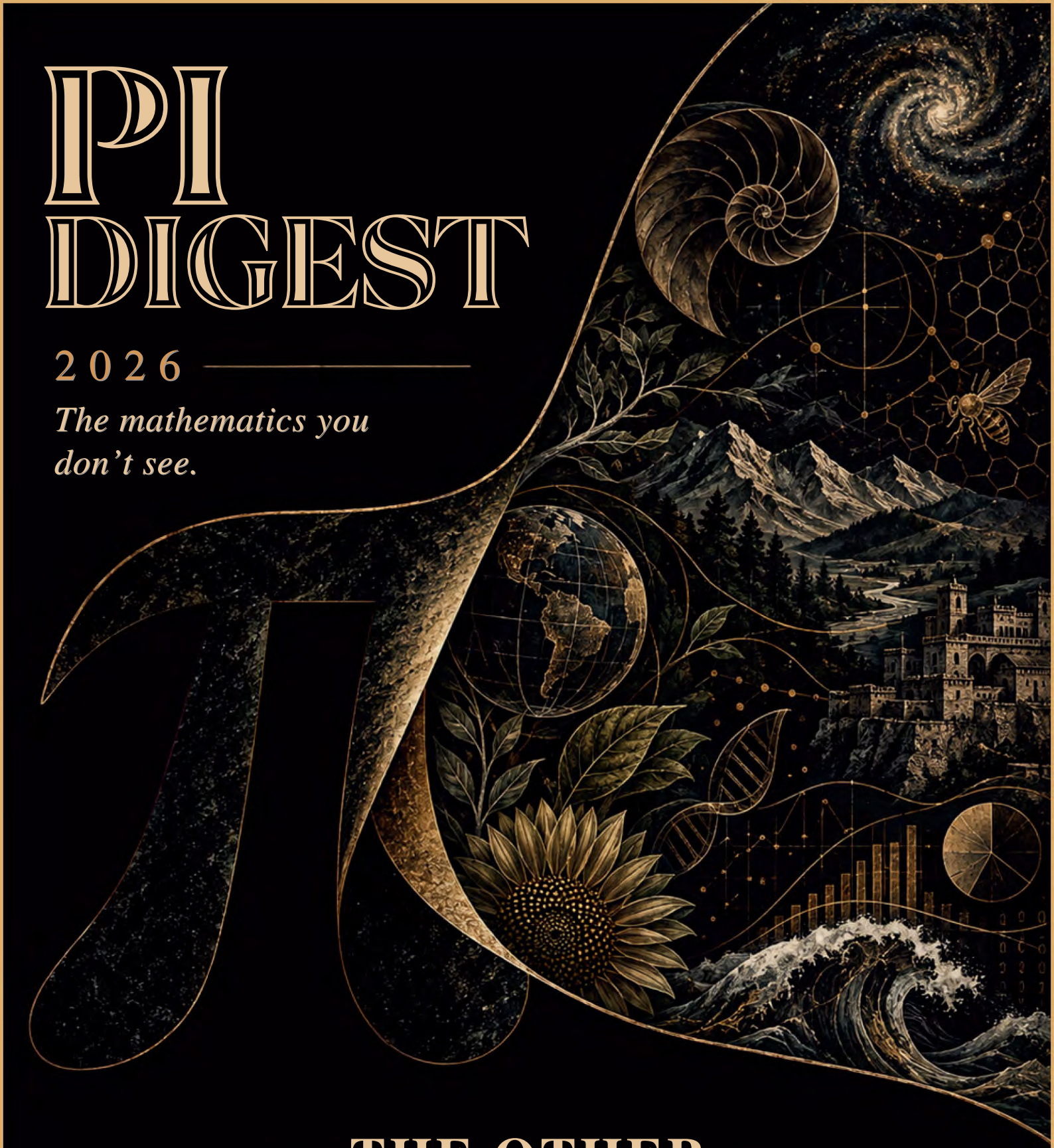
# PI DIGEST

2026

*The mathematics you don't see.*



## THE OTHER 99%

LOOK BEYOND THE EQUATION

VOLUME 2

2026

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# PRINCIPAL'S MESSAGE

I am pleased to welcome you to Pi Digest, Volume 2, 2026. What makes this edition particularly interesting is its willingness to look beyond mathematics as it is usually encountered in a classroom. The theme, "The Other 99%," is a reminder that learning begins when we become curious about what lies beyond what we already know. At a time when artificial intelligence, technology and data are reshaping almost every field, mathematics has acquired an even greater significance. It provides us with a disciplined way of understanding patterns, examining ideas and making sense of a world that is becoming increasingly complex. But mathematics is ultimately about much more than solving problems correctly. It develops a habit of thinking that encourages us to pause, question and look for possibilities where others may see only a fixed answer.

This connects closely with the larger purpose of education. The Sanskrit maxim "सा विद्या या विमुक्तये" — Sā Vidyā Yā Vimuktaye reminds us that true knowledge is that which liberates. It liberates us from unquestioned assumptions and gives us the confidence to form our own understanding.

