L27 - 08/11/2024

Characteristics of Leibniz's Math

1. His strength was identification of concepts as against their technical devp.

   eg - Notations : d/dx & $\int$

2. Introduced the word 'function'
   algebraic v/s transcendental

3. Preferred closed form rather than infinite series.

   From his perspective, $\int f(x)\,dx$ involved finding a fx^n F (antiderivative) s.t $F' = f$

- The search for such closed forms lead to a 'wild goose chase' but, integration of rational fx^{n}s lead to factoring of polynomials.

- Integration of $\int \frac{dx}{\sqrt{1-x^4}}$ lead to the theory of elliptic curves

Newton

- Born : 1642 in Woolsthope, Lincolnshire, England
- Tough early years
- Initial interest in Mechanics such as windmills, later academics
- Entered Trinity College, Cambridge ~ 1661 as a 'sizar' (students who earn their keep by serving wealthier students)

- Early studies : Aristotle, Descartes
- By 1664, he prepared notes 'Questiones Quaedem Philosophicae'. Mechanics, Optics & philosophy of vision

- 1665 : Plague in England Newton returned to Woolsthope & was absorbed in research

- 1664 to 1666 : Most creative period for Newton his first papers appeared (De Analysi, De Methodis)

- 1669: Lucasian Professor of Mathematics

- 1687: Principia Mathematica
  Theory of gravitation, elliptic loci of orbits

Leibniz

- Born: 1646, Leipzig, Germany
- Both parents were academics
- Access to father's library
- At 15, University of Leipzig & doctorate from Aldorf in Law 1666.
- 1663: Visited Jena, Germany
  studied Euclid
- 1672 – 1676: Crucial in Math
  - Pascal's triangle ~ 1666
  - Met Huygens

$$\sum_{n=1}^{\infty} \frac{1}{n(n+1)} = \sum_{n=1}^{\infty} \frac{1}{n} - \frac{1}{n+1}$$

- 1673: $\pi/4 = 1 - 1/3 + 1/5 \ldots$

$$1/2 \log(2) = \frac{1}{2 \cdot 4} + \frac{1}{6 \cdot 8} + \ldots$$

- De Arta Combinatoria ~ 1666
  - Systemically deduce all true statements
  - Identified by Leibniz & later developed by Hilbert, Gödel ..

  - Again, did not delve 'deep' into these but identified these concepts.