INDIA'S FASCINATION WITH MATHEMATICS - FROM A HISTORICAL VIEWPOINT

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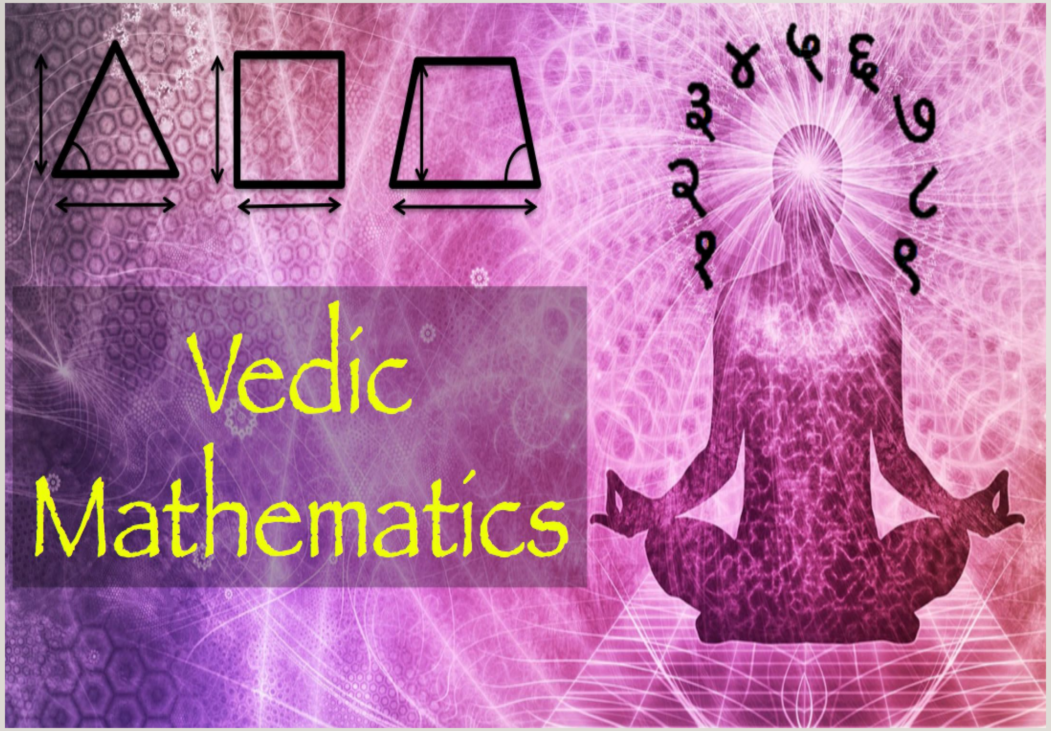
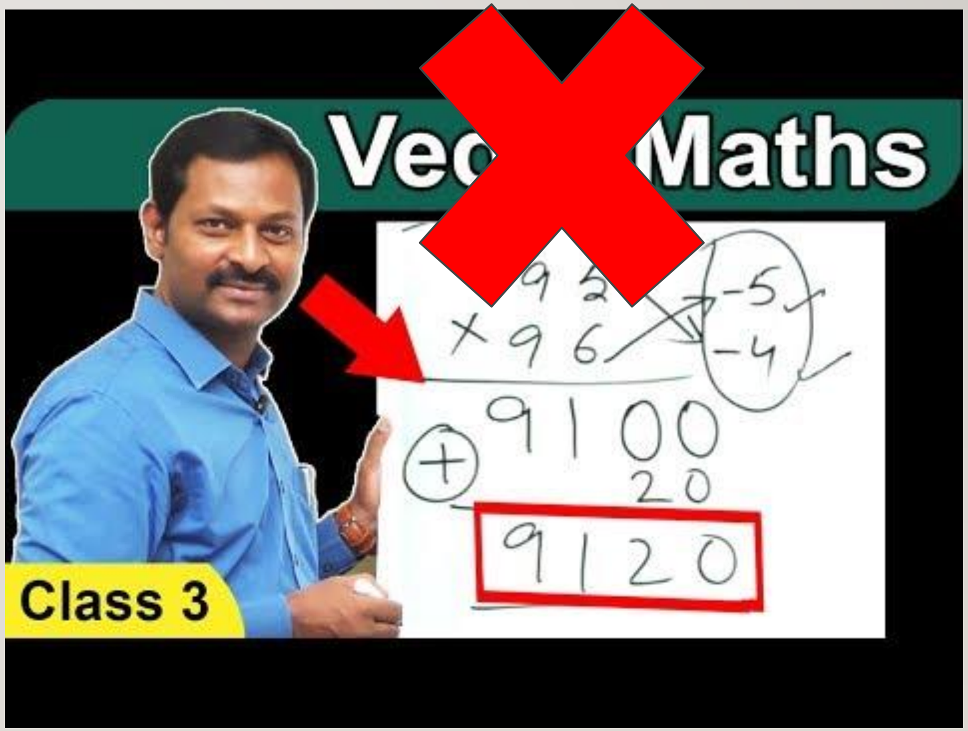
VEDIC PERIOD





S G Dani, Myths and reality : On 'Vedic Mathematics', Frontline, Vol 10, No. 21, Oct 22, 1993, pp. 90-92 and Vol 10, No. 22, Nov 5, 1993, pp. 91-93.

