

Omega

Omega (capital: **Ω**, lowercase: **ω**; Greek ὦ, later ὦ μέγα, Modern Greek ωμέγα) is the 24th and last letter of the Greek alphabet. In the Greek numeric system/Isopsephy (Gematria), it has a value of 800. The word literally means "great O" (*ō mega*, mega meaning "great"), as opposed to *omicron*, which means "little O" (*o mikron*, micron meaning "little").^[1]

In phonetic terms, the Ancient Greek Ω is a long open-mid *o* [ɔː], comparable to the vowel of British English *raw*. In Modern Greek, Ω represents the mid back rounded vowel /o/, the same sound as *omicron*. The letter omega is *transcribed* ō or simply *o*.

As the last letter of the Greek alphabet, Omega is often used to denote the last, the end, or the ultimate limit of a *set*, in contrast to *alpha*, the first letter of the Greek alphabet.

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History

Ω was not part of the early (8th century BC) Greek alphabets. It was introduced in the late 7th century BC in the Ionian cities of Asia Minor to denote the long half-open [ɔː]. It is a variant of omicron (Ο), broken up at the side (Ϟ), with the edges subsequently turned outward (ϙ, Ϛ, ϛ, Ϝ).^[2] The Dorian city of *Knidos* as well as a few Aegean islands, namely *Paros*, *Thasos* and *Melos*, chose the exact opposite innovation, using a broken-up circle for the short and a closed circle for the long /o/.^[2]

The name Ωμέγα is *Byzantine*; in *Classical Greek*, the letter was called ὦ (ὦ), whereas the omicron was called *ou* (οὖ).^[3] The modern lowercase shape goes back to the *uncial* form Ϝ, a form that developed during the 3rd century BC in ancient handwriting on papyrus, from a flattened-out form of the letter (Ϟ) that had its edges curved even further upward.^[4]

In addition to the Greek alphabet, Omega was also adopted into the *early Cyrillic alphabet*. See *Cyrillic omega* (Ѡ, ѡ). A *Raetic* variant is conjectured to be at the origin or parallel evolution of the *Elder Futhark* ŀ.

Omega was also adopted into the Latin alphabet, as a letter of the 1982 revision to the *African reference alphabet*. It has had little use. See *Latin omega*.

The symbol Ω (uppercase letter)

The uppercase letter Ω is used as a symbol:

- In *chemistry*:
 - For *oxygen-18*, a natural, *stable isotope of oxygen*.^[5]
- In *physics*:
 - For *ohm* – SI unit of electrical resistance; formerly also used upside down (Ϟ) to represent *mho*, the old name for the inverse of an ohm (now siemens with symbol S) used for electrical conductance. Unicode has a separate code point for the ohm sign (U+2126, Ω), but it is included only for backward compatibility, and the Greek uppercase omega character (U+03A9, Ω) is preferred.^[6]
 - In *statistical mechanics*, Ω refers to the *multiplicity* (number of microstates) in a system.
 - The *solid angle* or the rate of precession in a gyroscope.
 - In *particle physics* to represent the *Omega baryons*.
 - In *astronomy (cosmology)*, Ω refers to the *density of the universe*, also called the *density parameter*.
 - In *astronomy (orbital mechanics)*, Ω refers to the *longitude of the ascending node* of an orbit.
- In *mathematics and computer science*:
 - In *complex analysis*, the *Omega constant*, a solution of *Lambert's W function*
 - In *differential geometry*, the space of *differential forms* on a *manifold* (of a certain degree, usually with a superscript).
 - A *variable* for a 2-dimensional region in calculus, usually corresponding to the domain of a double integral.
 - In *topos theory*, the (codomain of the) *subobject classifier* of an elementary topos.
 - In *combinatory logic*, the *looping combinator*, (λ x. x x) (λ x. x x)
 - In *group theory*, the *omega and agemo subgroups* of a *p*-group, Ω(G) and ∩(G)
 - In *group theory*, *Cayley's Ω process* as a partial differential operator.
 - In *statistics*, it is used as the symbol for the *sample space*, or total set of possible outcomes.
 - In *number theory*, Ω(*n*) is the number of *prime divisors* of *n*.
 - In notation related to *Big O notation* to describe the *asymptotic behavior of functions*.
 - Chaitin's constant*.
- As part of logo or trademark:
 - The logo of *Omega Watches SA*.