I congratulate the Editorial Board, students and teachers for bringing together this volume of Pi Digest. I hope these pages encourage you to remain curious and, whenever possible, to look beyond the answer in front of you and ask what lies beyond it.

**Mr. Ajay Singh**
**Principal**

# VICE - PRINCIPAL'S MESSAGE

Mathematics teaches us many things, but perhaps one of its quieter lessons is humility. No matter how much we learn, there is always another problem to explore, another pattern to notice and another question waiting to be asked. The theme of Pi Digest, Volume 2, 2026, "The Other 99%," reflects this beautifully.

It reminds us that learning does not end with knowing the answer. It begins with the curiosity to ask what lies beyond it. There is an ancient Sanskrit saying: "विद्या ददाति विनयं, विनयाद् याति पात्रताम्।" Vidyā dadāti vinayam, vinayād yāti pātratām. "Knowledge gives humility; through humility, one becomes worthy." This is a valuable lesson for every learner. The more we understand, the more we realise how much remains to be discovered. Mathematics, in particular, teaches us to accept that we may be wrong, to reconsider our approach and to appreciate solutions that we had not thought of ourselves.

I hope this edition of Pi Digest reflects that spirit, not only the brilliance of mathematics, but also the curiosity, openness and humility that make learning worthwhile.

My congratulations to the Editorial Board, teachers and students whose ideas have brought this volume together. May these pages inspire you to keep questioning, keep discovering and, above all, keep learning.

Ms. Smita Chaturvedi
Vice Principal

# EDITORIAL MESSAGE

We are taught in school that mathematics is about reaching the finish line: isolate x, balance the formula, box the final number, and turn the page. We grow accustomed to chasing that single, neat result—the visible one percent. Yet the real wonder of mathematics has never been the boxed answer; it is the unseen ninety-nine percent of logic, symmetry, and hidden machinery that makes the answer possible in the first place. Welcome to Volume 2 of Pi Digest, where we step away from traditional chalkboard drills and explore the extraordinary world hiding in plain sight.

Once you look beneath the surface, the invisible mathematics running our daily lives is impossible to ignore. When you shuffle a deck of cards, the resulting sequence of fifty-two cards has likely never existed before in the entire history of the universe. Turn a scrambled Rubik's cube in your hands, and despite forty-three quintillion chaotic possibilities, order is so deeply rooted that any valid position is solvable in twenty moves or fewer. Far from being abstract marks in a notebook, mathematics is physical: it is the heavy undersea cables powering our "wireless" internet, the counterintuitive curves of Gabriel's Horn holding finite paint within infinite surface area, and the non-transitive dice that turn standard probability into an endless loop of Rock-Paper-Scissors.

As our Principal, Mr. Ajay Singh, and Vice Principal, Ms. Smita Chaturvedi, remind us in their addresses, learning does not stop when you arrive at a solution. Rooted in the virtues of liberation and humility, genuine knowledge begins when we doubt our first assumptions and stay curious about what lies ahead. Mathematics is not a field reserved for flawless geniuses, nor does it demand immediate perfection. It simply asks us to pause, look at an unfamiliar puzzle, and develop the patience to explore how each moving piece connects to the whole.

Within these pages, you will find student breakthroughs, teacher perspectives, logic challenges, and even Srinivasa Ramanujan transforming a simple birth date into an intricate magic square. We hope this edition sparks your curiosity and helps you view everyday patterns through a sharper, more adventurous lens. Do not just look for the answer—look beyond the equation.

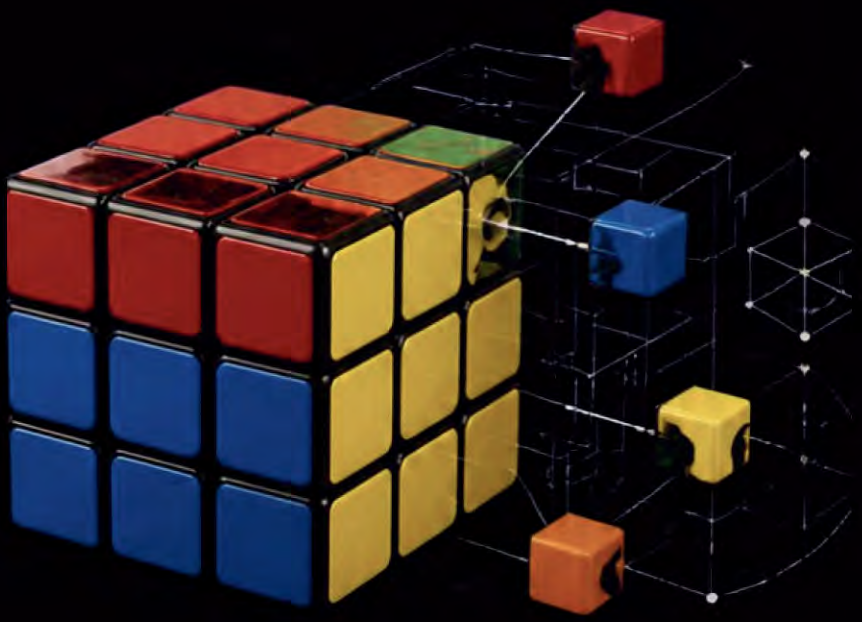
**Happy Reading!**

# WHAT MY RUBIK'S CUBE TAUGHT ME ABOUT MATHS

A Rubik's Cube may look unrelated to π, but geometry connects them. Every face of a cube has angles and rotations. A standard turn rotates a face by 90°, which is π/2 radians. A half-turn is 180° (π radians), while three-quarter rotation is 270° (3π/2 radians). These rotations describe how the cube's pieces move through space. Although π itself does not determine how many Rubik's Cube positions exist, it helps describe the rotational geometry behind the puzzle.