VEDIC PERIOD

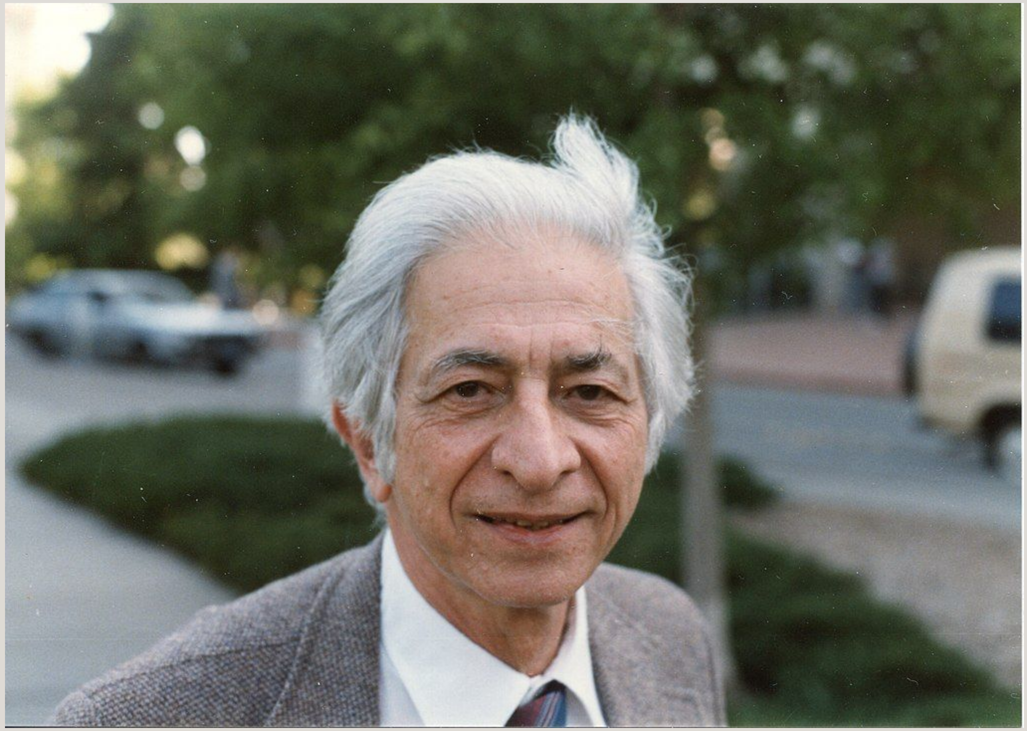
Mathematics, in its early stages, developed mainly along two broad overlapping traditions:

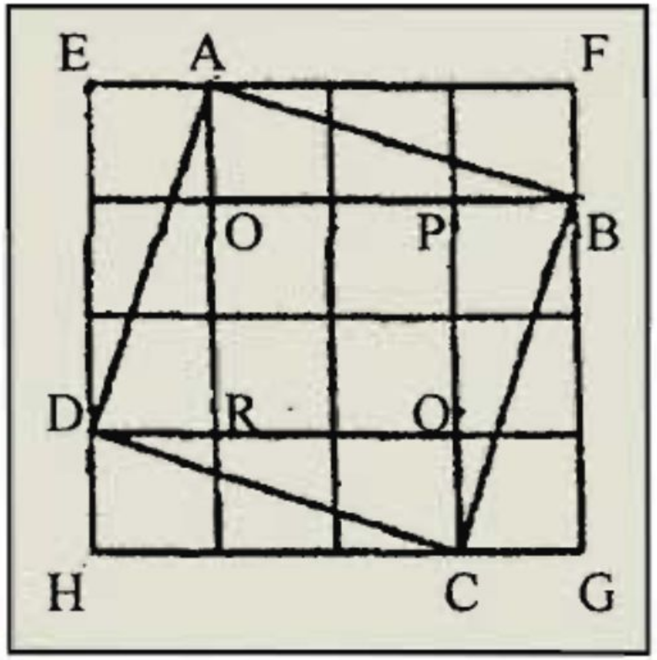
(i) Geometric (ii) Arithmetic and Algebraic

Meanwhile Egyptians and the Babylonians had progressed essentially along the computational tradition

ABRAHAM SEIDENBERG,

An Eminent Algebraist And Historian Of Mathematics
Traced The Origin Of Sophisticated Mathematics To The Originators Of The Rigvedic Rituals. See [3; 4].





