

On Pascal's Triangle (3035 Words)

Word Count: 3035

Original Abstract:

Blaise Pascal was a French mathematician and philosopher. He was a child prodigy in mathematics and wrote an essay on conic sections at the age of 16. He made many contributions to mathematics, including creating an early calculator called the “Pascaline” and laying the groundwork for the formulation of calculus through his development of probability theory.

Maybe his most famous mathematical contribution is his *Treatise on the Arithmetical Triangle*, where he explains “Pascal’s Triangle.” Pascal’s Triangle is a triangular system of numbers in which each number is the sum of the numbers above it. It is a pattern that is found in many areas of mathematics. Specifically, the number pattern in Pascal’s Triangle is observed in binomial expansions and combinations.

There is, however, some confusion as to who really discovered this number pattern first. Multiple other mathematicians, such as Indian Halayudha, Persian Omar Khayyam, and Chinese Yang Hui, discussed this triangle in their own works throughout history.

Original Outline:

- Blaise Pascal Biography
 - Early/Personal Life – born in 1623; child prodigy in mathematics; essay on conic sections (*Essai pour les coniques*) in 1640; Christian theologian
 - Contributions to mathematics – built an early calculator (the Pascaline) for his father; developed probability theory; laid groundwork for Leibniz’ formulation of calculus; studied “Pascal’s Triangle”
- Pascal’s Triangle
 - What is it? – triangular system of numbers in which each number is the sum of the numbers above it
 - Pascal’s explanations/contributions – *Treatise on the Arithmetical Triangle*
- Other versions of Pascal’s Triangle
 - Halayudha – it is believed that Indian mathematician Halayudha first described “Pascal’s Triangle”
 - Khayyam Triangle – Persian mathematician Omar Khayyam explains binomial expansion in *The Difficulties of Arithmetic*
 - Yang Hui’s Triangle – Chinese mathematician Yang Hui described “Pascal’s Triangle” in *A Detailed Analysis of the Nine Chapters on the Mathematical Procedures*

- Tartaglia's Triangle – Italian mathematician Niccolò Fontana Tartaglia published the triangle in *General Treatise on Number and Measure*
- Applications
 - Binomial expansions – explain the relationship between Pascal's Triangle and binomial expansions
 - Combinations – explain the relationship between Pascal's Triangle and combinations (“n choose k”)

Math Point: combinations and binomial coefficients as explained in Pascal's *Traité du triangle arithmétique*

Book:

Edwards, A. W. F. “Pascal's Work on Probability.” In *The Cambridge Companion to Pascal*, edited by Nicholas Hammond, 40–52. Cambridge: Cambridge University Press, 2003.

Primary Source:

Pascal, Blaise. *Traité du triangle arithmétique, avec quelques autres petits traitez sur la mesme matière*. Paris: Guillaume Desprez, 1665.

Secondary Source:

Cobeli, Cristian, and Alexandru Zaharescu. "Promenade around Pascal Triangle — Number Motives." *Bulletin Mathématique de la Société des Sciences Mathématiques de Roumanie, Nouvelle Série*, 56 (104), no. 1 (2013): 73-98. Accessed November 18, 2020. <http://www.jstor.org/stable/43679285>.