The cube therefore gives us a physical example of how mathematical constants like π can appear in everyday objects and movement.

TURNS TRANSFORMATIONS ALGORITHM



**BY- Divy Yadav**

### 43 QUINTILLION POSSIBILITIES

A normal 3-3 subtile cube can have around 43 quintillion different arrangements. The number is almost impossible to imagine. Every position comes from the same cube in your hand. This is where permutations become fascinating; the pieces can be rearranged in an enormous number of ways, depending on their quality. Rules govern what is possible and what is not. Even when the cube looks chastic, order is hiding underneath.

### CHAOS HAS LIMITS

More than 43 quintillion positions may exist, yet every legal 3x+1 position is made in 20 moves or fewer under the standard optimal definition of a move. This is known as God's Number. Something that looks look still has structure underhead it.

GOD'S NUMBER
-20
20 MOVES

### AND THEN THERE IS GROUP THEORY

The mathematics of the cubes connect to group theory. Moves can be combined, reversed and repeated. Different sequencesances can produce the same result, while some arrangements simply cannot occur through legal moves. The cube turns abstract mathematics into something physical: you can hold it, turn it and watch it change.

### SOLVING ISN'T REALLY THE END

After solving my first cube, I thought I had finished. Instead, new questions appeared: Can I solve faster? Can I use fewer moves? Can I reguggle patterns? What happens if I change the puzzle? Beyond the 3x+3 are the 2-2, 4-4, Pyramids, Megatrix and many more, each bringing new challenges.

That is what 'The Other 99%' means to me. I knew how to solve a Rubik's Cube, but I did not know the mathematics behind it, how many possibilities were hiding inside it, or that my algorithms were connected to mathematical transformations. There is always another question, another pattern, another puzzle, another possibility. You solve one cube and discover you have only opened the door.Maybe the other 99% isn't somewhere far away. maybe it is hiding inside the things we think we already understand.

# THE MATHEMATICS OF SHUFFLING CARDS

How many different ways can you arrange a pack of 52 cards?

**52!**

$$52 \times 51 \times 50 \times \ldots \times 2 \times 1$$

**About $8.07 \times 10^{67}$ possible orders**

## Counting the possibilities

There are 52 choices for the first card, then 51 for the second, and so on. Multiply those numbers together and you get 52 factorial, written 52!. The answer has 68 digits.

After a thorough shuffle, your deck may be in an order that nobody has seen before. We cannot be certain, because shuffles are not perfectly random and we do not know every order used in the past.

## How big is that?

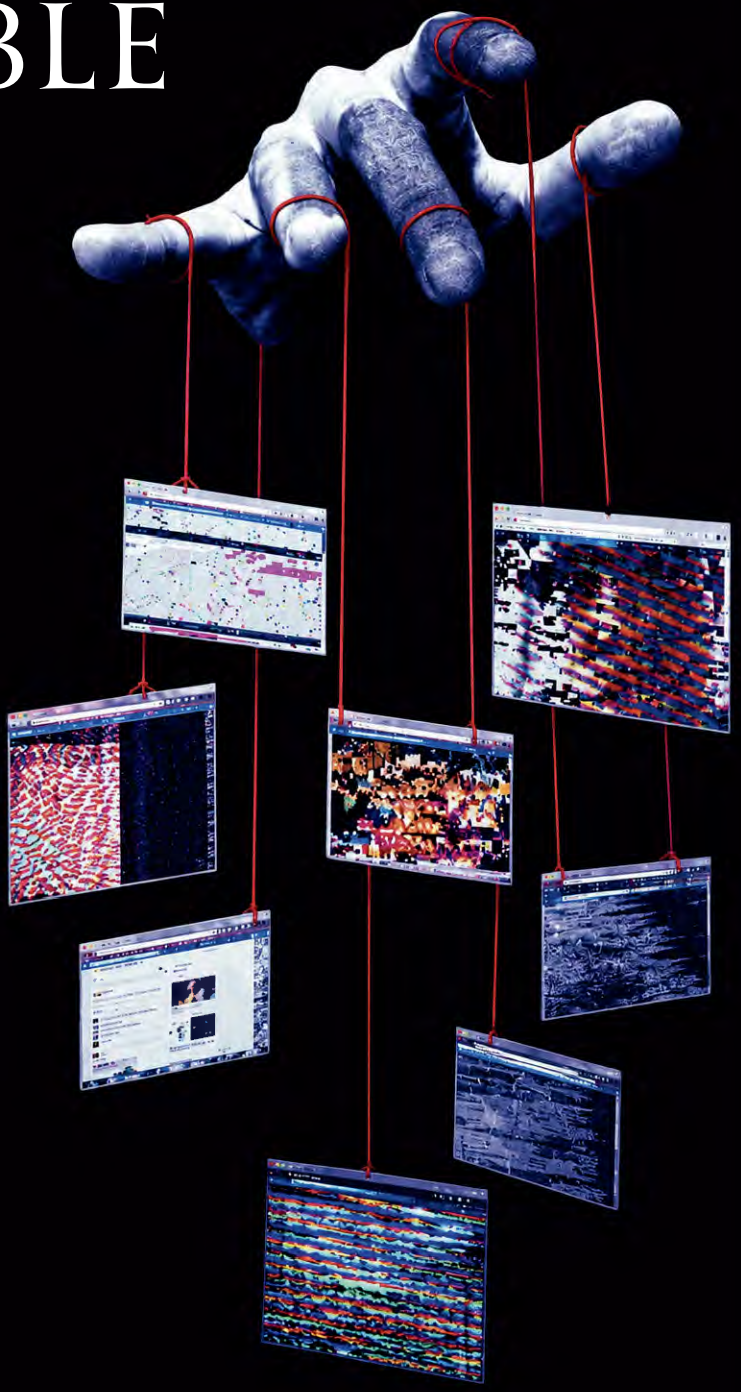
Imagine checking a billion different arrangements every second for a billion years. You would inspect about $3.16 \times 10^{25}$ orders. The fraction of all possible decks you had covered would still be less than one part in $10^{42}$.