An alternate form of capital Ω resembles an underlined superscripted omicron or some forms of Latin Q. The O and underscore may, but need not, be touching.

- Part of the original Pioneer logo.
- Part of the Badge of the Supreme Court of the United Kingdom.
- Part of the mission patch for STS-135, as it was the last mission of the Space Shuttle program.
- The logo of the *God of War* video game series based on Greek mythology. In *God of War* (2018), it is revealed it stands as the symbol of war in Greece.
- The logo of *E-123 Omega*, a *Sonic the Hedgehog* character.
- The logo of the *Heroes of Olympus* series, based on Greek mythology.
- the logo of the *Ultramirines* in *Warhammer 40,000*
- The logo of Primal Groudon, the version mascot of *Pokémon Omega Ruby*.
- The logo of *Darkseid* in DC comics
- One of the logos of professional wrestler *Kenny Omega*
- Other
 - The symbol of the resistance movement against the Vietnam-era draft in the United States
 - Year or date of death
 - Used to refer to the lowest-ranked wolf in a pack
 - In *eschatology*, the symbol for the end of everything
 - In *molecular biology*, the symbol is used as shorthand to signify a genetic construct introduced by a two-point crossover
 - Omega Particle in the *Star Trek* universe
 - The final form of NetNavi bosses in some of the *Mega Man Battle Network* games
 - The personal symbol for Death, as worn by Death in the *Discworld* series by Terry Pratchett
 - The symbol to represent Groudon in *Pokémon Omega Ruby and Alpha Sapphire*
 - A secret boss in the *Final Fantasy* series called Omega (Ω) Weapon.

The symbol ω (lower case letter)

The minuscule letter ω is used as a symbol:

- Biochemistry and chemistry:
 - Denotes the carbon atom furthest from the carboxyl group of a fatty acid
 - In *biochemistry*, for one of the RNA polymerase subunits
 - In *biochemistry*, for the dihedral angle associated with the peptide group, involving the backbone atoms Cα-C'-N-Cα
 - In *biology*, for the fitness.
 - In *genomics*, as a measure of evolution at the protein level (also denoted as d_N/d_S or K_a/K_s ratio)
- Physics
 - Angular velocity or angular frequency
 - In *computational fluid dynamics*, the specific turbulence dissipation rate
 - In *meteorology*, the change of pressure with respect to time of a parcel of air
 - In *circuit analysis* and *signal processing* to represent natural frequency, related to frequency f by $\omega = 2\pi f$
 - In *astronomy*, as a ranking of a star's brightness within a constellation
 - In *orbital mechanics*, as designation of the argument of periapsis of an orbit
 - In *particle physics* to represent the omega meson
- Computer science:
 - In notation related to Big O notation, the asymptotically dominant nature of functions
 - In *relational database* theory to represent NULL, a missing or inapplicable value
- Mathematics:
 - The first transfinite ordinal number, often identified with the set of natural numbers including 0 (sometimes written ω_0)
 - In *set theory*, the first uncountable ordinal number (more commonly written as ω_1)
 - A primitive root of unity, like the complex cube roots of 1
 - The Wright Omega function
 - A generic differential form
 - In *number theory*, $\omega(n)$ is the number of distinct prime divisors of n
 - In *number theory*, an arithmetic function
 - In *combinatory logic*, the self-application combinator, $(\lambda x. x x)$
 - In *mathematical/options finance*, the elasticity of financial options
 - In *analytical investment management*, the tracking error of an investment manager
- Other:
 - Used in place of *ん* in Japanese typing shorthand.
 - In *linguistics*, the phonological word
 - In *textual criticism*, the archetype of a manuscript tradition
 - In *sociology*, used to refer to the lowest ranking member of a group
 - In *shift_JIS art*, used to represent the cat's mouth. (e.g. (・ω・) ヽ3猫ノ)

