C

C

with diacritics: ?C? with diacritics: ? ? ? ? ? ? ? ? ? ? ? C? c? ? ? Ç ç ? ? ? ? ??? ??? : Claudian letters © : copyright symbol °C : degree Celsius - ?C?, or ?c?, is the third letter of the Latin alphabet, used in the modern English alphabet, the alphabets of other western European languages and others worldwide. Its name in English is cee (pronounced), plural cees.

C++

C++ is a high-level, general-purpose programming language created by Danish computer scientist Bjarne Stroustrup. First released in 1985 as an extension - C++ is a high-level, general-purpose programming language created by Danish computer scientist Bjarne Stroustrup. First released in 1985 as an extension of the C programming language, adding object-oriented (OOP) features, it has since expanded significantly over time adding more OOP and other features; as of 1997/C++98 standardization, C++ has added functional features, in addition to facilities for low-level memory manipulation for systems like microcomputers or to make operating systems like Linux or Windows, and even later came features like generic programming (through the use of templates). C++ is usually implemented as a compiled language, and many vendors provide C++ compilers, including the Free Software Foundation, LLVM, Microsoft, Intel, Embarcadero, Oracle, and IBM.

C++ was designed with systems programming and embedded, resource-constrained software and large systems in mind, with performance, efficiency, and flexibility of use as its design highlights. C++ has also been found useful in many other contexts, with key strengths being software infrastructure and resource-constrained applications, including desktop applications, video games, servers (e.g., e-commerce, web search, or databases), and performance-critical applications (e.g., telephone switches or space probes).

C++ is standardized by the International Organization for Standardization (ISO), with the latest standard version ratified and published by ISO in October 2024 as ISO/IEC 14882:2024 (informally known as C++23). The C++ programming language was initially standardized in 1998 as ISO/IEC 14882:1998, which was then amended by the C++03, C++11, C++14, C++17, and C++20 standards. The current C++23 standard supersedes these with new features and an enlarged standard library. Before the initial standardization in 1998, C++ was developed by Stroustrup at Bell Labs since 1979 as an extension of the C language; he wanted an efficient and flexible language similar to C that also provided high-level features for program organization. Since 2012, C++ has been on a three-year release schedule with C++26 as the next planned standard.

Despite its widespread adoption, some notable programmers have criticized the C++ language, including Linus Torvalds, Richard Stallman, Joshua Bloch, Ken Thompson, and Donald Knuth.

Complex number

set of complex numbers is denoted by either of the symbols C {\displaystyle \mathbb {C} } or C. Despite the historical nomenclature, "imaginary" complex - In mathematics, a complex number is an element of a number system that extends the real numbers with a specific element denoted i, called the imaginary unit and satisfying the equation

i

2

=

?

1

{\displaystyle i^{2}=-1}

; every complex number can be expressed in the form

a

+

b

i

{\displaystyle a+bi}

, where a and b are real numbers. Because no real number satisfies the above equation, i was called an imaginary number by René Descartes. For the complex number

a

+

b

i

{\displaystyle a+bi}

, a is called the real part, and b is called the imaginary part. The set of complex numbers is denoted by either of the symbols

C

{\displaystyle \mathbb {C} }

or C. Despite the historical nomenclature, "imaginary" complex numbers have a mathematical existence as firm as that of the real numbers, and they are fundamental tools in the scientific description of the natural world.

Complex numbers allow solutions to all polynomial equations, even those that have no solutions in real numbers. More precisely, the fundamental theorem of algebra asserts that every non-constant polynomial equation with real or complex coefficients has a solution which is a complex number. For example, the equation

(

x

+

1

)

2

=

?

9

{\displaystyle (x+1)^{2}=-9}

has no real solution, because the square of a real number cannot be negative, but has the two nonreal complex solutions

?

1

+

3

i

{\displaystyle -1+3i}

and

?

1

?

3

i

{\displaystyle -1-3i}

.

Addition, subtraction and multiplication of complex numbers can be naturally defined by using the rule

i

2

=

?

1

{\displaystyle i^{2}=-1}

along with the associative, commutative, and distributive laws. Every nonzero complex number has a multiplicative inverse. This makes the complex numbers a field with the real numbers as a subfield. Because of these properties, ?

a

+

b

i

=

a

+

i

b

{\displaystyle a+bi=a+ib}

?, and which form is written depends upon convention and style considerations.

