NATIONAL MATHEMATICS DAY

DR. KALIPADA MAITY

ASSISTANT PROFESSOR OF MATHMATICS

MUGBERIA GANGADHAR MAHAVIDYALAYA

History Of S.RAMANUJAN-

- Born on December 22 , 1887.
- In a village in Madras State, at Erode, in Tanjore District.
- In a poor HINDU BRAHMIN family.
- Full name is "SRINIVAS RAMANUJAN AYYANGER".
- Son of Srinivas Iyenger.
- Accountant to a cloth merchant at KUMBHAKONAM. Daughter of petty official (Amin) in District Munsif's court at Erode.
- Daughter of petty official (Amin) in District Munsif's court at Erode.
- First went to school at the age of 7.

- His famous history was :- One day a primary School teacher of 3rd form was telling to his students 'If three fruits are divided among three persons, each would get one , even would get one , even if 1000 fruits are divided among 1000 persons each would get one '. Thus , generalized that any number divided by itself was unity . This Made a child of that class jump and ask- ' is zero divided by zero also unity?' If no fruits are divided nobody , will each get one? This little boy was none other than RAMANUJAN .

- So intelligent that as students of class 3rd or primary school.
- Solved all problems of Looney’s Trigonometry meant for degree classes.
- At the age of seven , he was transferred to Town High School at Kumbhakonam.
- He held scholarship.
- Stood first in class.
- Popular in mathematics.

- At the age of 12, he was declared "CHILD MATHEMATICIAN" by his teachers.
- Entertain his friends with theorem and formulas.
- Recitation of complete list of Sanskrit roots and repeating value of ∏ and square root of 2, to any number of decimal places.
- In 1903 , at the age of 15, in VI form he got a book , "Carr's Synopsis".
- "Pure and Applied Mathematics"

- Gained first class in matriculation in December 1903.
- Secured Subramanian's scholarship.
- Joined first examination in Arts (F.A).
- Tried thrice for F.A.
- In 1909, he got married to Janaki ammal.
- Got job as clerk.
- Office of Madras port trust.

Born	4 November 1897 Tellicherry,Kerala
Died	February 1984 (aged 87)
Nationality	Indian
Fields	Botany, Cytology
Institutions	University Botany,,Laboratory Madras
Alma mater	University of Michigan

- Published his work in “Journal of Indian Mathematical Society”.
- In 1911, at 23 , wrote a long article on some properties of “Bernoullis Numbers”.
- Correspondence with Prof.J.H Hardy.
- Attached 120 theorems to the first letter.

GLORY AND TRAGEDY

- He found a Clerical job in Madras port to help his family from poverty. (All other free time were spent for maths)
- Ramanujan wrote many letters to mathematician around the world including one to G.H. Hardy.
- Hardy invited Ramanujan to Cambridge. During his visit, Ramanujan wrote 30 papers (some on his own, some joint with Hardy)
- Ramanujan had to overcome many difficulties like world war I, Inability to eat English food.
- Despite these hardships, for his field-changing work he was elected "Fellow of the Royal Society"
- Due to Malnutrition, he felt ill, and he returned to home, where he died one year later in 1920 at the Young age of 32.

Ramanujan's Magic Square

22	12	18	87
88	17	9	25
10	24	89	16
19	86	23	11

This square looks like any other normal magic square. But this is formed by great mathematician of our country – Srinivasa Ramanujan.

What is so great in it?

Ramanujan's Magic Square

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- ❖ **Sum of numbers of any row is 139.**
- ❖ **Sum of numbers of any Column is 139.**

RAMANUJAN’S MAGIC SQUARE

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88	17	9	25
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Sum of numbers of any diagonal is also 139.
Sum of corner numbers is also 139.

22	12	18	87
88	17	9	25
10	24	89	16
19	86	23	11

Look at these possibilities. Sum of identical coloured boxes is also 139.

Interesting..?

22	12	18	87
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- Can you find Ramanujan Birthday from the square?
- Yes. It is 22.12.1887

How it Works ?