Character encodings

Greek omega/Coptic ouu

Character	Ω		ω		Ⲫ		Ⲭ	
Unicode name	GREEK CAPITAL LETTER OMEGA		GREEK SMALL LETTER OMEGA		COPTIC CAPITAL LETTER OOU		COPTIC SMALL LETTER OOU	
Encodings	decimal	hex	decimal	hex	decimal	hex	decimal	hex
Unicode	937	U+03A9	969	U+03C9	11440	U+2CB0	11441	U+2CB1
UTF-8	206 169	CE A9	207 137	CF 89	226 178 176	E2 B2 B0	226 178 177	E2 B2 B1
Numeric character reference	Ω	Ω	ω	ω	Ⲱ	Ⲱ	ⲱ	ⲱ
Named character reference	Ω		ω					
DOS Greek	151	97	224	E0				
DOS Greek-2	213	D5	250	FA				
Windows 1253	217	D9	249	F9				
TeX	\Omega		\omega					

[7]

Cyrillic omega

Character	Ω		ω		Ɑ	
Unicode name	CYRILLIC CAPITAL LETTER OMEGA		CYRILLIC SMALL LETTER OMEGA		COMBINING CYRILLIC LETTER OMEGA	
Encodings	decimal	hex	decimal	hex	decimal	hex
Unicode	1120	U+0460	1121	U+0461	42619	U+A67B
UTF-8	209 160	D1 A0	209 161	D1 A1	234 153 187	EA 99 BB
Numeric character reference	Ѡ	Ѡ	ѡ	ѡ	ꙻ	ꙻ

Character	Ω		ω		Ɱ		Ɐ	
Unicode name	CYRILLIC CAPITAL LETTER ROUND OMEGA		CYRILLIC SMALL LETTER ROUND OMEGA		CYRILLIC CAPITAL LETTER BROAD OMEGA		CYRILLIC SMALL LETTER BROAD OMEGA	
Encodings	decimal	hex	decimal	hex	decimal	hex	decimal	hex
Unicode	1146	U+047A	1147	U+047B	42572	U+A64C	42573	U+A64D
UTF-8	209 186	D1 BA	209 187	D1 BB	234 153 140	EA 99 8C	234 153 141	EA 99 8D
Numeric character reference	Ѻ	Ѻ	ѻ	ѻ	Ꙍ	Ꙍ	ꙍ	ꙍ

Latin/IPA omega

Character	Ω		Ɱ		Ɐ	
Unicode name	LATIN SMALL LETTER CLOSED OMEGA		LATIN CAPITAL LETTER OMEGA		LATIN SMALL LETTER OMEGA	
Encodings	decimal	hex	decimal	hex	decimal	hex
Unicode	631	U+0277	42934	U+A7B6	42935	U+A7B7
UTF-8	201 183	C9 B7	234 158 182	EA 9E B6	234 158 183	EA 9E B7
Numeric character reference	ɷ	ɷ	Ꞷ	Ꞷ	ꞷ	ꞷ

Technical omega symbols

Character	ω		̰		Ω		Ɱ	
Unicode name	APL FUNCTIONAL SYMBOL OMEGA		APL FUNCTIONAL SYMBOL OMEGA UNDERBAR		OHM SIGN		INVERTED OHM SIGN	
Encodings	decimal	hex	decimal	hex	decimal	hex	decimal	hex
Unicode	9077	U+2375	9081	U+2379	8486	U+2126	8487	U+2127
UTF-8	226 141 181	E2 8D B5	226 141 185	E2 8D B9	226 132 166	E2 84 A6	226 132 167	E2 84 A7
Numeric character reference	⍵	⍵	⍹	⍹	Ω	Ω	℧	℧