From the KĀTYĀYANA sulba.

The oldest known mathematics texts in existence are the Sulba-sutras of Baudhayana, Apastamba and Katyayana which form part of the literature of the Sutra period of the later Vedic age.

The Sulbasutras had been estimated to have been composed around 800 BC (some recent researchers are suggesting earlier dates).

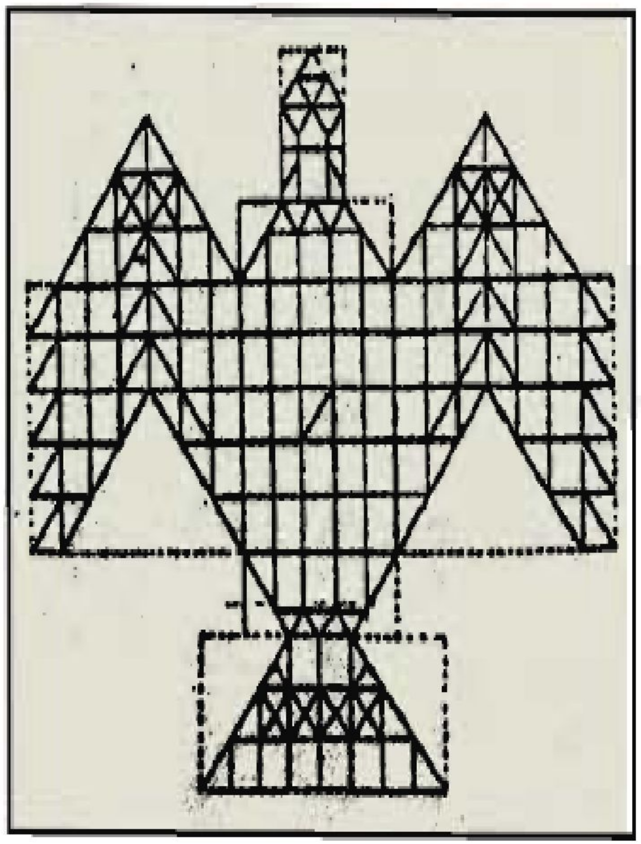
Two pillars of plane geometry applications (i) ‘Pythagoras theorem’ and (ii) the properties of similar figures.

*Sulbasutras: E*xplicit statement of the Pythagoras’ theorem and its applications in various geometric constructions.

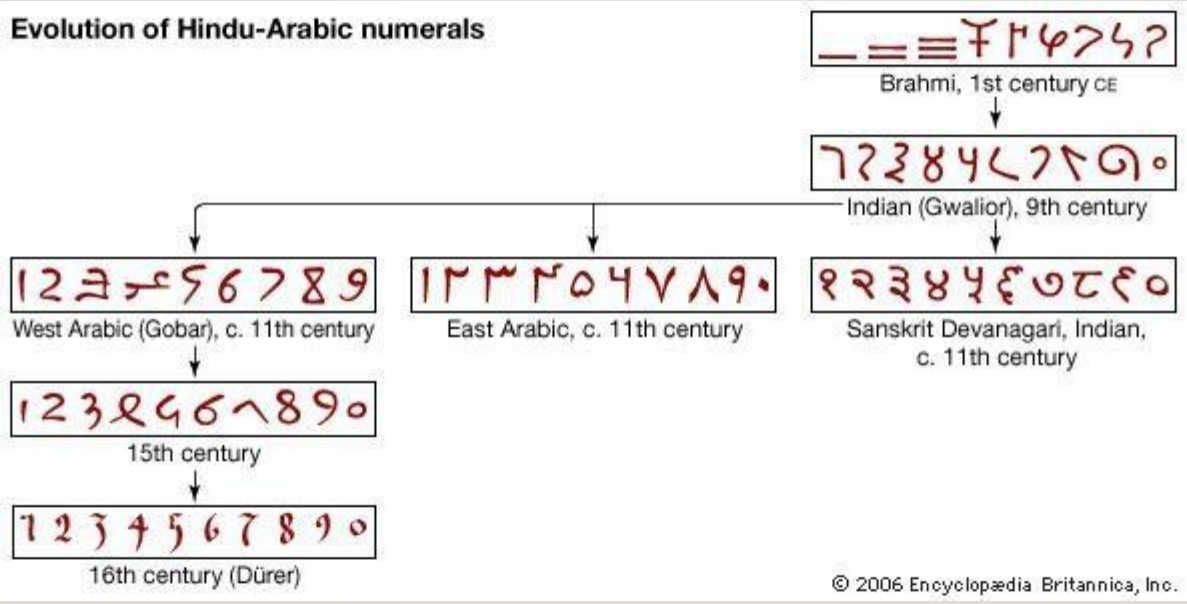
Even reflect a blending of geometric and subtle algebraic thinking and insight which we associate with Euclid.

In fact, the Sulba construction of a square equal in area to a given rectangle is exactly the same as given by Euclid several centuries later!

