

Greek Characters

Name	Symbol	Typical use(s)
alpha	α	angle, constant
beta	β	angle, constant
gamma	γ	angle, constant
epsilon	ϵ or ε	angle, constant
theta	θ or ϑ	angle, constant
pi	π or π	circular constant
phi	ϕ or φ	angle, constant

Named Sets

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

Set Symbols

Meaning	Symbol
is a member	\in
subset	\subset
intersection	\cap
union	\cup

Intervals

For numbers a and b , we define the intervals:

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

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

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

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

Logic Symbols

Meaning	Symbol
negation	\neg
and	\wedge
or	\vee
implies	\Rightarrow
equivalent	\equiv
for all	\forall
there exists	\exists

Exponents

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

$$a^0 = 1, \quad 0^a = 0$$

$$1^a = 1, \quad a^n a^m = a^{n+m}$$

$$a^n / a^m = a^{n-m}, \quad (a^n)^m = a^{n \cdot m}$$

$$a^{-m} = 1/a^m, \quad (a/b)^m = a^m / b^m$$

Polar to Cartesian

$$x = r \cos(\theta)$$

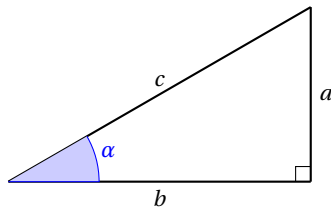
$$y = r \sin(\theta)$$

For $r > 0$ and $0 \leq \theta < 2\pi$

$$r = \sqrt{x^2 + y^2}$$

$$\theta = \begin{cases} 2\pi - \arccos(x/r) & \text{if } y < 0 \\ \arccos(x/r) & \text{if } y \geq 0 \end{cases}$$

Right Triangle Trigonometry



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

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

Trigonometric Identities

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

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

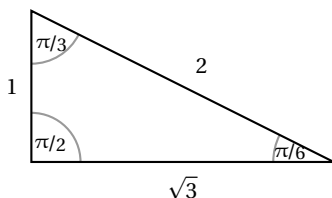
$$2 \sin(x)^2 = 1 - \cos(2x)$$

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

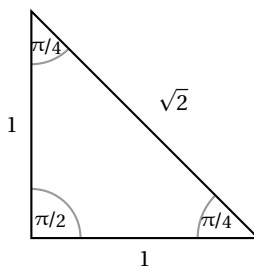
$$\cos(x + y) = \cos(x) \cos(y) - \sin(x) \sin(y)$$

Famous Triangles

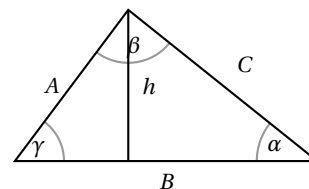
The 30-60-90 triangle



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

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

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 $a \neq 0$,

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

Trig

$$[\cos(a) = 0] \equiv [a = (k - 1/2)\pi, k \in \mathbf{Z}]$$

$$[\sin(a) = 0] \equiv [a = k\pi, k \in \mathbf{Z}]$$

$$[\tan(a) = 0] \equiv [a = k\pi, k \in \mathbf{Z}]$$

$$[\cos(a) = b] \equiv [a = \pm \arccos(b) + 2k\pi, k \in \mathbf{Z}]$$

$$[\sin(a) = b] \equiv [a = \arcsin(b) + 2k\pi, k \in \mathbf{Z} \text{ or } a = -\arcsin(b) + (2k + 1)\pi, k \in \mathbf{Z}]$$

$$[\tan(a) = b] \equiv [a = \arctan(b) + k\pi, k \in \mathbf{Z}]$$

Vectors

Dot product: $\langle x_1, y_1 \rangle \cdot \langle x_2, y_2 \rangle = x_1 x_2 + y_1 y_2$

Length: $\|\langle x, y \rangle\| = \sqrt{x^2 + y^2}$

Unit Vectors: $\mathbf{i} = \langle 1, 0 \rangle$, $\mathbf{j} = \langle 0, 1 \rangle$

Angle: $\mathbf{a} \cdot \mathbf{b} = \|\mathbf{a}\| \|\mathbf{b}\| \cos(\theta)$, where (θ) is the acute angle between \mathbf{a} and \mathbf{b} .

Graphs

Cosine, sine, and tangent

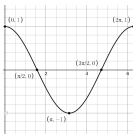


Figure 1: Graph of $y = \cos(x)$ on $[0, 2\pi]$.

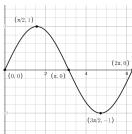


Figure 2: Graph of $y = \sin(x)$ on $[0, 2\pi]$.

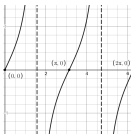


Figure 3: Graph of $y = \tan(x)$ on $[0, 2\pi]$.

Arccosine, arcsine, and arctangent

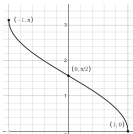


Figure 4: Graph of $y = \arccos(x)$ on $[-1, 1]$.

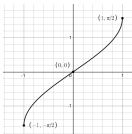


Figure 5: Graph of $y = \arcsin(x)$ on $[-1, 1]$.

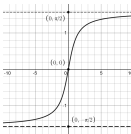


Figure 6: Graph of $y = \arctan(x)$ on $[-10, 10]$.

Unit Circle