You can see how quickly the number grows with a smaller pack. Three cards have six possible orders. Four cards have 24. Each extra card multiplies the total by the new number of cards.

## Try it yourself

List every order of A, 2, 3 and 4. There are only 24. Now add a fifth card: the total jumps to 120.

# THE INVISIBLE INTERNET



You open an app, send a message, or stream a video. Within seconds, information appears on your screen. It feels effortless. But behind that simple experience lies a vast world that most of us never see. We often imagine the internet as something floating invisibly around us—a “cloud” that stores our photographs and delivers our messages. In reality, the internet is deeply physical. It depends on enormous data centres, electrical systems, servers, cables, routers and thousands of people working behind the scenes.

**The Cloud Has a Physical Home**

When we say that our data is stored “in the cloud”, It is actually stored on physical computers in data centres. These facilities contain thousands of powerful servers that process and store information. Servers generate heat, so data centres require sophisticated cooling systems. They also need backup electricity, security and constant maintenance. Every photograph uploaded, video streamed or website visited depends on this hidden infrastructure.

**The Ocean Beneath the Internet**

One of the internet's most surprising secrets lies beneath the oceans. Much of the world's digital communication travels through undersea fibre-optic cables connecting continents. Information travels through these cables as pulses of light, carrying messages, financial transactions, videos and countless other forms of data. We think of the internet as wireless, yet much of its backbone is made of physical cables stretching across the ocean floor.