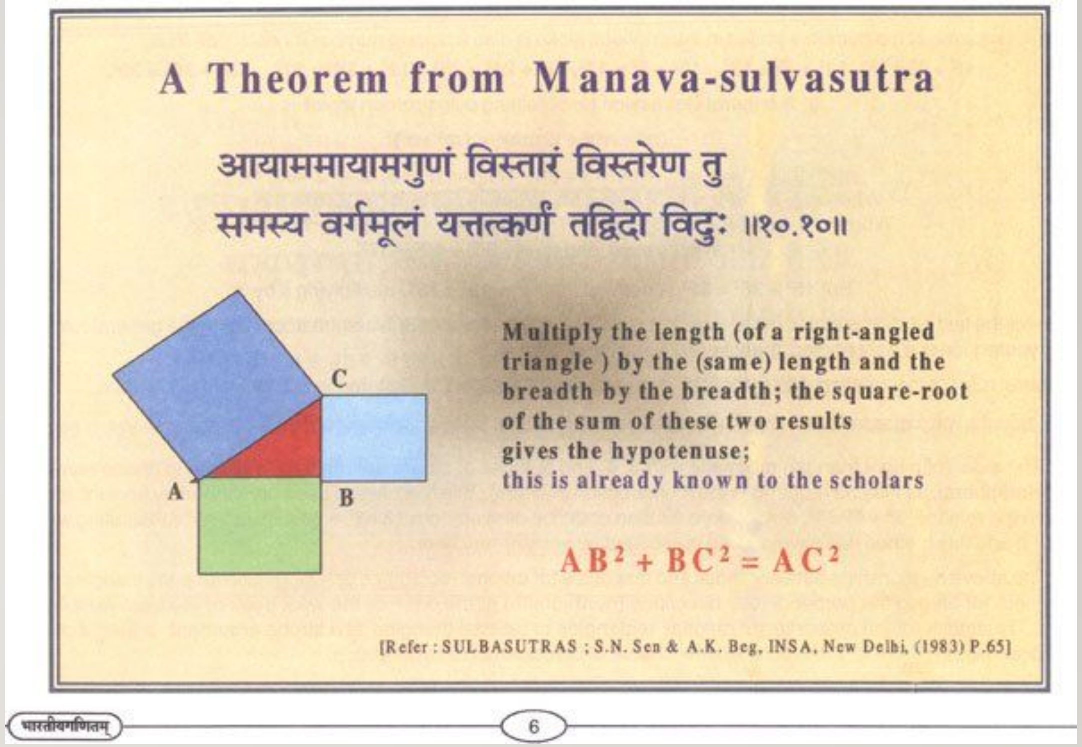
Vakrapaksa-syenacit. First layer of construction (after Baudhayana)



EVOLUTION OF "ARABIC NUMERALS" FROM BRAHMI (250 B.C.E.) TO THE 16TH CENTURY.



Ancient Indian mathematical literature, beginning with the *Sulbasutras*, composed entirely in verses - an incredible feat!



This verse directly yields the decimal equivalent of pi divided by 10:

pi/10 = 0.31415926535897932384626433832792.

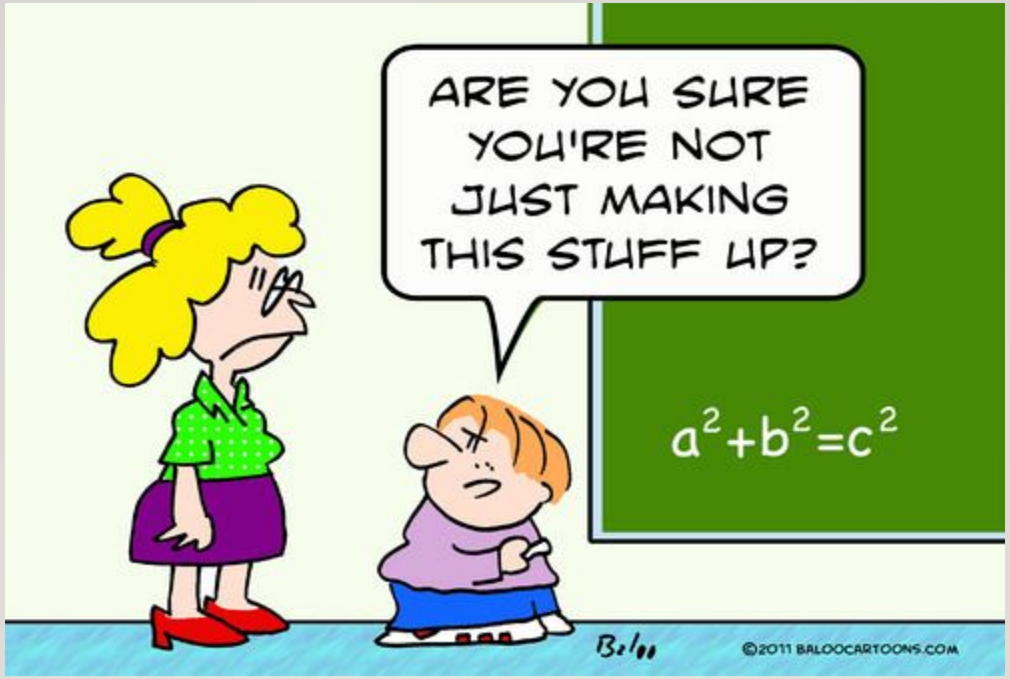
Post Vedic Period - 600 BC-300 AD
India gave to the world a priceless gift - the decimal system

