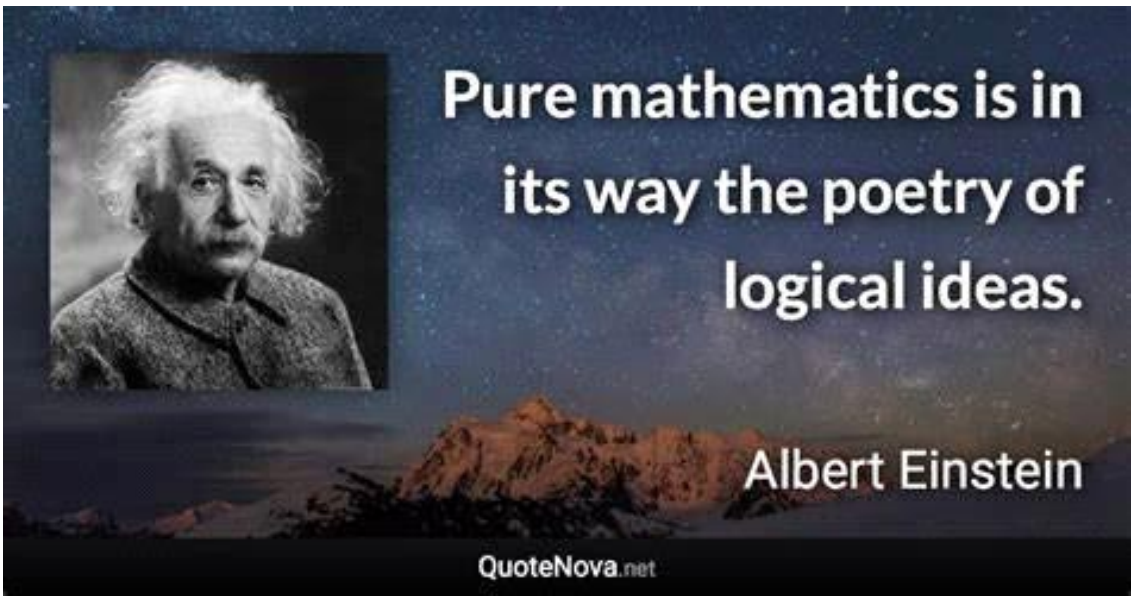
Introduction & Motivation

Saturday, 17 August 2024 12:35 pm

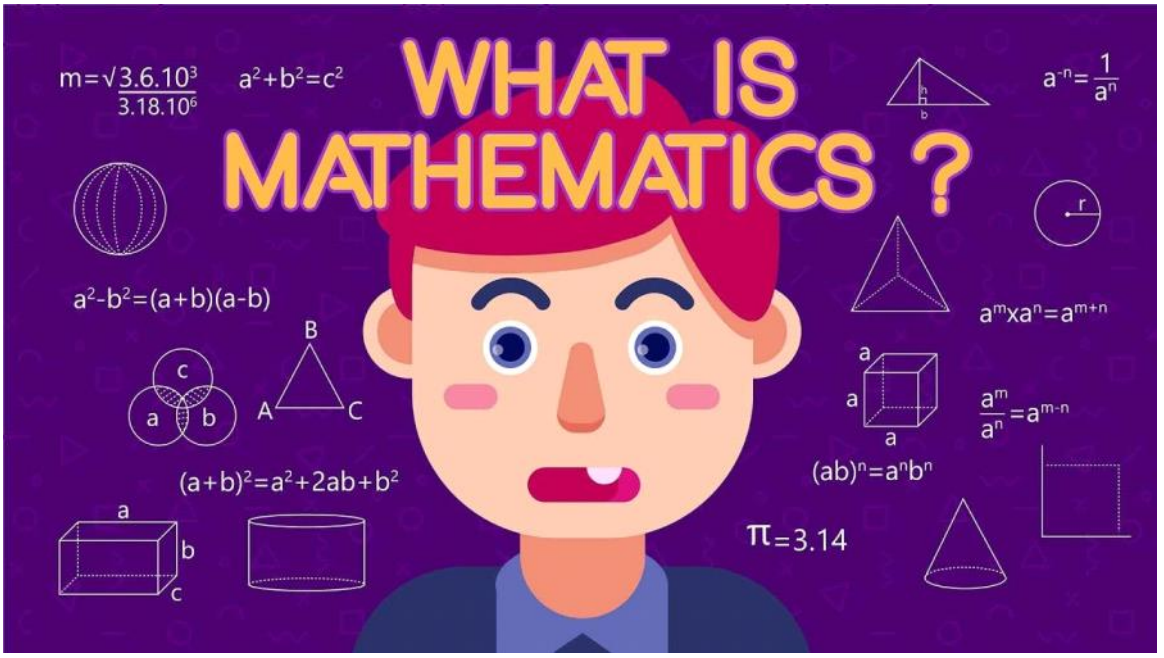


Theorem 1.1. *If $A \subseteq B$ and $B \subseteq A$ then $A = B$.*

من تو شدم تو من شدی من تن شدم تو جاں شدی
تاکس نگوید بعد ازیں من دیگرم تو دیگری

Mun tu shudam tu mun shudi,mun tun shudam tu jaan shudi
Taakas na guyad baad azeen, mun deegaram tu deegari

I have become you, and you me,
I am the body, you soul;
So that no one can say hereafter,
That you are are someone, and me someone else.



The word *mathematics* comes from Ancient Greek *máthēma* (*μάθημα*), meaning "that which is learnt", "what one gets to know", hence also "study" and "science".

Its adjective is *mathēmatikós* (μαθηματικός), meaning "related to learning" or "studious", which likewise further came to mean "mathematical".

Similarly, one of the two main schools of thought in Pythagoreanism was known as the *mathēmatikoi* (μαθηματικοί)—which at the time meant "learners" rather than "mathematicians" in the modern sense.

What is Calculus?

Calculus, originally called **infinitesimal calculus** or "the calculus of infinitesimals", is the mathematical study of continuous change.

> Infinitesimal calculus was developed independently in the late 17th century by Isaac Newton and Gottfried Wilhelm Leibniz.

Gottfried Wilhelm Leibniz was the first to state clearly the rules of

Gottfried Wilhelm Leibniz was the first to state clearly the rules of calculus.

Isaac Newton developed the use of calculus in his laws of motion and gravitation.

Egypt

Calculations of volume and area, one goal of integral calculus, can be found in the Egyptian Moscow papyrus (c.1820 BC),

Greece

Laying the foundations for integral calculus and foreshadowing the concept of the limit, ancient Greek mathematician Eudoxus of Cnidus (c.390 – 337 BC) developed the method of exhaustion to prove the formulas for cone and pyramid volumes

China

The method of exhaustion was later discovered independently in China by Liu Hui in the 3rd century AD in order to find the area of a circle

Middle East

In the Middle East, Hasan Ibn al-Haytham, Latinized as Alhazen (c.965 – c.1040 AD) derived a formula for the sum of fourth powers. He used the results to carry out what would now be called an integration of this function, where the formulae for the sums of integral squares and fourth powers allowed him to calculate the volume of a paraboloid.[14]

India

In the 14th century, Indian mathematicians gave a non-rigorous method, resembling differentiation, applicable to some trigonometric functions. Madhava of Sangamagrama and the Kerala School of Astronomy and Mathematics thereby stated components of calculus.

Applications

Calculus is used in every branch of the physical sciences, actuarial science, computer science, statistics, engineering, economics, business, medicine, demography, and other fields wherever a problem can be mathematically modeled and an optimal solution is desired.