The complex numbers also form a real vector space of dimension two, with

{

1

,

i

}

{\displaystyle \{1,i\}}

as a standard basis. This standard basis makes the complex numbers a Cartesian plane, called the complex plane. This allows a geometric interpretation of the complex numbers and their operations, and conversely some geometric objects and operations can be expressed in terms of complex numbers. For example, the real numbers form the real line, which is pictured as the horizontal axis of the complex plane, while real multiples

of

i

{\displaystyle i}

are the vertical axis. A complex number can also be defined by its geometric polar coordinates: the radius is called the absolute value of the complex number, while the angle from the positive real axis is called the argument of the complex number. The complex numbers of absolute value one form the unit circle. Adding a fixed complex number to all complex numbers defines a translation in the complex plane, and multiplying by a fixed complex number is a similarity centered at the origin (dilating by the absolute value, and rotating by the argument). The operation of complex conjugation is the reflection symmetry with respect to the real axis.

The complex numbers form a rich structure that is simultaneously an algebraically closed field, a commutative algebra over the reals, and a Euclidean vector space of dimension two.

Cardinality of the continuum

_{0}}={\mathfrak {c}}^{n}=\aleph _{0}{\mathfrak {c}}=n{\mathfrak {c}}={\mathfrak {c}}} where n is any finite cardinal ? 2 and c c = (2 ? 0) c = 2 c × ? 0 = 2 c {\displaystyle - In set theory, the cardinality of the continuum is the cardinality or "size" of the set of real numbers

R

{\displaystyle \mathbb {R} }

, sometimes called the continuum. It is an infinite cardinal number and is denoted by

c

{\displaystyle {\mathbf {\mathfrak {c}}}}

(lowercase Fraktur "c") or

|

R

|

.

{\displaystyle {\mathbf {|}}{\mathbf {\mathbb {R} }}{\mathbf {|}}.}

The real numbers

R

{\displaystyle \mathbb {R} }

are more numerous than the natural numbers

N

{\displaystyle \mathbb {N} }

. Moreover,

R

{\displaystyle \mathbb {R} }

has the same number of elements as the power set of

N

{\displaystyle \mathbb {N} }

. Symbolically, if the cardinality of

N

{\displaystyle \mathbb {N} }

is denoted as

?

0

{\displaystyle \aleph _{0}}

, the cardinality of the continuum is

This was proven by Georg Cantor in his uncountability proof of 1874, part of his groundbreaking study of different infinities. The inequality was later stated more simply in his diagonal argument in 1891. Cantor defined cardinality in terms of bijective functions: two sets have the same cardinality if, and only if, there exists a bijective function between them.

Between any two real numbers a < b, no matter how close they are to each other, there are always infinitely many other real numbers, and Cantor showed that they are as many as those contained in the whole set of real numbers. In other words, the open interval (a,b) is equinumerous with

R

{\displaystyle \mathbb {R} }

, as well as with several other infinite sets, such as any n-dimensional Euclidean space

R

n

{\displaystyle \mathbb {R} ^{n}}

(see space filling curve). That is,

The smallest infinite cardinal number is

?

0

{\displaystyle \aleph _{0}}

(aleph-null). The second smallest is

?

1

{\displaystyle \aleph _{1}}

(aleph-one). The continuum hypothesis, which asserts that there are no sets whose cardinality is strictly between

?

0

{\displaystyle \aleph _{0}}

and

c

{\displaystyle {\mathfrak {c}}}

, means that

c

=

?

1

{\displaystyle {\mathfrak {c}}=\aleph _{1}}

. The truth or falsity of this hypothesis is undecidable and cannot be proven within the widely used Zermelo–Fraenkel set theory with axiom of choice (ZFC).

Unicode subscripts and superscripts

The Phonetic Extensions Supplement block has several more: Latin/IPA ?, Greek - Unicode has subscripted and superscripted versions of a number of characters including a full set of Arabic numerals. These characters allow any polynomial, chemical and certain other equations to be represented in plain text without using any form of markup like HTML or TeX.

The World Wide Web Consortium and the Unicode Consortium have made recommendations on the choice between using markup and using superscript and subscript characters:

When used in mathematical context (MathML) it is recommended to consistently use style markup for superscripts and subscripts [...] However, when super and sub-scripts are to reflect semantic distinctions, it is easier to work with these meanings encoded in text rather than markup, for example, in phonetic or phonemic transcription.

Fraktur

[z], ?? ?? for unvoiced [s], ??ch? [ž] / ??ch? [š], ?d?ch? [dž] / ?t?ch? [?]), while accents (?à?, ?â?, ?ê?, ?î?, ?ô?, ?û?) together with digraphs (?ah? - Fraktur (German: [f?ak?tu???]) is a calligraphic hand of the Latin alphabet and any of several blackletter typefaces derived from this hand. It is designed such that the beginnings and ends of the individual strokes that make up each letter will be clearly visible, and often emphasized; in this way it is often contrasted with the curves of the Antiqua (common) typefaces where the letters are designed to flow and strokes connect together in a continuous fashion. The word "Fraktur" derives from Latin fr?ct?ra ("a break"), built from fr?ctus, passive participle of frangere ("to break"), which is also the root for the English word "fracture". In non-professional contexts, the term "Fraktur" is sometimes misused to refer to all blackletter typefaces – while Fraktur typefaces do fall under that category, not all blackletter typefaces exhibit the Fraktur characteristics described above.