The decimal notation derives its power mainly from two key strokes of genius:

the concept of place-value

and

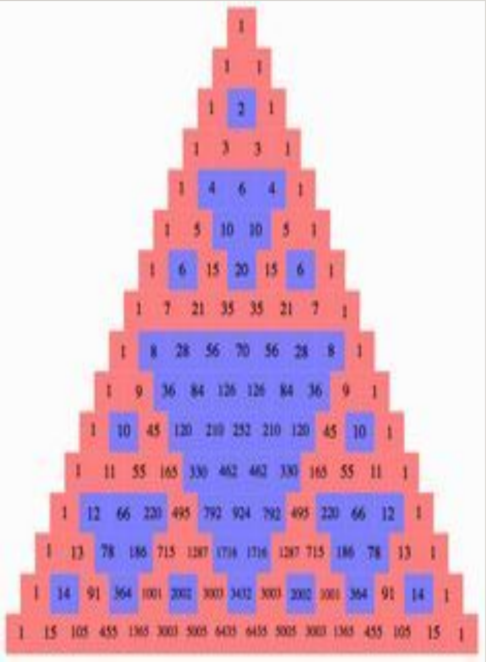
the notion of zero as a digit.



Algebra

Algebra provides elegance, simplicity, precision, clarity and technical power in the hands of the mathematicians.

Pascal's triangle OR India's triangle

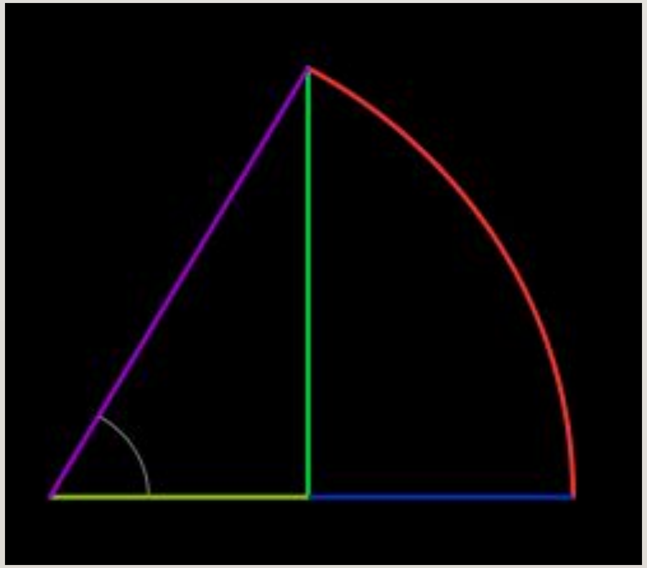


Halayudha described this for quick computations of nPr and nCr in Meru-Prastara 700 years before Pascal

Pingala more than 1200 years earlier (around 200 BC)

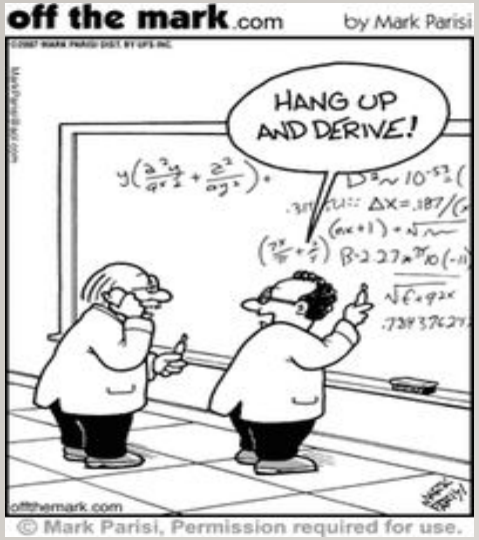
Trigonometric functions

Sine and cosine are derived from Aryabhatta's notations *ardha-jya* and *kotijya*



Trigonometry
and
Calculus

"Just a darn minute — yesterday you said that X equals **two**!"


