IRJSE International Research Journal of Science & Engineering

Int. Res. J. of Science & Engineering, Volume 9 (5) 2021
ISSN: 2322-0015

SJIF Impact Factor 6.70

RESEARCH REPORT OPEN ACCESS

A Short Note On Mathematical Constant pi (π)

Rupesh Rambhau Atram

M.Sc Mathematics , B.Ed , SET
Mob 8999048630
Email rupeshatram10@gmail.com

Manuscript Details

Received :27.11.2021
Accepted: 27.12.2021
Published: 30.12.2021

Available online on https://www.irjse.in
ISSN: 2322-0015

Cite this article as:

Rupesh Rambhau Atram. A Short Note On Mathematical Constant pi (π), *Int. Res. Journal of Science & Engineering*, 2021, Volume 9(6): 187-189.

Abstract

The Interest of this paper is the curiosity behind the most beautiful irrational number in the field of mathematics that is pi π, the purpose of this paper is to highlight the historical evidence behind pi .

Keywords: pi, approximate value

Introduction

The ancient Babylonians calculated the area of a circle by taking 3 times the square of its radius, which gave a value of pi = 3. One Babylonian tablet (ca. 1900–1680 BC) indicates a value of 3.125 for pi, which is a closer approximation. In the Egyptian Rhind Papyrus (ca.1650 BC), there is evidence that the Egyptians calculated the area of a circle by a formula that gave the approximate value of 3.1605 [1]

A similar approach was used by Zu Chongzhi (429–501), a brilliant Chinese mathematician and astronomer. Zu Chongzhi would not have been familiar with Archimedes' method—but because his book has been lost, little is known of his work [2]. He calculated the value of the ratio of the circumference of a circle to its diameter to be 355/113. To compute this accuracy for pi, he must have started with an inscribed regular 24,576-gon and performed lengthy calculations involving hundreds of square roots carried out to 9 decimal places [3]. Mathematicians began using the Greek letter π in the 1700s. Introduced by William Jones in 1706, use of the symbol was popularized by Euler, who adopted it in 1737. [4] An 18th century French mathematician named Georges Buffon devised a way to calculate pi based on probability. You can try it yourself at the Exploratorium exhibit Throwing Pi.

Continued fractions

As an irrational number, π cannot be represented as a common fraction But every number, including π, can be represented by an infinite series of nested fractions, called a continued fraction. [5]

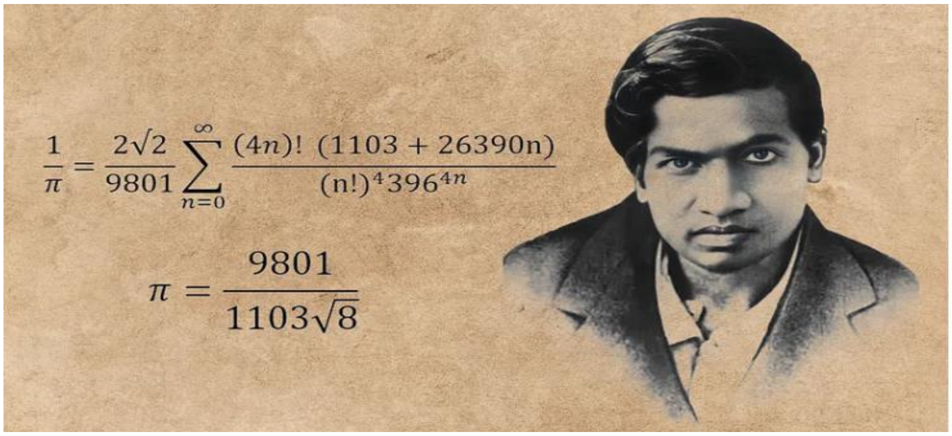
$$\pi = 3 + \cfrac{1}{7 + \cfrac{1}{15 + \cfrac{1}{1 + \cfrac{1}{292 + \cfrac{1}{1 + \cfrac{1}{1 + \cfrac{1}{1 + \ddots}}}}}}}$$