A	B	C	D
D	C	B	A
B	A	D	C
C	D	A	B

A	B	C	D
D+1	C-1	B-3	A+3
B-2	A+2	D+2	C-2
C+1	D-1	A+1	B-1

Example:

25	08	19	96
87	18	05	28
06	27	88	17
20	85	26	07

- SSR's Birthday

  Magic Square

- Its 25. 08. 1986

Ramanujan's Radical Brain Teaser(1911)

- What is the value of *x* in the following equation?

$$x = \sqrt{1 + 2\sqrt{1 + 3\sqrt{1 + 4\sqrt{1 + \ldots}}}}$$

Any Guess !

$$x + 1 = \sqrt{1 + x\sqrt{1 + (x+1)\sqrt{1 + \ldots}}}$$

Remarkably the answer is exactly 3. Behold!

$$\begin{aligned}
3 &= \sqrt{9} \\
&= \sqrt{1+8} \\
&= \sqrt{1+2\cdot 4} \\
&= \sqrt{1+2\sqrt{16}} \\
&= \sqrt{1+2\sqrt{1+15}} \\
&= \sqrt{1+2\sqrt{1+3\cdot 5}} \\
&= \sqrt{1+2\sqrt{1+3\sqrt{25}}} \\
&= \sqrt{1+2\sqrt{1+3\sqrt{1+4\cdot 6}}} \\
&= \sqrt{1+2\sqrt{1+3\sqrt{1+4\sqrt{1+\ldots}}}}
\end{aligned}$$

Ramanujan's works with Infinity

- Ramanujan Summation Problem
- 1+2+3+4+…………… = ?   Is it Infinity!
- The Hardy-Ramanujan Asymptotic Partition Formula

We can partition 2 into 2 different ways !

2, 1+1 → P(2)= 2

We can partition 3 into 3 different ways !

3, 2+1, 1+1+1 → P(3)= 3

We can partition 4 into 5 different ways !

4, 3+1, 2+2, 2+1+1,1+1+1+1 → P(4)= 5

- ✓ P(8)=22
- ✓ P(32)=213
- ✓ P(96)=8349
- ✓ P(64)=1741630
- ✓ P(128)=4351078600
- ✓ P(256)=365749566870782
- ✓ He developed a formula for partition of any number (A long time unsolved problem!)

