

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
set minus	\setminus

Intervals

For numbers a and b , we define the intervals:

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

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

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

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

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

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

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

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

Logic Symbols

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

Exponents

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

$$a^0 = 1$$

$$0^a = 0$$

$$1^a = 1$$

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

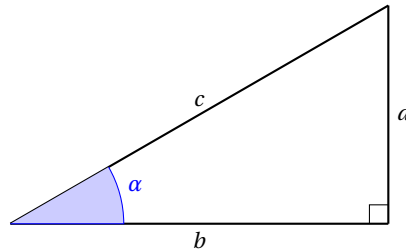
$$a^n / a^m = a^{n-m}$$

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

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

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

Right triangle Trigonometry



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

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

Trigonometric Identities

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

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

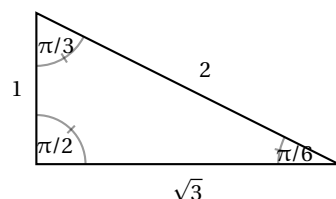
$$2\sin^2(x) = 1 - \cos(2x)$$

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

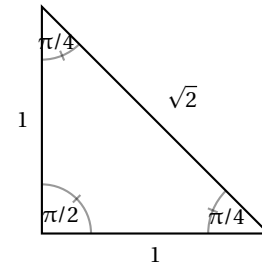
$$\cos(x+y) = \cos(x)\cos(y) - \sin(x)\sin(y)$$

Famous Triangles

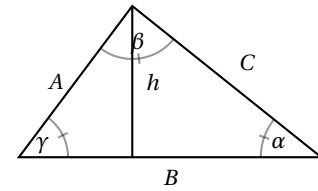
The 30-60-90 triangle



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

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

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

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

Graphs

Cosine, sine, and tangent

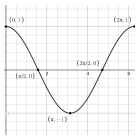


Figure 1: Graph of $y = \cos(x)$ on $[0, 2\pi]$.

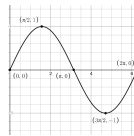


Figure 2: Graph of $y = \sin(x)$ on $[0, 2\pi]$.

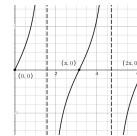


Figure 3: Graph of $y = \tan(x)$ on $[0, 2\pi]$.

Arccosine, arcsine, and arctangent

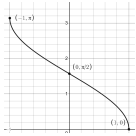


Figure 4: Graph of $y = \arccos(x)$ on $[-1, 1]$.

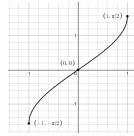


Figure 5: Graph of $y = \arcsin(x)$ on $[-1, 1]$.

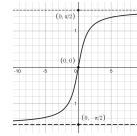
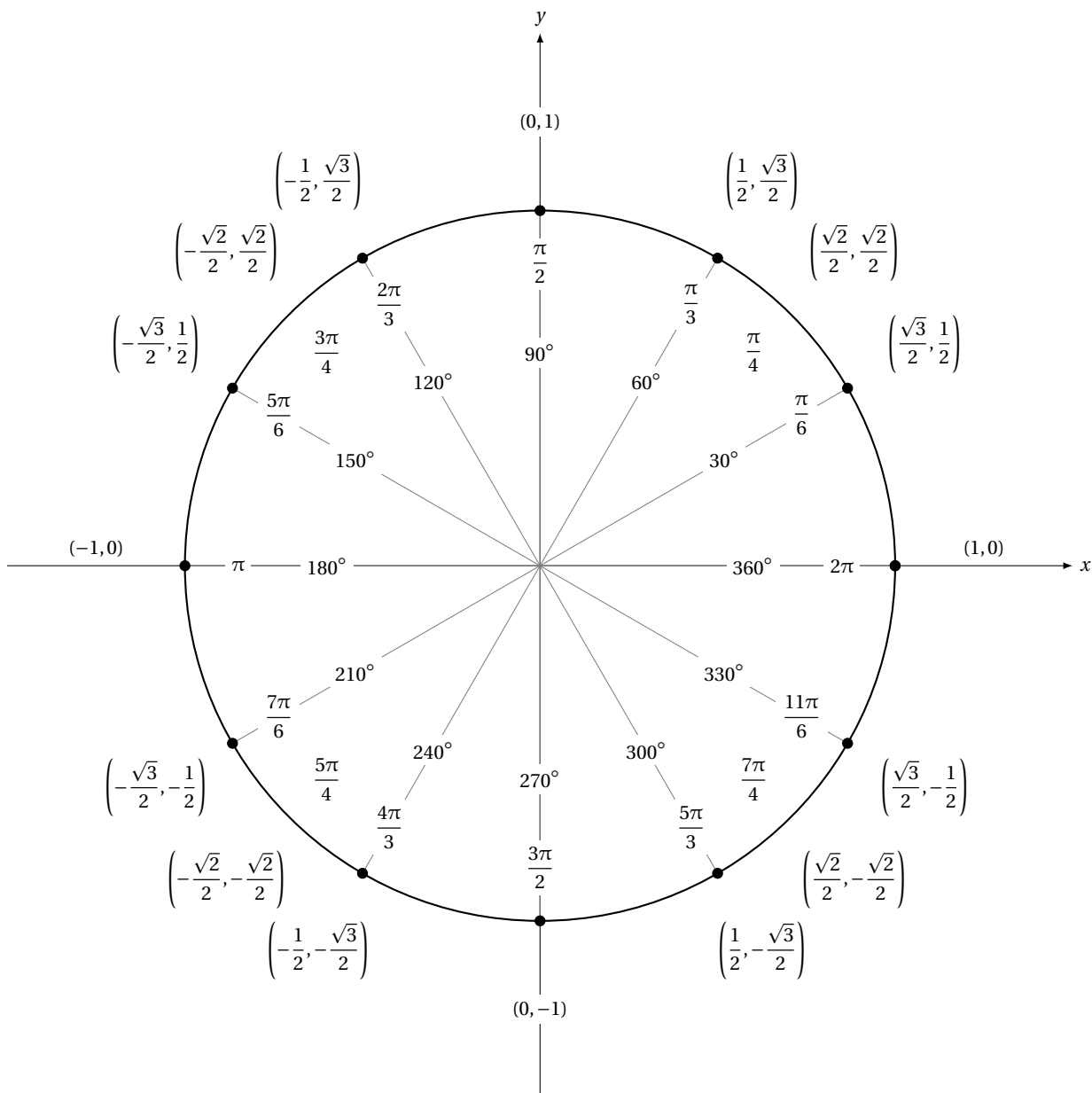


Figure 6: Graph of $y = \arctan(x)$ on $[-10, 10]$.

Unit Circle



For an extensive list of trigonometric function facts, see <https://dlmf.nist.gov/4.14>.

Revised 18 September 2021. Barton Willis is the author of this work. It licensed under CC0 1.0 (<https://creativecommons.org/publicdomain/zero/1.0>).