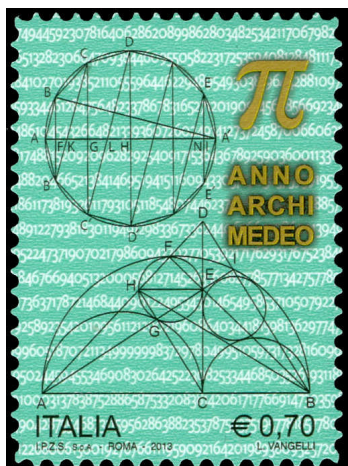


# Pi Day

by John Walter



Stamp issued by Italy in 2013 honoring the 2300<sup>th</sup> anniversary of the birth of Archimedes

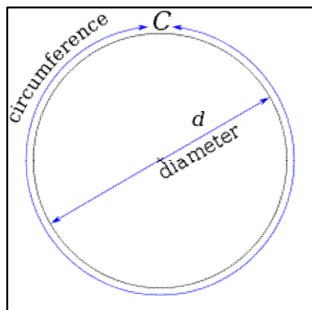
The number  $\pi$  is a mathematical constant, the ratio of a circle's circumference to its diameter, commonly approximated as 3.14159. It has been represented by the Greek letter " $\pi$ " since the mid-18th century, though it is also sometimes spelled out as "pi".

Being an irrational number,  $\pi$  cannot be expressed exactly as a common fraction, although fractions such as  $22/7$  and other rational numbers are commonly used to approximate  $\pi$ . Consequently its decimal representation never ends and never settles into a permanent repeating pattern. Also,  $\pi$  is a transcendental number – a number that is not the root of any non-zero polynomial having rational coefficients. This

transcendence of  $\pi$  implies that it is impossible to solve the ancient challenge of squaring the circle with a compass and straightedge.

Although ancient civilizations needed the  $\pi$  to be computed accurately for practical reasons, it was not calculated to more than seven digits, using geometrical techniques, in Chinese mathematics and to about five in Indian mathematics in the 5th century. The historically first exact formula for  $\pi$ , based on infinite series, was not available until a millennium later, when in the 14th century the Madhava–Leibniz series was discovered in Indian mathematics. In the 20th and 21st centuries, mathematicians and computer scientists discovered new approaches that, when combined with increasing computational power, extended the decimal representation of  $\pi$  to, as of late 2013, over 13.3 trillion ( $10^{13}$ ) digits. Scientific applications generally require no more than 40 digits of  $\pi$  so the primary motivation for these computations is the human desire to break records. However, the extensive calculations involved have been used to test supercomputers and high-precision multiplication algorithms.

Because its definition relates to the circle,  $\pi$  is found in many formulae in trigonometry and geometry, especially those concerning circles, ellipses or spheres. It is also found in formulae used in other branches of science such as cosmology, number theory, statistics, fractals, thermodynamics, mechanics and electromagnetism. The ubiquity of  $\pi$  makes it one of the most widely known mathematical constants both inside and outside the scientific community: Several books devoted to it have been published, the number is celebrated on Pi Day and record-setting calculations of the digits of  $\pi$  often result in news headlines. Attempts to memorize the value of  $\pi$  with increasing precision have led to records of over 67,000 digits.



The circumference of a circle is slightly more than three times as long as its diameter. The exact ratio is called  $\pi$ .

**Pi Day** is an annual celebration commemorating the mathematical constant  $\pi$  (pi). Pi Day is observed on March 14 (or 3/14 in the *month/day* date format), since 3, 1, and 4 are the first three significant digits of  $\pi$  in decimal form. In 2009, the United States House of Representatives supported the designation of Pi Day.

Pi Day will have special significance on 3/14/15 at 9:26:53 a.m. and p.m., with the date and time representing the first 10 digits of  $\pi$ . That same second will also contain a precise instant corresponding to *all* of the digits of  $\pi$ . However, some argue that 9:26:54 a.m. and p.m. on 3/14/15 are more accurate because of the 11th digit of  $\pi$  being 5, which would cause the 10th digit to round up to 4. Postmarks no longer include the time, but making your own cover with the 10 digit  $\pi$  will make a nice souvenir.