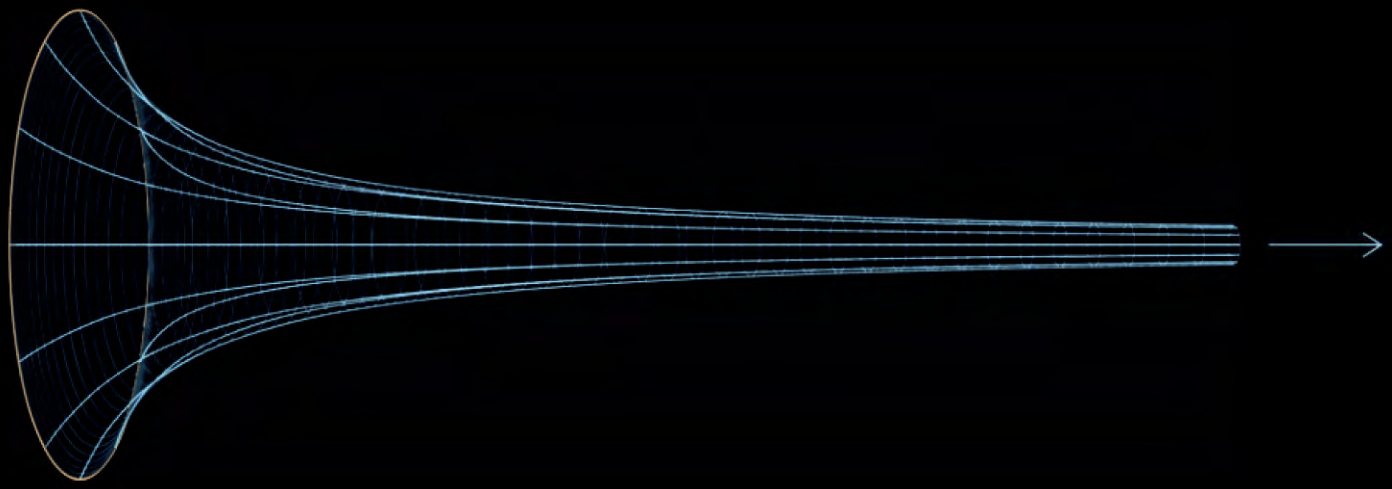
**The Other 99%**

The internet perfectly represents the idea of The Other 99%. We see the website, but not the server. We see the video, but not the network carrying it. We see the message, but not the cables delivering it. The digital world may feel weightless, but beneath it exists an enormous physical world of machines, electricity, cables and human effort. The next time your phone connects to the internet in seconds, pause for a moment. What looks invisible is actually one of the most complex physical systems humans have ever built.

**BY- SHHAUNAK AGARWAL**

# GABRIEL'S HORN

## A SHAPE THAT NEVER ENDS



**x = 1** **Continues forever** **Radius = 1/x**

**ITS VOLUME IS FINITE, EVEN THOUGH ITS SURFACE AREA IS INFINITE.**

## Volume

### π cubic units

Take the curve y = 1/x for x ≥ 1 and spin it around the x-axis. The result is Gabriel's horn. It narrows forever, never quite closing. Its cross-sections shrink fast enough that the total volume settles at π.

The volume calculation

$$V = \pi \int_1^\infty x^{-2}\, dx = \pi$$

## Surface area

### Infinite

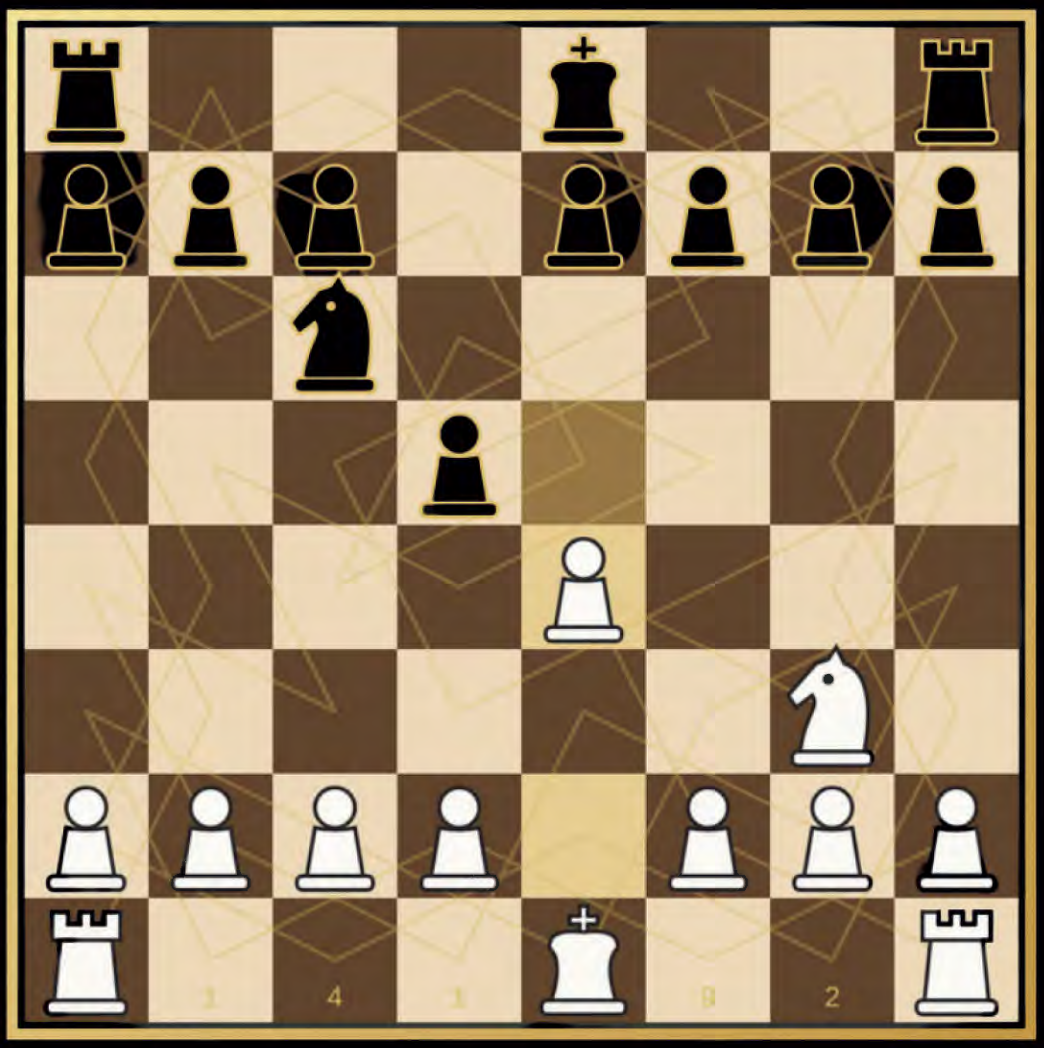
The curved surface behaves differently. Even as the horn narrows, each extra stretch adds enough area to keep the total growing without bound. Finite volume does not force finite surface area. This is an ideal mathematical shape. A real horn would have to end somewhere, and a coat of paint would have thickness.

