L16 – 03/10/2024

Aryabhatta

There are atleast 2 mathematicians of the same name.

1. Aryabhatta of Kusumapura (~ 499 AD)
2. Aryabhatta who wrote Aryasiddhanta or Maharyasiddhanta (~ 950 AD) (astronomical treatise)

There is some evidence regarding the existence of an Aryabhatta prior to Aryabhatta of Kusumapura

- Al-Biruni (Persian historian) ~ 1050 AD mentions 2 Aryabhatta - one of Kusumapura & the other who is elder.

- Also, he wasn't aware of the author of Aryasiddhanta.

- But, his work is known to contain errors.

- His references to the 2 Aryabhatta are both from the same book - Aryabhatiya leading to confusion.

- Aryabhatta of Aryasiddhanta mentions a quote in his work along the lines of :

'A long time has elapsed since the elderly Aryabhatta propounded his theory and hence it contains specific errors. Hence, I resay in my own terms'

But, Aryasiddhanta and Aryabhatiya are different in flavour.
Hence, the 'Aryabhatta' here does <u>not</u> seem the one of Kusumapura.

- Brahmagupta (~628 AD) fiercely critisizes Aryabhatiya in the beginning of his text & later speaks of reverence of Aryabhatta.

Aryabhatta of Kusumapura

- Born in Kerala (476 AD)
- Wrote Aryabhatiya (499 AD)
- Aryabhatiya is a relatively small text with 108 shlokas. (in Aryavritta chandas).

- 3 parts : Ganita, Kalakriya, Goda. (sphere)
- Topics :
  1. Enumeration (via alphabets)
  2. Cube roots
  3. Summations
  4. Approx. of π
  5. Trigonometry

6. Linear Diophantine Eq^{n}s

(integer sol^{n}s to $ax + by = c$, $(a, b, c) \in \mathbb{Z}^3$
this method is called 'Kuttaka')

After the discovery of Jain texts & the Bhakshali manuscript, some of these cannot be attributed to Aryabhatta.

But, 4, 5, 6 still stand to his credit

1. Enumeration

In Devanagari script,

25 Vargiya consonants - Ka, Kha, Ga ...
9 Avargiya consonants - Ya, Ra, La ...
10 vowels - A, Aa, E, Ee ...

Assign VC - 1 to 25
AC - 30, 40, 50 ..
V - 10^0, 10^1, 10^2 ...

eg - Khya - $\underbrace{\text{Kha}}_{2} + \underbrace{\text{Ya}}_{30} = 32$

Khyu - $(\underbrace{\text{Kha}}_{2} + \underbrace{\text{Ya}}_{30}) \cdot \underbrace{\text{U}}_{10^5} = 32 \cdot 10^5$

Ghoo - $(\underbrace{\text{Gha}}_{4}) \cdot \underbrace{\text{oo}}_{10^6} = 4 \cdot 10^6$

2. Summation

- $\sum n^2 = \frac{1}{6} n(n+1)(2n+1)$
- $\sum n^3 = \left(\frac{n(n+1)}{2}\right)^2$
- $1 + (1+2) + (1+2+3) + \cdots$

  $= \sum\sum n = \frac{1}{6} n(n+1)(n+2)$

4. Approx. to π - 3.1416

(given in the form that circumference of circle with diameter 20000 is 62832)

He also mentions that this is just an approx. & that π is maybe irrational.