The first Recognition of pi

The first recorded algorithm for rigorously calculating the value of π was a geometrical approach using polygons, devised around 250 BC by the Greek mathematician Archimedes This polygonal algorithm dominated for over 1,000 years, and as a result π is sometimes referred to as Archimedes' constant Archimedes computed upper and lower bounds of π by drawing a regular hexagon inside and outside a circle, and successively doubling the number of sides until he reached a 96-sided regular polygon. By calculating the perimeters of these polygons, he proved that $223/71 < \pi < 22/7$ (that is, $3.1408 < \pi < 3.1429$) Archimedes' upper bound of 22/7 may have led to a widespread popular belief that π is equal to 22/7. Around 150 AD, Greek-Roman scientist Ptolemy in his *Almages* , gave a value for π of 3.1416, which he may have obtained from Archimedes or from Apollonius of Perga. Mathematicians using polygonal algorithms reached 39 digits of π in 1630, a record only broken in 1699 when infinite series were used to reach 71 digits.
In ancient China , values for π included 3.1547 (around 1 AD), *(100 AD, approximately 3.1623), and* 142/45 (3rd century, approximately 3.1556).[Around 265 AD, the Wei Kingdom mathematician Liu Hui created a polygon-based iterative algorithm and used it with a 3,072-sided polygon to obtain a value of π of 3.1416.Liu later invented a faster method of calculating π and obtained a value of 3.14 with a 96-sided polygon, by taking advantage of the fact that the differences in area of successive

Ramanujan Work On pi

Modern π calculators do not use iterative algorithms exclusively. New infinite series were discovered in the 1980s and 1990s that are as fast as iterative algorithms, yet are simpler and less memory intensive. The fast iterative algorithms were anticipated in 1914, when Indian mathematician Srinivasa Ramanujan published dozens of innovative new formulae for π, remarkable for their elegance, mathematical depth and rapid convergence. One of his formulae, based on modular equations [7]



Pi in Complex Number and Eulers Identity

Any complex number say *z*, can be expressed using a pair of real numbers. In the polar coordinate system one number (radius or *r*) is used to represent *z*'s distance from the origin of the complex plane, and the other (angle or *φ*) the counter-clockwise rotation from the positive real line.

$$\mathbb{Z} = r\,(cos\theta + isin\theta)$$

The appearance of π in the behavior of exponential function of a complex variable described by Eulers.

$$e^{i\theta} = cos\theta + isin\theta$$

Conclusion

With considering the above mathematical theories and concepts for mathematical constant pi.

I can observe that it is most important irrational number, constant in mathematics having wide application in Algebra, Geometry, Trigonometry, and many other Applied Sciences. Nowadays lots of research work is going on. This pi existence in mathematics is the gift from God to the human civilization.

References

1. Gupta, R. C. (1992). "On the remainder term in the Madhava–Leibniz's series". Ganita Bharati.14 (1-4): 68–71.
2. salikhov, V. (2008). "On the Irrationality Measure of pi". Russian Mathematical Surveys. 53 (3): 570–572.
3. Maor, Eli (2009). E: The Story of a Number. Princeton University Press. p. 160.
4. The life of π: from Archimedes to ENIAC and beyond". In Sidoli, Nathan; Van Brummelen, Glen (eds.). From Alexandria, through Baghdad: Surveys and studies in the ancient Greek and medieval Islamic mathematical sciences in honor of J. L. Berggren. Heidelberg: Springer. pp. 531–561.
5. Finch, S. R. (2003). Mathematical constants. Cambridge university press.
6. Bailey, D. H. (1988). Numerical results on the transcendence of constants involving *π*, *e*, and Euler's constant. Mathematics of Computation, 50(181), 275-281.
7. Baruah, N. D., Berndt, B. C., & Chan, H. H. (2009). Ramanujan's series for 1/π: a survey. The American Mathematical Monthly, 116(7), 567-587.