## A surprising detail

The section from x = 1 to x = 2 holds half the entire volume. Everything beyond x = 2 shares the other half.

# BEYOND THE BOARD

The Hidden Mathematics of Chess



## NO DICE.
## JUST MOVES.

*P(luck) = 0*

Zermelo’s theorem: with perfect play, the result is already decided.

**$2^{64} - 1$**

Grains of rice on a chessboard, doubling on every square

**92**

Ways to place 8 queens so none can attack another

**$10^{120}$**

Shannon number: estimated count of possible games

*“Every position is a theorem waiting to be proved.”*

INSIDE: KNIGHT’S TOURS · 8 QUEENS · GAME TREES · ZERMELO

# DICE WITH NO OVERALL WINNER

Choosing second can give you the better chance of winning.

| Die A | Die B | Die B | Die C |
|---|---|---|---|
| 2 | 2 4 | 1 1 6 | 3 3 5 |
| 4 | 9 9 | 6 8 8 | 5 7 7 |
| | A beats B | B beats C | C beats A |

**EACH WINS 20 OF THE 36 POSSIBLE OUTCOMES**

## How the game works

Each panel lists the six faces of a fair die. Roll two dice independently; the higher number wins. A beats B with probability 5/9. B beats C with the same probability. Yet C beats A, also with probability 5/9.

This is called nontransitivity. Each die is more likely to beat one of the others and lose to the remaining one. There is no single best choice, rather like rock, paper, scissors.

## Checking the odds

Against B, A's two 9s win all 12 pairings. Its two 4s beat B's two 1s in four pairings, and its two 2s do the same. Total: 20 wins out of 36 equally likely outcomes.

If your opponent chooses A, choose C. If they choose B, choose A. If they choose C, choose B. You will have a better chance, although you can still lose any individual roll.

## Try it yourself

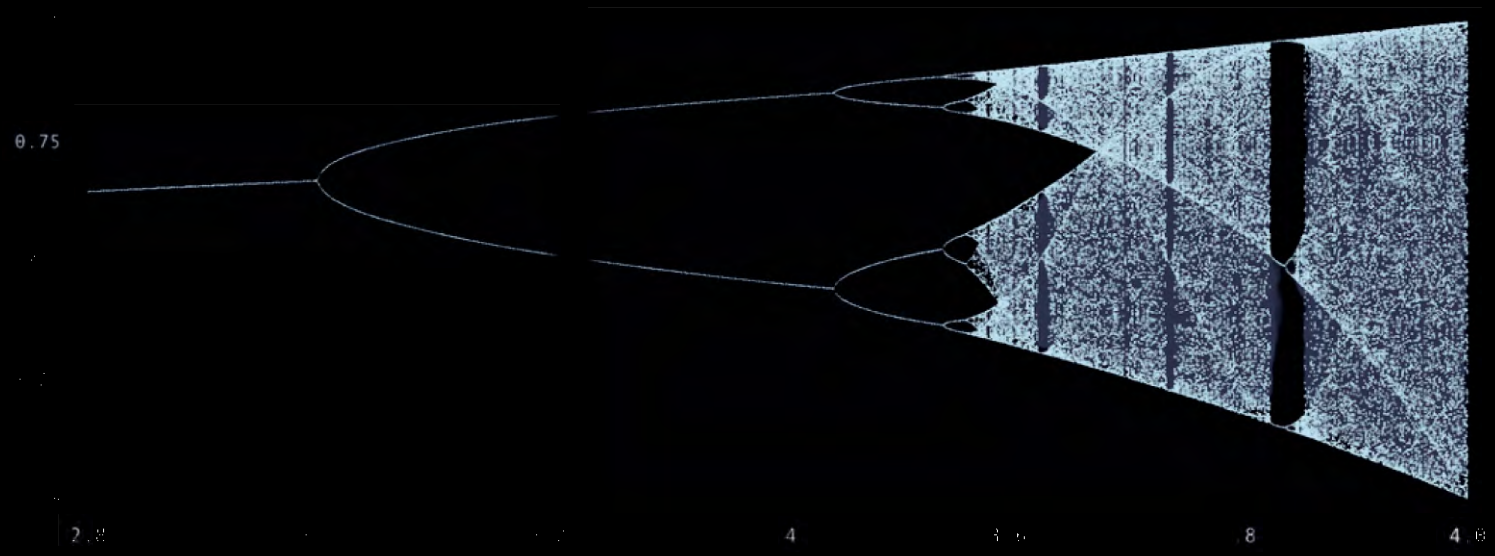
Use six numbered slips per die and draw at random, replacing each slip. Can your friends discover the loop?

