac{A+B}{2}\sin\frac{A \quad B}{2}$

## Product-to-Sum Identities

$\sin A \cos B = \frac{1}{2}[\sin(A+B) + \sin(A \quad B)]$

$\cos A \cos B = \frac{1}{2}[\cos(A \quad B) + \cos(A+B)]$

$\sin A \sin B = \frac{1}{2}[\cos(A \quad B) \quad \cos(A+B)]$

## Sums of Sines and Cosines

$A\cos x + B\sin x = \sqrt{A^2+B^2}\sin(x + \quad)$ where

$\cos \quad = \frac{B}{\sqrt{A^2+B^2}}$ and $\sin \quad = \frac{A}{\sqrt{A^2+B^2}}$

$A\cos x + B\sin x = \sqrt{A^2+B^2}\cos(x \quad)$ where

$\cos \quad = \frac{A}{\sqrt{A^2+B^2}}$ and $\sin \quad = \frac{B}{\sqrt{A^2+B^2}}$

## Circular Sections

Arc length: $s = r$

Area: $A = \frac{1}{2}r^2$

Angular velocity: $! = \frac{v}{r}$

## Graphing

For $y = A\cos(Bx + C) + D$ and $y = \sin(Bx + C) + D$,

Amplitude $= |A|$ $\qquad$ Period $= \frac{2}{B}$

Frequency $= B$

Vertical Shift $= D$ $\qquad$ Phase Shift $= \frac{C}{B}$

The graph of $y = \tan(Bx + C)$ has asymptotes at the locations where $\cos(Bx + C) = 0$.

## Range of Inverse Functions

$y = \arccos x; \quad 0 \quad y$

$y = \arcsin x; \quad \frac{\ }{2} \quad y \quad \frac{\ }{2}$

$y = \arctan x; \quad \frac{\ }{2} < y < \frac{\ }{2}$

$y = \text{arcsec}\, x; \quad 0 \quad y < \frac{\ }{2}$ and $\frac{\ }{2} < y$

$y = \text{arccsc}\, x; \quad \frac{\ }{2} \quad y < 0$ and $0 < y \quad \frac{\ }{2}$

$y = \text{arccot}\, x; \quad \frac{\ }{2} < y < 0$ and $0 < y < \frac{\ }{2}$

## Laws of Sines and Cosines

$c^2 = a^2 + b^2 \quad 2ab\cos C$

$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$