off the mark.com
by Mark Parisi
HANG UP AND DERIVE!
offthemark.com
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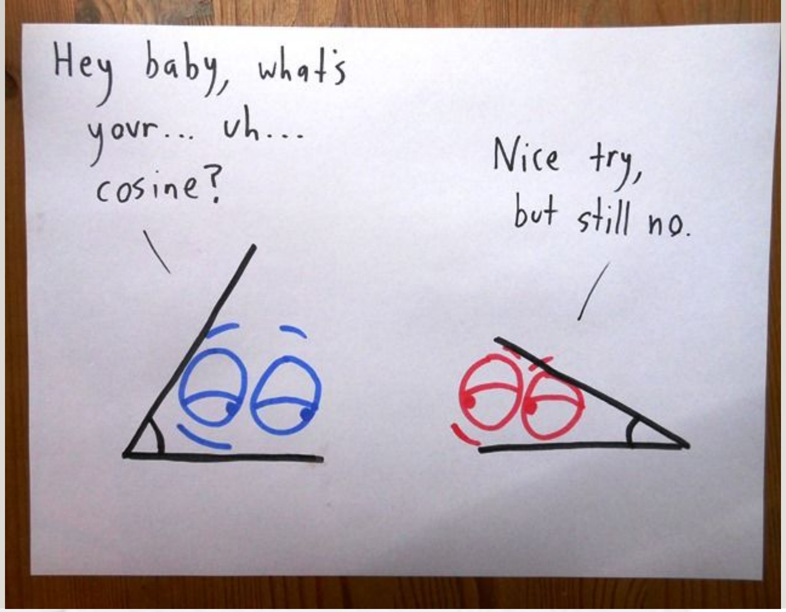
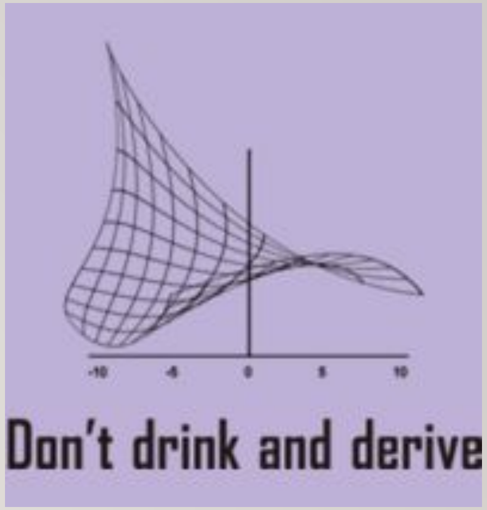

Hey baby, what's yovr... uh... cosine?
Nice try, but still no.