$$p(n) \sim \frac{1}{4n\sqrt{3}} e^{\pi\sqrt{n/6}}.$$

Taxicab Number

1729

equals

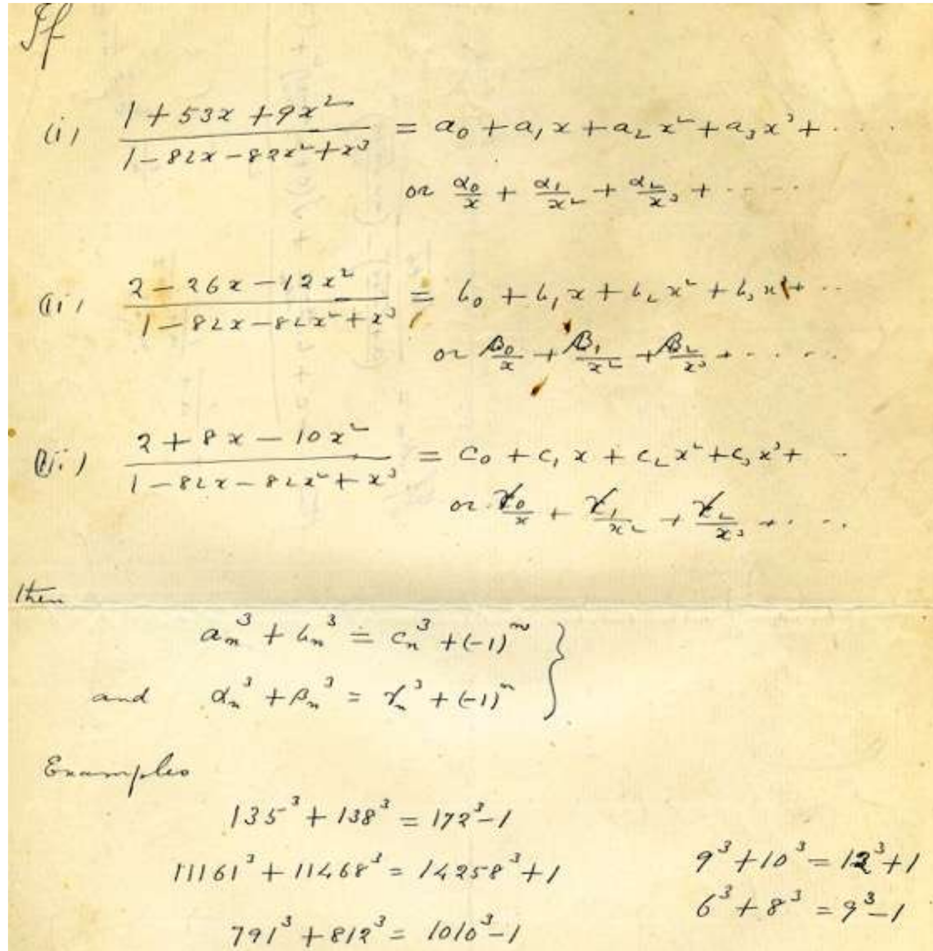
$$1^3 + 12^3$$

equals

$$9^3 + 10^3$$

1729

is a sum of two cubes in two different ways



If

(i) $$\frac{1+53x+9x^2}{1-82x-82x^2+x^3} = a_0 + a_1x + a_2x^2 + a_3x^3 + \cdots$$
or $$\frac{\alpha_0}{x} + \frac{\alpha_1}{x^2} + \frac{\alpha_2}{x^3} + \cdots$$

(ii) $$\frac{2-26x-12x^2}{1-82x-82x^2+x^3} = b_0 + b_1x + b_2x^2 + b_3x^3 + \cdots$$
or $$\frac{\beta_0}{x} + \frac{\beta_1}{x^2} + \frac{\beta_2}{x^3} + \cdots$$

(iii) $$\frac{2+8x-10x^2}{1-82x-82x^2+x^3} = c_0 + c_1x + c_2x^2 + c_3x^3 + \cdots$$
or $$\frac{\gamma_0}{x} + \frac{\gamma_1}{x^2} + \frac{\gamma_2}{x^3} + \cdots$$

then

$$a_n^3 + b_n^3 = c_n^3 + (-1)^n$$
and $$\alpha_n^3 + \beta_n^3 = \gamma_n^3 + (-1)^n$$

Examples

$135^3 + 138^3 = 172^3 - 1$

$11161^3 + 11468^3 = 14258^3 + 1$

$791^3 + 812^3 = 1010^3 - 1$

$9^3 + 10^3 = 12^3 + 1$

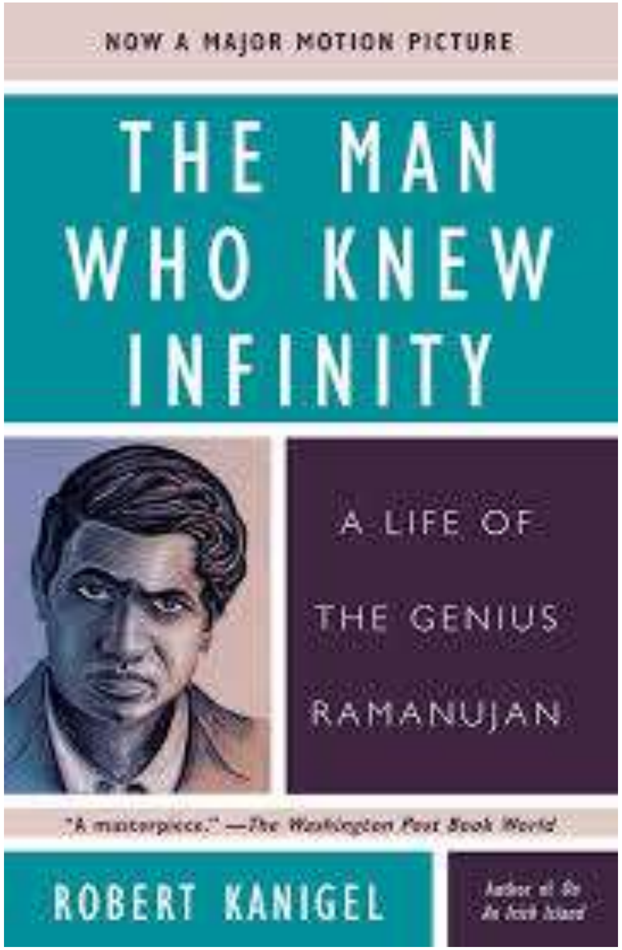
$6^3 + 8^3 = 9^3 - 1$

Ramanujan’s work

Ramanujan note books

Ramanujan's note book with his own hand writing

The reprint of Ramanujan's note book


NOW A MAJOR MOTION PICTURE
THE MAN WHO KNEW INFINITY
A LIFE OF THE GENIUS RAMANUJAN
"A masterpiece." —The Washington Post Book World
ROBERT KANIGEL