Fraktur is often characterized as "the German typeface", as it remained popular in Germany and much of Eastern Europe far longer than elsewhere. Beginning in the 19th century, the use of Fraktur versus Antiqua (seen as modern) was the subject of controversy in Germany. The Antiqua–Fraktur dispute continued until 1941, when the Nazi government banned Fraktur typefaces. After Nazi Germany fell in 1945, Fraktur was unbanned, but it failed to regain widespread popularity.

Enclosed C

Enclosed C or circled Latin C (? or ?) is a typographical symbol. As one of many enclosed alphanumerics, the symbol is a "C" within a circle. The symbols - Enclosed C or circled Latin C (? or ?) is a typographical symbol. As one of many enclosed alphanumerics, the symbol is a "C" within a circle.

Numerals in Unicode

context, such as encircled numbers. Not noted is a numbering like "A. B. C." for chapter numbering. Hexadecimal digits in Unicode are not separate characters; - A numeral (often called number in Unicode) is a character that denotes a number. The decimal number digits 0–9 are used widely in various writing systems throughout the world, however the graphemes representing the decimal digits differ widely. Therefore Unicode includes 22 different sets of graphemes for the decimal digits, and also various decimal points, thousands separators, negative signs, etc. Unicode also includes several non-decimal numerals such as Aegean numerals, Roman numerals, counting rod numerals, Mayan numerals, Cuneiform numerals and ancient Greek numerals. There is also a large number of typographical variations of the Western Arabic numerals provided for specialized mathematical use and for compatibility with earlier character sets, such as ² or ?, and composite characters such as ½.

Mathematical Alphanumeric Symbols

? ? ? 01 B ? ? ? ? ? ? ? ? ? ? ? ? ? 02 C ? ? ? ? ? ? ? ? ? ? ? ? ? 03 D ? ? ? ? ? ? ? ? ? ? ? ? ? 04 E ? ? ? - Mathematical Alphanumeric Symbols is a Unicode block comprising styled forms of Latin and Greek letters and decimal digits that enable mathematicians to denote different notions with different letter styles. The letters in various fonts often have specific, fixed meanings in particular areas of mathematics. By providing uniformity over numerous mathematical articles and books, these conventions help to read mathematical formulas. These also may be used to differentiate between concepts that share a letter in a single problem.

Unicode now includes many such symbols (in the range U+1D400–U+1D7FF). The rationale behind this is that it enables design and usage of special mathematical characters (fonts) that include all necessary properties to differentiate from other alphanumerics, e.g. in mathematics an italic letter "?" can have a different meaning from a roman letter "A". Unicode originally included a limited set of such letter forms in its Letterlike Symbols block before completing the set of Latin and Greek letter forms in this block beginning in version 3.1.

Unicode expressly recommends that these characters not be used in general text as a substitute for presentational markup; the letters are specifically designed to be semantically different from each other. Unicode does not include a set of normal serif letters in the set. Still they have found some usage on social media, for example by people who want a stylized user name, and in email spam, in an attempt to bypass filters.

All these letter shapes may be manipulated with MathML's attribute mathvariant.

The introduction date of some of the more commonly used symbols can be found in the Table of mathematical symbols by introduction date.

Enclosed Alphanumeric Supplement

Supplement[1][2] Official Unicode Consortium code chart (PDF) 0 1 2 3 4 5 6 7 8 9 A B C D E F U+1F10x ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? U+1F11x ? ? - Enclosed Alphanumeric Supplement is a Unicode block consisting of Latin alphabet characters and Arabic numerals enclosed in circles, ovals or boxes, used for a variety of purposes. It is encoded in the range U+1F100–U+1F1FF in the Supplementary Multilingual Plane.

The block is mostly an extension of the Enclosed Alphanumerics block, containing further enclosed alphanumeric characters which are not included in that block or Enclosed CJK Letters and Months. Most of the characters are single alphanumerics in boxes or circles, or with trailing commas. Two of the symbols are identified as dingbats. A number of multiple-letter enclosed abbreviations are also included, mostly to provide compatibility with Broadcast Markup Language standards (see ARIB STD B24 character set) and Japanese telecommunications networks' emoji sets. The block also includes the regional indicator symbols to be used for emoji country flag support.