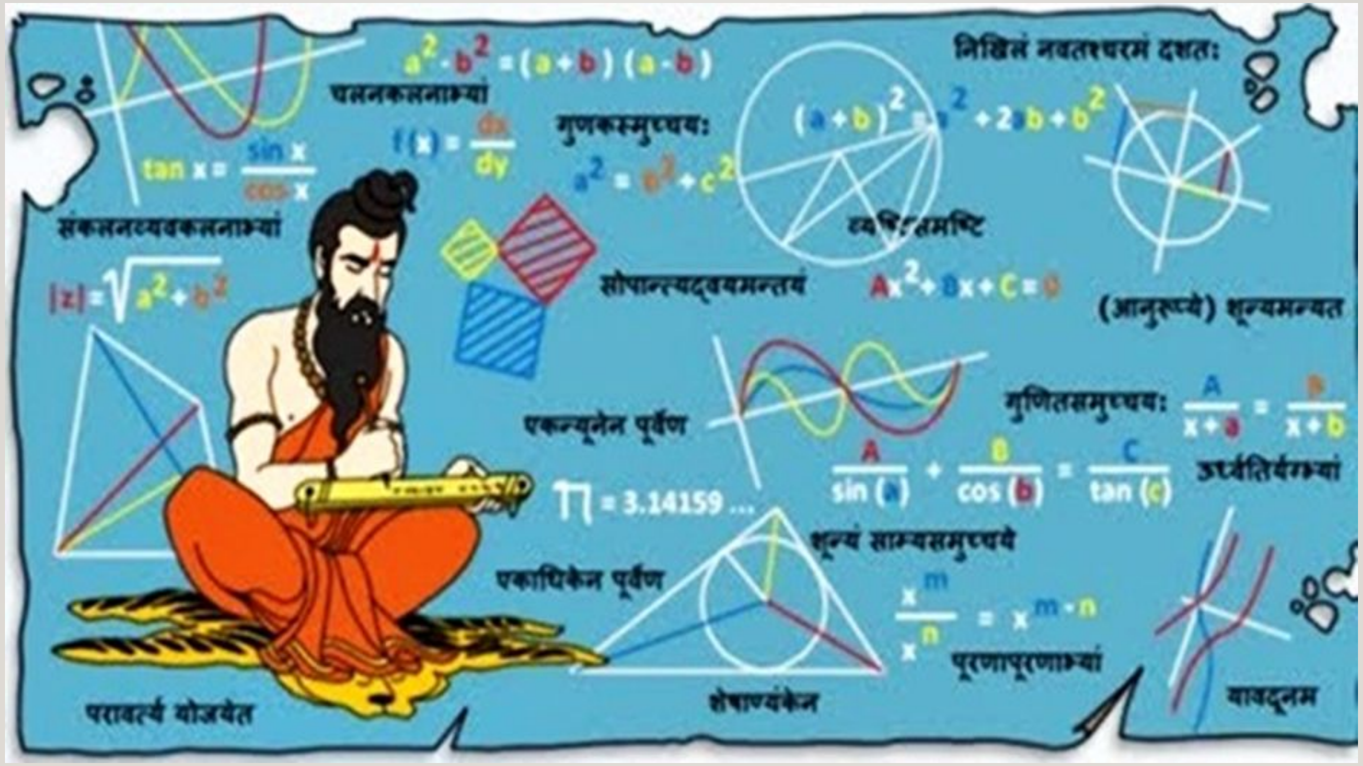

-10 -5 0 5 10
Don't drink and derive


IF WE HAVE THE INTEGRAL EQUATION:
$Vf(P)=x^2{}_1(X_1-X_0)+X^2{}_2(X_2-X_1)+\dots+X^2{}_n(X_n-X_{n-1})$
WHAT DO WE GET?
CONFUSED.

Madhava(1340-1425)

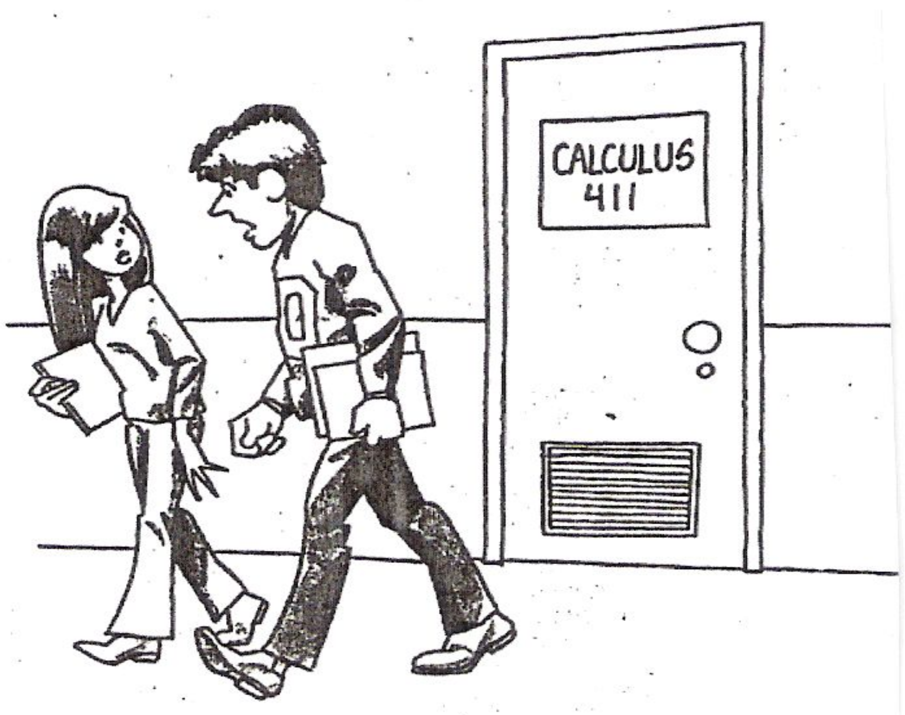
$$\theta = \tan\theta - \frac{(\tan\theta)^3}{3} + \frac{(\tan\theta)^5}{5} - \frac{(\tan\theta)^7}{7} + \cdots (|\tan\theta| \leq 1).$$

Leibniz
(1646-1716)



Newton
(1642-1727)

Brahmagupta (628 AD) and Govindaswami (880 AD) gave interpolation formulae for calculating the sines of intermediate angles from sine tables



"I think I understood the part about bringing two sharp pencils to class every day."

Madhavacharya might be regarded as the first mathematician who worked in analysis!

In India, if the common man is asked to name great mathematicians from our country, it is almost certain that the first name that they would name is

Shrinivasa Ramanujan
(December 22, 1887-April 26,1920)

$$\frac{e^{-2\pi/5}}{1+}\,\frac{e^{-2\pi}}{1+}\,\frac{e^{-4\pi}}{1+}\,\frac{e^{-6\pi}}{1+}\cdots=\sqrt{\frac{5+\sqrt{5}}{2}}-\frac{\sqrt{5}+1}{2}.$$

This continued fraction appeared in Ramanujan’s very first letter to Hardy written on January 16, 1913. Of this and some other formulae in that letter, Hardy said in 1937

“They defeated me completely. I had never seen anything in the least like them before. A single look at them is enough to show that they could only be written down by a mathematician of the highest class. They must be true because, if they were not true, no one would have had the imagination to invent them.”