படப்பிடிப்பில்
ராமானுஜன்


GREAT KNOWLEDGE COMES FROM THE HUMBLEST OF ORIGINS
DEV PATEL JEREMY IRONS
THE MAN WHO KNEW INFINITY
INTRODUCING DEVIKA BHISE
WITH STEPHEN FRY
AND TOBY JONES
BASED ON THE TRUE STORY

Advantages of mathematicians learning history of math

- better communication with non-mathematicians

- enables them to see themselves as part of the general cultural and social processes and not to feel “out of the world”

- additional understanding of problems pupils and students have in comprehending some mathematical notions and facts

- if mathematicians have fun with their discipline it will be felt by others; history of math provides lots of fun examples and interesting facts

History of math for school teachers

- plenty of interesting and fun examples to enliven the classroom math presentation
- use of historic versions of problems can make them more appealing and understandable
- additional insights in already known topics
- no-nonsense examples – historical are perfect because they are real!
- serious themes presented from the historical perspective are usually more appealing and often easier to explain
- connections to other scientific disciplines
- better understanding of problems pupils have and thus better response to errors

- making problems more interesting
- visually stimulating
- proofs without words
- giving some side-comments can enliven the class even when (or exactly because) it’s not requested to learn... e.g. when a math symbol was introduced
- making pupils understand that mathematics is not a closed subject and not a finished set of knowledge, it is cummulative (everything that was once proven is still valid)
- creativity – ideas for leading pupils to ask questions (e.g. we know how to double a sqare, but can we double a cube -> Greeks)
- showing there are things that cannot be done

- history of mathematics can improve the understanding of learning difficulties; e.g. the use of negative numbers and the rules for doing arithmetic with negative numbers were far from easy in their introducing (first appearance in India, but Arabs don’t use them; even A. De Morgan in the 19th century considers them inconceavable; though begginings of their use in Europe date from rennaisance – Cardano – full use starts as late as the 19th century)
- math is not dry and mathematicians are human beeings with emotions → anecdotes, quotes and biographies
- improving teaching → following the natural process of creation (the basic idea, then the proof)

Example 1: Completing a square / solving a quadratic equation

[al-Khwarizmi (ca. 780-850)](#)