Mathematical omega

Character	Ω		ω		Ω		ω		Ω		ω	
Unicode name	MATHEMATICAL BOLD CAPITAL OMEGA		MATHEMATICAL BOLD SMALL OMEGA		MATHEMATICAL ITALIC CAPITAL OMEGA		MATHEMATICAL ITALIC SMALL OMEGA		MATHEMATICAL BOLD ITALIC CAPITAL OMEGA		MATHEMATICAL BOLD ITALIC SMALL OMEGA	
Encodings	decimal	hex	decimal	hex	decimal	hex	decimal	hex	decimal	hex	decimal	hex
<u>Unicode</u>	120512	U+1D6C0	120538	U+1D6DA	120570	U+1D6FA	120596	U+1D714	120628	U+1D734	120654	U+1D74E
<u>UTF-8</u>	240 157 155 128	F0 9D 9B 80	240 157 155 154	F0 9D 9B 9A	240 157 155 186	F0 9D 9B BA	240 157 156 148	F0 9D 9C 94	240 157 156 180	F0 9D 9C B4	240 157 157 142	F0 9D 9D 8E
<u>UTF-16</u>	55349 57024	D835 DEC0	55349 57050	D835 DEDA	55349 57082	D835 DEFA	55349 57108	D835 DF14	55349 57140	D835 DF34	55349 57166	D835 DF4E
<u>Numeric character reference</u>	&#120512;	&#x1D6C0;	&#120538;	&#x1D6DA;	&#120570;	&#x1D6FA;	&#120596;	&#x1D714;	&#120628;	&#x1D734;	&#120654;	&#x1D74E;

Character	Ω		ω		Ω		ω		6	
Unicode name	MATHEMATICAL SANS-SERIF BOLD CAPITAL OMEGA		MATHEMATICAL SANS-SERIF BOLD SMALL OMEGA		MATHEMATICAL SANS-SERIF BOLD ITALIC CAPITAL OMEGA		MATHEMATICAL SANS-SERIF BOLD ITALIC SMALL OMEGA		MATHEMATICAL SANS-SERIF BOLD ITALIC P.OOO OMEGA	
Encodings	decimal	hex	decimal	hex	decimal	hex	decimal	hex	decimal	hex
<u>Unicode</u>	120686	U+1D76E	120712	U+1D788	120744	U+1D7A8	120770	U+1D7C2	120788	U+1D7D4
<u>UTF-8</u>	240 157 157 174	F0 9D 9D AE	240 157 158 136	F0 9D 9E 88	240 157 158 168	F0 9D 9E A8	240 157 159 130	F0 9D 9F 82	240 157 159 148	F0 9D 9F 94
<u>UTF-16</u>	55349 57198	D835 DF6E	55349 57224	D835 DF88	55349 57256	D835 DFA8	55349 57282	D835 DFC2	55349 57300	D835 DFD4
<u>Numeric character reference</u>	&#120686;	&#x1D76E;	&#120712;	&#x1D788;	&#120744;	&#x1D7A8;	&#120770;	&#x1D7C2;	&#120788;	&#x1D7D4;

These characters are used only as mathematical symbols. Stylized Greek text should be encoded using the normal Greek letters, with markup and formatting to indicate the style of text.

See also

- Alpha and Omega

Notes

- The Greek Alphabet (<http://www.quinapalus.com/gr0.1.html>)
- Anne Jeffery (1961), *The local scripts of archaic Greece*, p.37–38.
- Herbert Weir Smyth. *A Greek Grammar for Colleges*. §1
- Edward M. Thompson (1912), *Introduction to Greek and Latin paleography*, Oxford: Clarendon. p.144
- Capilla, José E.; Arevalo, Javier Rodriguez; Castaño, Silvino Castaño; Teijeiro, María Fé Díaz; del Moral, Rut Sanchez; Diaz, Javier Heredia (September 19, 2012). "Mapping Oxygen-18 in Meteoric Precipitation over Peninsular Spain using Geostatistical Tools" (http://www.cedex.es/NR/rdonlyres/B8A9522A-5D6F-4675-921A-24BB8458187B/124720/Capilla_et_al_geoENV_2012_Valencia_Espa%C3%B1a_Extended.pdf) (PDF). *cedex.es*. Valencia, Spain: Ninth Conference on Geostatistics for Environmental Applications. Retrieved May 8, 2017.
- Excerpts from *The Unicode Standard, Version 4.0* (<https://www.unicode.org/versions/Unicode4.0.0/ch07.pdf#search=%22character%20U%2B2126%20maps%20OR%20map%20OR%20mapping%22>). Retrieved 11 October 2006.
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