Problem from Strand magazine

Imagine that you are on a street with houses marked 1 through n. There is a house in between such that the sum of the house numbers to the left of it equals the sum of the house numbers to its right. If n is between 50 and 500, what are n and the house number?

If the house number is r, then we have

$$1 + 2 + \cdots + (r-1) = (r+1) + \cdots + n.$$

The LHS is $\frac{(r-1)r}{2}$ and if we add $1 + 2 + \cdots + r = \frac{r(r+1)}{2}$ to both sides, we have $r^2 = \frac{n(n+1)}{2}$. Multiplying by 8 and adding 1, we have $8r^2 + 1 = (2n+1)^2$ which is a special case of Pell's equation.

In the above problem, the house number r and the total number n of houses are related by the equation $(2n+1)^2 - 8r^2 = 1$; this means $(n, r) = (1, 1), (8, 6), (288, 204), (1681, 1189), \cdots$

Literature

[1] Bibhutibhushan Datta. Ancient Hindu geometry ”the science of the Sulba.” Cosmo, 1993.

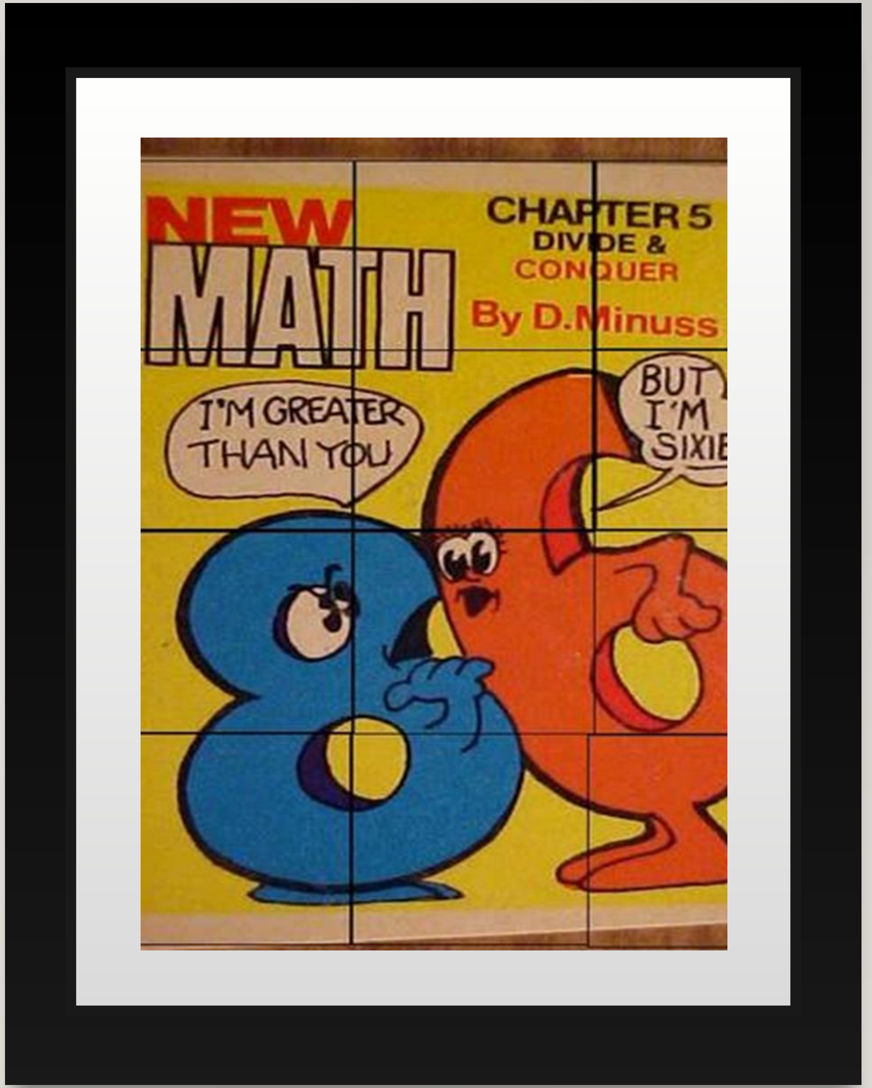
[2] Amartya Kumar Dutta. “Mathematics in ancient India”. In: Resonance 7.4 (2002), S. 4–19.

[3] Abraham Seidenberg. “The origin of mathematics”. In: Archive for history of exact sciences (1978), S. 301–342.

[4] Abraham Seidenberg. “The geometry of the Vedic rituals”. In: Agni: The Vedic ritual of the firealtar 2 (1983), S. 95–126.

[5] B Suri. “Ramanujan’s mathematics - some glimpses”. In: The Mathematics Consortium Bulletin 1.3 (2020), S. 1–12.

THANK YOU!


NEW
MATH
CHAPTER 5
DIVIDE &
CONQUER
By D.Minuss
I'M GREATER THAN YOU
BUT I'M SIXIE