**BY DIVYRAJ SINGH PARIHAR**

# How a simple rule creates chaos

Repeating the same calculation can lead to surprising results.

$$x_{next} = r \times x \times (1 - x)$$




## Following the calculation

Start with a number x between 0 and 1. Choose a value for r and use the formula above. Use your answer as the next x and repeat. This is called the logistic map, a simple model of growth with limits.

At r = 2.8, typical starting values settle to one level. At 3.2, they alternate between two. At 3.5, they cycle through four. Increasing r further can produce chaotic behaviour.

## Reading the pattern

The diagram records values after the early steps have faded. One branch splits into two, then four. Beyond about 3.57, chaotic behaviour appears, interrupted by windows of repeating order.

The calculation contains no random choices. Yet in a chaotic region, two nearly identical starting values can eventually give very different answers. A tiny measurement error can make long term prediction difficult.

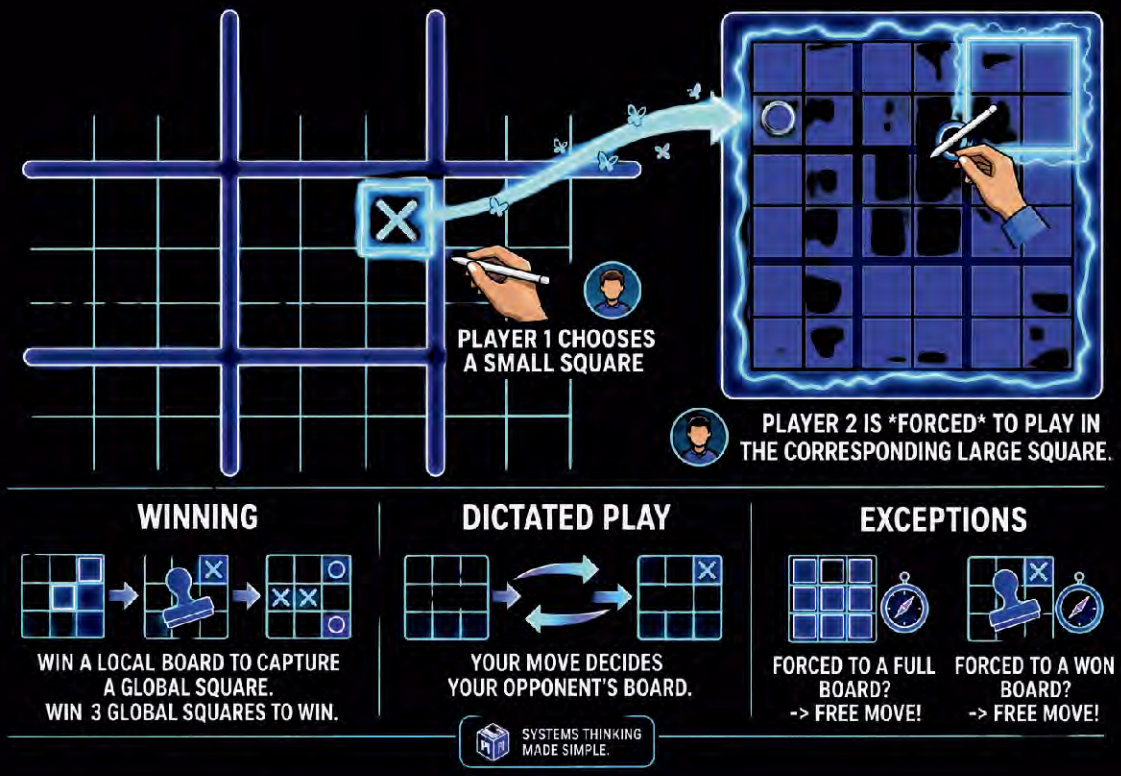
## Try it yourself

Use r = 4. Compare starts 0.2 and 0.200001 for 30 steps. Watch a microscopic difference become visible.

**BY RUDRAKSH BANSAL**

# THE 99% WE IGNORE

## The Fractal Battlefield of Ultimate Tic-Tac-Toe




We abandoned Tic-Tac-Toe in primary school. Once we learned the obvious patterns, the nine-square board seemed completely understood—the visible 1%. But zoom in, expand the boundaries, and the familiar game opens into a far deeper system.

Ultimate Tic-Tac-Toe begins with a massive 3×3 board. Inside every large square sits another 3×3 board, creating 81 playable cells. To win the whole game, you must capture three large boards in a row by winning the small game inside them.

Then comes the rule that changes everything: your move determines where your opponent may play next. Place X in the top-right cell of a local board, and your opponent is sent to another large board. Their move then sends you to another large board. Every local decision creates a global consequence.
That makes the game a lesson in systems thinking.

A move that looks look perfect on the small board may be strategically disastrous because it gives your opponent access to a powerful large board. Sometimes the right choice is to sacrifice a small battle to control where the next battle happens.

In ordinary Tic-Tac-Toe, the board is a closed, isolated system. In Ultimate Tic-Tac-Toe, each square is connected to another square through a chain of consequences. The game behaves almost like a fractal, zoom in and you find the same basic structure repeated, yet the interactions between those structures create something much larger.

