### **Greek Characters**

Name	Symbol	Typical use(s)
alpha	α	angle, constant
beta	β	angle, constant
gamma	γ	angle, constant
epsilon	$\epsilon$ or $\epsilon$	angle, constant
theta	$\theta$ or $\theta$	angle, constant
pi	$\pi$ or $\pi$	circular constant
phi	$\phi$ or $\varphi$	angle, constant

## Named Sets

empty set	Ø
real numbers	R
ordered pairs of reals	$\mathbf{R}^2$
integers	Z
positive integers	$\mathbf{Z}_{>0}$
positive real numbers	$\mathbf{R}_{>0}$

# Set Symbols

Meaning	Symbol
is a member	€
subset	$\subset$
intersection	Λ
union	U
set minus	\

## **Intervals**

For numbers *a* and *b*, we define the intervals:

$$(a, b) = \{x \in \mathbf{R} \mid a < x < b\}$$

$$[a, b) = \{x \in \mathbf{R} \mid a \le x < b\}$$

$$(a, b] = \{x \in \mathbf{R} \mid a < x \le b\}$$

$$[a, b] = \{x \in \mathbf{R} \mid a \le x \le b\}$$

$$(-\infty,a) = \{x \mid x < a\}$$

$$(-\infty,a]=\{x\mid x\leq a\}$$

$$(a, \infty) = \{x \mid a < x\}$$

$$[a,\infty)=\{x\mid a\leq x\}$$

# Logic Symbols

Meaning	Symbol
negation	_
and	^
or	V
implies	$\Rightarrow$
equivalent	≡
for all	A
there exists	3

## Exponents

For a, b > 0 and m, n real:

$$a^0 = 1$$

$$0^a = 0$$

$$1^a = 1$$

$$a^n a^m = a^{n+m}$$

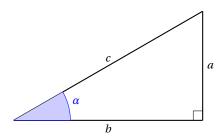
$$a^n/a^m = a^{n-m}$$

$$(a^n)^m = a^{n \cdot m}$$

$$a^{-m} = 1/a^m$$

$$(a/b)^m = a^m/b^m$$

# Right triangle Trigonometry



$$\sin(\alpha) = a/c$$
  $\cos(\alpha) = b/c$   $\tan(\alpha) = a/b$ 

$$\csc(\alpha) = c/a$$
  $\sec(\alpha) = c/b$   $\cot(\alpha) = b/a$ 

## Trigonometric Identities

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

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

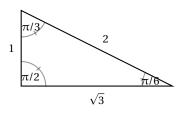
$$2\sin(x)^2 = 1 - \cos(2x)$$

$$\sin(x+y) = \sin(x)\cos(y) + \cos(x)\sin(y)$$

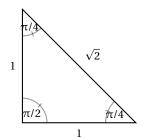
$$\cos(x+y) = \cos(x)\cos(y) - \sin(x)\sin(y)$$

## Famous Triangles

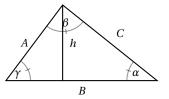
#### **The 30-60-90 triangle**



### The 45-45-90 triangle



## Laws of Cosine & Sine



#### Law of cosines

$$C^2 = A^2 + B^2 - 2AB\cos(\gamma)$$

#### Law of sines

$$\frac{\sin \alpha}{A} = \frac{\sin \beta}{B} = \frac{\sin \gamma}{C}$$

#### Area

Area = 
$$hB/2 = AB\sin(\gamma)/2$$

### Solution of equations

#### Algebraic

$$[ab = 0] \equiv [a = 0 \text{ or } b = 0]$$

$$[a^2 = b^2] \equiv [a = b \text{ or } a = -b]$$

$$\left[\frac{a}{b} = 0\right] \equiv [a = 0 \text{ and } b \neq 0]$$

$$\left[\frac{a}{b} = \frac{c}{d}\right] \equiv [ad = bc \text{ and } b \neq 0 \text{ and } d \neq 0]$$

$$[|a| = |b|] \equiv [a = b \text{ or } a = -b]$$

$$[\sqrt{a} = b] \equiv [a = b^2 \text{ and } b \geq 0]$$

For  $a \neq 0$ ,

$$\left[ax^2 + bx + c = 0\right] \equiv \left[x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}\right]$$

### Trig

$$\begin{bmatrix} \cos(a) = 0 \end{bmatrix} \equiv \begin{bmatrix} a = (k - 1/2)\pi, k \in \mathbf{Z} \end{bmatrix}$$
$$\begin{bmatrix} \sin(a) = 0 \end{bmatrix} \equiv \begin{bmatrix} a = k\pi, k \in \mathbf{Z} \end{bmatrix}$$
$$\begin{bmatrix} \tan(a) = 0 \end{bmatrix} \equiv \begin{bmatrix} a = k\pi, k \in \mathbf{Z} \end{bmatrix}$$

# Graphs

### Cosine, sine, and tangent



Figure 1: Graph of  $y = \cos(x)$  on  $[0, 2\pi]$ .



Figure 2: Graph of  $y = \sin(x)$  on  $[0, 2\pi]$ .



Figure 3: Graph of  $y = \tan(x)$  on  $[0, 2\pi]$ .

### Arccosine, arcsine, and arctangent



Figure 4: Graph of  $y = \arccos(x)$  on [-1, 1].

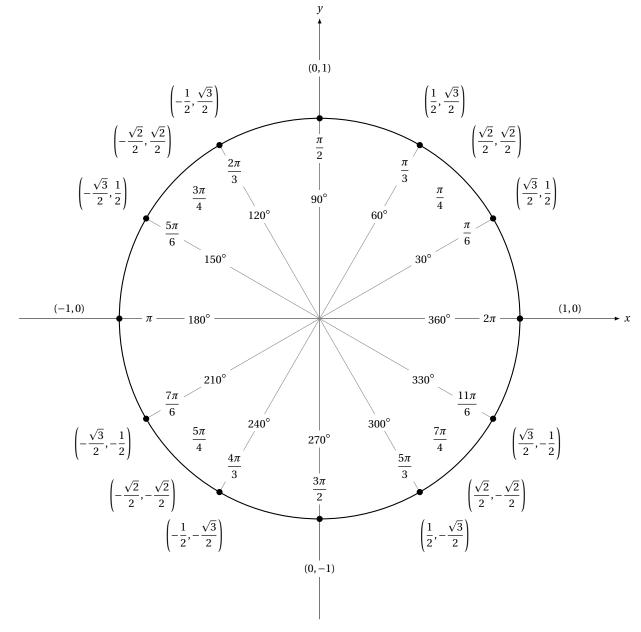


Figure 5: Graph of  $y = \arcsin(x)$  on [-1, 1].



Figure 6: Graph of  $y = \arctan(x)$  on [-10, 10].

# Unit Circle



For an extensive list of trigonometric function facts, see  $\verb|https://dlmf.nist.gov/4.14|.$