

25-Feb-2025

Term 1/Week 4

## Early History of Mathematics

Brahma Gupta (598 - 668 AD)

- Mathematics was quite evolved in India by the time of Brahma Gupta.
- However, a comprehensive manuscript (book) written by him has miraculously survived.
- He authored a book called "Brahma Sphuta Siddhanta" (Correctly developed Doctrine of God!) in 628 AD at age 30 years!

- 3 -

An immediate outcome was the spread of decimal number system used in the texts.

Consequently, the mathematician Al-Khwarizmi (800-850 AD) wrote a text called

"Hisal-al-Hind" (Arithmetic of Hindus!)

By about 13<sup>th</sup> century, it was translated into Latin and called "Algorithmi de Numero Indorum" (Algorithms of Indian Numbers).

The above resulted in the famous book by Italian mathematician "Leonardo Fibonacci" (1170-1250 AD)

The book consists of 24 chapters with a total of 1008 verses.

It included chapters on Algebra, geometry, trigonometry and a good deal of astronomy.

In 774/775 AD an astrologer called Kanaka, visited the court of Caliph Al-Mansur (Iraq?) with various astronomical texts.

Brahma Gupta's texts were translated into Arabic by Mohammad Ibn Ibrahim Al-Fazari - an astronomer in Al-Mansur's court.

- 4 -

The book is called, "Liber Abaci - Modus Indorum" (Book of Calculation - the Method of Indians)

This book introduced the decimal system into Europe and the Era of modern mathematics started!

Fibonacci is well known for Fibonacci Numbers and the Golden triangle

Fibonacci Numbers

0, 1, 1, 2, 3, 5, 8, 13, 21, ...

Starting Numbers

Sum of previous 2 nos.

• Fibonacci conceived this sequence considering the reproduction of rabbits!

• Problem Definition

- Start with a male & female rabbit
- Each pair take one month to mature & produce another pair following month
- Rabbit never die!

Home work

• How many pair of rabbits will be there after one year (12 months)

• Surprisingly, Fibonacci numbers occur quite frequently in natural formations

- spiral patterns in pine cones, pine apples, nautilus shells etc
- Flower petals
- spiral of the galaxy etc.

• It is often thought to be the nature's secret code!

• The ratio of the Fibonacci numbers were popular in Greek and Egyptian architecture!

• It is called the "Golden Ratio" ( $\phi$  or Phi)

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, ...

$\frac{1}{1}$   $\frac{2}{1}$   $\frac{3}{2}$   $\frac{5}{3}$   $\frac{8}{5}$   $\frac{13}{8}$   $1.615$   $1.619$

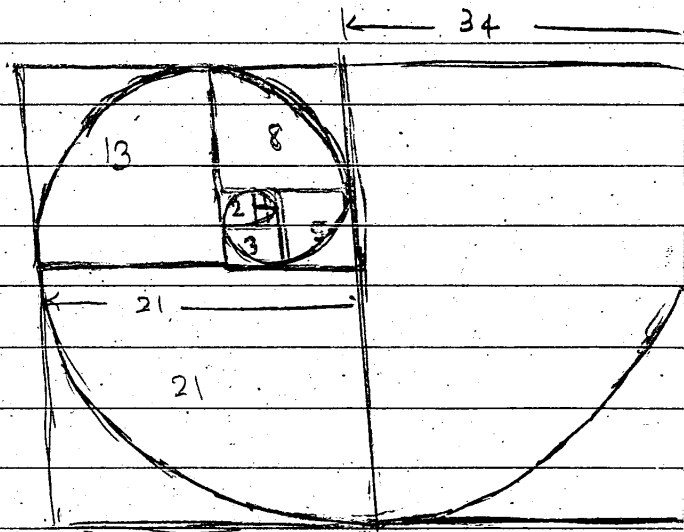
= 1   = 2   = 1.5   = 1.666...   = 1.6   = 1.625

• The ratio finally extends to an irrational number

$\phi = 1.618033988 \dots$

$\approx 1.618$

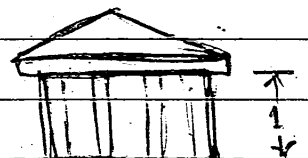
Fibonacci Spiral is obtained by plotting Fibonacci numbers as squares.



Golden Ratio ( $\phi$ )

Rectangle

$\phi = 1.618$



Very popular in Architecture  $\leftarrow 1.618 \rightarrow$