$x^2 + 10x = 39$

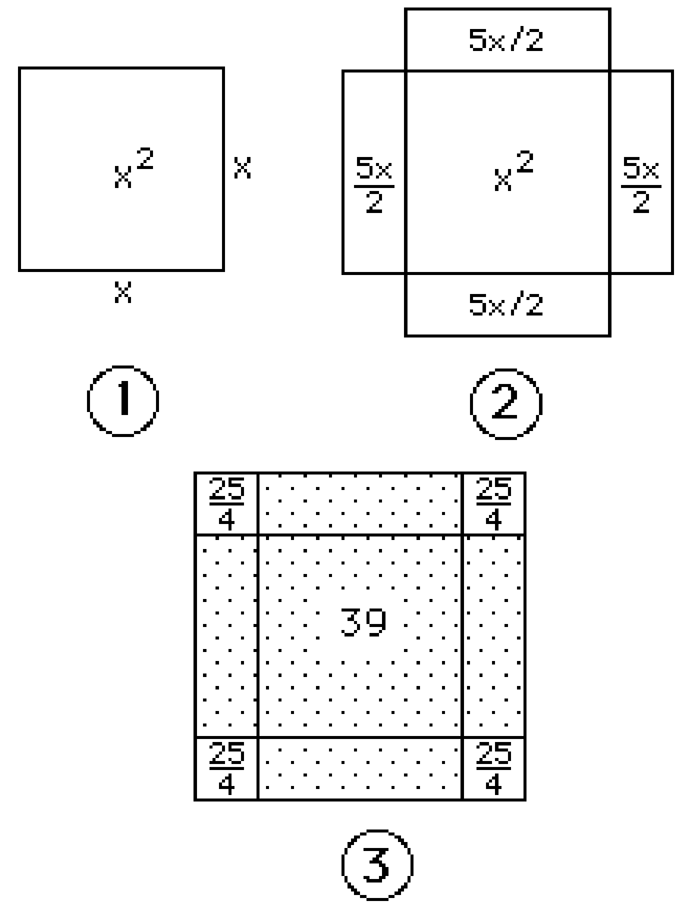
$x^2 + 10x + 4 \cdot 25/4 = 39+25$

$(x+5)^2 = 64$

$x + 5 = 8$

$x = 3$

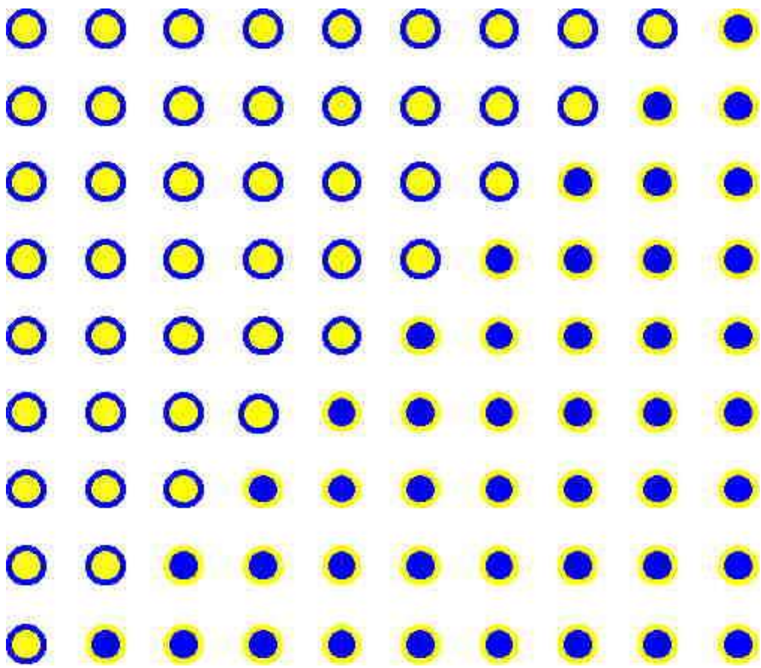
al-Khwarizmi completes the square

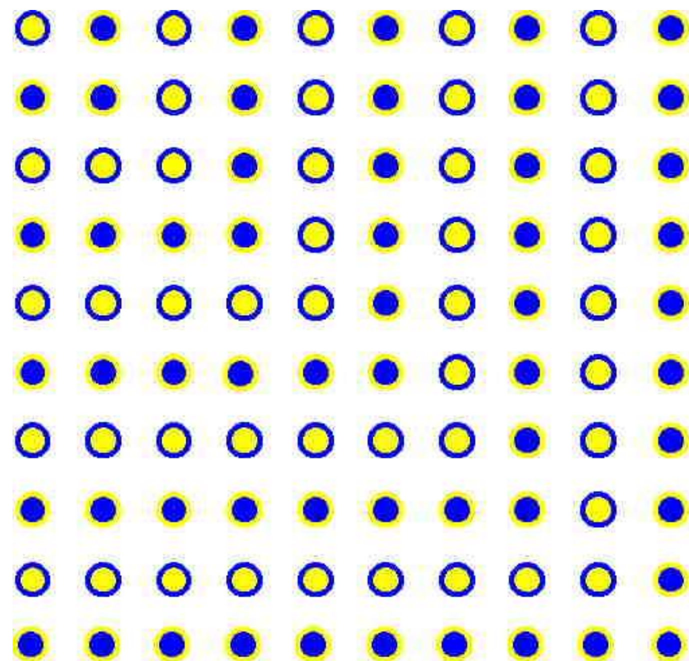


Example : **Proofs without words**

→ Pythagorean number theory

$2(1+2+...+n)=n(n+1)$ $\qquad$ $1+3+5+...+(2n-1)=n^2$





Golden Ratio

- Golden Ratio\Golden Ratio.pptx

Quotes from great mathematicians

→ ideas for discussions or simply for enlivening the class

- Albert Einstein (1879-1955)

Imagination is more important than knowledge.

- René Descartes (1596-1650)

Each problem that I solved became a rule which served afterwards to solve other problems.

- Georg Cantor (1845-1918)

In mathematics the art of proposing a question must be held of higher value than solving it.

- Augustus De Morgan (1806-1871)

The imaginary expression $\sqrt{(-a)}$ and the negative expression $-b$, have this resemblance, that either of them occurring as the solution of a problem indicates some inconsistency or absurdity. As far as real meaning is concerned, both are imaginary, since $0 - a$ is as inconceivable as $\sqrt{(-a)}$.


Thank You
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