

# Infinity Index



$$x_{t+1} = kx_t(1-x_t)$$

Ever heard of **chaos theory**? A popular example of chaos theory is something the meteorologist Edward Lorenz called the “butterfly effect.” If a butterfly flaps its wings on one side of the world, that simple action could change the weather all the way on the other side of the world. One way scientists and mathematicians show this phenomenon mathematically is with this equation called the logistic map popularized by biologist Robert May in the 1970s.



$$10^{666}!$$

A number of truly epic proportions! The **Leviathan number**, named after the mythical biblical sea monster, is intimidating as can be because it has approximately  $6.656 \times 10^{(668)}$  decimal digits.



$$E = hv$$

The **Planck-Einstein Relation** is an important formula in quantum mechanics stating that the energy of a photon (E) is proportional to its frequency (v) by a constant factor (h). In 1900, the German physicist Max Planck announced a number (Planck’s constant) that describes the behavior of particles and waves. Then in 1905, Einstein went on to connect that number to the particle properties of light, and a world-changing partnership was born!



$$f(x) = ae^{-\frac{(x-b)^2}{2c^2}}$$

The **Gaussian function** is a mathematical function named after the mathematician Carl Friedrich Gauss and is shaped like a bell when graphed. Gaussian functions are used in many fields, including mathematics, chemistry, and statistics, and they are so handy that they can describe things like artificial neural networks, vacuum states, and molecular orbitals.



$$G_{\mu\nu} = 8\pi GT_{\mu\nu}$$

This equation is actually a series of ten equations called **Einstein’s field equations**. As part of the general theory of relativity, the field equations look at gravity and the distribution of matter in the context of the space-time continuum.



$$e^{i\pi} + 1 = 0$$

**Euler’s Identity**, named after the mathematician Leonhard Euler, is considered to be one of the most beautiful mathematical equations! What does beautiful math look like? It’s like a perfect platter of snacks: the basic operations and fundamentals of mathematics are all laid out in this elegant form—if you know what you’re looking at.



6.022 x 10<sup>23</sup>

The **Avogadro constant** represents the number of atoms or molecules found in one mole of any substance. Basically, the volume of a substance is proportionally related to the number of particles that are in it. In 1811, Italian scientist Amadeo Avogadro proposed this theory, and other scientists ran with it. Unfortunately, Avogadro died a few years before the constant's value was actually determined.



$\Delta S \geq 0$

While the first law of thermodynamics states that energy cannot be created or destroyed, the **second law of thermodynamics** determines the direction that energy moves in a system. For instance, a ball rolls downhill naturally but not uphill and heat will always flow from higher temperature to lower temperature. The entropy (S) in a closed system cannot decrease with time.



A **whole note rest** in musical notation.



1973

The **year** the author was born.



$i\hbar\gamma^\mu\partial_\mu\psi - mc\psi = 0$

Another beautiful equation, this time in physics! The **Dirac Equation**, discovered in the 1920s by physicist Paul Dirac, brings together quantum mechanics and relativity in an elegant, simple way. It describes how particles behave when they travel close to the speed of light.



111

Is 111 your lucky number? In some mystical traditions the number **111**, also known as the **Angel Number**, shows up as a sign you're on the right path. A combination of 1 plus 11, both important numbers in numerology, 111 can symbolize spiritual awakening and enlightenment and can be associated with optimism, starting anew, intuition, and illumination.



44

In quiniela, a game in Argentina similar to the lottery here in the US in which people choose a number to win big prizes, each number 0-99 has a corresponding image. The meaning attached to the number **44** in quiniela is jail.



$K = 100$

In four-color printing—used for this book, in fact!—CMYK stands for the ink colors cyan, magenta, yellow, and black. Different percentages of each ink are combined to create the full range of tones printed on each page. **K = 100** means pure, or 100%, black.



$\lambda = h/p$

In 1924 Louis de Broglie posited that matter behaves like a wave. This is now known as the **de Broglie hypothesis**. The wavelike behavior he referred to can be calculated with three different numbers: wavelength, momentum (mass times velocity), and Planck's constant.



Å

**Angstrom**, also a letter in the Swedish alphabet, is a unit of length used to measure wavelengths of light equal to 0.1 nanometer.



$$\varepsilon = \omega^\varepsilon$$

In set theory, **Cantor's equation** uses the lowercase Omega symbol (last letter of the Greek alphabet) to prove infinite numbers of infinities. Georg Cantor's work in the field, in the late 1800s, was both controversial and foundational to the development of set theory.



2HB

**2HB** stands for good, old-fashioned pencil lead. Well, technically, the H stands for hard and the B for black. The higher the number before HB, the lighter its mark on paper will be.



57%

The **percentage of time** the author puts down a book without finishing it!



$$i\hbar \frac{d}{dt} |\Psi(t)\rangle = \hat{H} |\Psi(t)\rangle$$

A huge breakthrough in quantum mechanics, sort of like Newton's second law in classical mechanics, the **Schrödinger equation** predicts the way an atom will behave in quantum mechanical system based on certain conditions. You guessed it, the equation was named after the physicist who developed it, Erwin Schrödinger, who won a Nobel Prize for this work in 1933.



$$E = mc^2$$

Maybe the most famous equation ever,  $E=mc^2$  was created by Albert Einstein to describe his **special theory of relativity**: that mass and energy are equivalent. To describe the equation in words, the energy of a system is equal to its mass times the speed of light squared.



$$n_i + 1 = 1$$

Can numbers be happy? **Happy numbers** are actually numbers that eventually reach the number one when you replace the number with the sum of the square of each of its digits. So, for example, 7 is a happy number. Here's why:  $7^2=49$ ,  $4^2+9^2=97$ ,  $9^2+7^2=130$ ,  $1^2+3^2+0^2=10$ , and finally  $1^2+0^2=1$ . If you can't arrive at one, you have yourself an unhappy number.



$$\Phi = 1.6180339887$$

The **Golden Ratio**, also known as the Greek letter *phi*, appears in many patterns in nature and has been used in mathematics, art, and architecture since the days of the ancient Greeks. It's an irrational number, meaning it goes on forever if given the chance. Geometrically, it shows the ratio between segments of a line related to the whole. Many thinkers across the ages have believed that the Golden Ratio creates the most perfect proportions—Leonardo da Vinci called it the Divine Ratio for this very reason.



$$v = H_0 d$$

When Edwin Hubble discovered that the universe is expanding, he also discovered that the farther away objects are from Earth, the faster they are moving away

from us. This idea became **Hubble's law**, demonstrating how distant galaxies are moving, and is used today as evidence of the Big Bang model. Objects observed in deep space have redshifts (changes in wavelength) and these shifts are proportional to the objects' distance from earth.



**B 612**

The asteroid the little prince lived on.



**3.14159265358979323846**

**Pi** is an ancient mathematical constant that was only approximated until the 14th century when Indian mathematics described the exact formula. In the 1700s, it was first described as the ratio of a circle's circumference to its diameter. Because Pi is an irrational number, it cannot be shown as a fraction, and its decimal form never ends and never repeats a pattern, but it starts like this: 3.14159265358979323846264338327950288419716939937510...