The lesson reaches beyond the game. We often dismiss simple things—a basic equation, a familiar routine, a childhood game—because we think we have already seen everything there is to see. But complexity can emerge when you change the scale, connect the parts, and look beyond the obvious boundary. That is the hidden 99%: not something new, but something that was there all along, waiting for us to look closer.

**BY YASHWIN SALUJA**

# PI SUMMIT 2025

The Scindia School, Gwalior, successfully hosted **Pi-Summit 2025**, an inter-school mathematics event, on **18–19 August 2025.** The two-day summit brought together students from schools across the country to celebrate mathematics through creativity, collaboration, and competition.

The event was inaugurated by **Prof. Niladri Chatterjee,** Head of the Department of Mathematics and Artificial Intelligence at IIT Delhi, who highlighted the importance of mathematics in innovation and emerging technologies. A special attraction was a Vedic Mathematics Workshop conducted by **Mr. Gourav Tekriwal,** a renowned expert featured on **Prime Minister Narendra Modi's Mann Ki Baat, introducing students to innovative mental calculation techniques**.

The summit featured four exciting rounds: **Pi-TOTYPE**, a mathematical model competition won by The Scindia School's Team E; **Pi-RATES QUEST,** a mathematics presentation round won by Vidya Devi Jindal School, Hisar; **Pi-RATES DEN,** a collaborative problem-solving round won by The Scindia School's Team J; and **Pi-PI Ka Hisaab**, a thrilling quiz conducted by renowned quizmaster **Mr. Ajay Poonia,** also won by Team J**.**

After two days of spirited competition, **Vasant Valley School, Delhi, emerged as the Overall Winner**, while **The Scindia School's Team J secured the Overall Runner-Up position.** The event concluded with a vote of thanks acknowledging the school administration, teachers, students, mess, health centre, and support staff for their invaluable contributions. The participating schools and their principals were also appreciated for their support and encouragement.

**Pi-Summit 2025 was a celebration of mathematical curiosity, teamwork, and intellectual excellence,** creating an enriching experience for all participants.

# THE CRAFT OF WRITING A RESEARCH ARTICLE: TURNING OBSERVATIONS INTO DISCOVERIES

Whenever we begin writing a research article, one of the biggest challenges is identifying a meaningful research problem. However, if we learn to observe our surroundings carefully, we will realise that countless unanswered questions are waiting to be explored. We have so much to offer the world, and research provides us with an opportunity to contribute to knowledge through curiosity, observation, and evidence. We are fortunate to be living in a sixth-century fort, surrounded by nature and rich biodiversity. Our school is not just a place of learning; it is a living laboratory that offers numerous opportunities for research, discovery, and innovation.

## Identify a Research Problem

Dear students, research begins when we look beyond what we see every day and start asking questions. The initiatives undertaken by our school and the natural environment around us can provide excellent starting points for meaningful research.

For instance, the presence of vultures within our fort offers an opportunity to study their population, habitat, behaviour, and conservation requirements. Since several vulture species are threatened globally, systematic observations of their presence and habitat could contribute to a valuable conservation study.

Similarly, our school's energy conservation initiatives provide opportunities to investigate their environmental impact. The No Vehicle Tuesday initiative, for example, raises an important research question: **Does reducing vehicle movement on campus lead to measurable improvements in air quality?** This could be investigated by collecting air-quality data, recording vehicle movement, and comparing observations across suitable days while accounting for weather and other influencing factors.

We can also explore energy consumption, biodiversity, waste management, and the effectiveness of other sustainability initiatives. Each of these areas may offer research opportunities if we identify a specific question that has not been adequately answered.

## Explore Existing Research

Once you have identified a potential research problem, the next step is to find out what is already known. Conduct a literature review using books, reports, and reliable academic sources such as Google Scholar, arXiv, ScienceDirect, and ResearchGate.

Read relevant studies, understand their findings, examine their limitations, and identify what remains unanswered. This helps you establish a research gap and determine how your investigation might contribute something new.

Remember, a research gap does not necessarily mean that nobody has ever studied the topic. It may mean that a question has not been explored in your particular setting, that existing findings need further verification, or that a different method could provide additional insights.

## Plan and Collect Data

After identifying your research question and reviewing existing literature, decide how to investigate it. Depending on your topic, you may conduct observations, surveys, interviews, experiments, or systematic measurements.

For example, a study of vultures could involve recording their sightings, numbers, locations, and observable behaviour over a defined period. A study of the No Vehicle Tuesday initiative could examine vehicle counts and air-quality measurements on comparable days.

Before collecting data, establish a clear methodology, identify the resources required, seek the necessary permissions, and decide how the information will be recorded. Ensure that your observations are consistent and that your conclusions are supported by the evidence.

## Analyse Your Findings

Once the data has been collected, organise and analyse it using suitable tables, graphs, statistical methods, or qualitative analysis. Look for patterns, relationships, and differences that help answer your research question.

Your findings may support your initial expectations, challenge them, or reveal something unexpected. All these outcomes are valuable. Good research presents evidence honestly rather than adjusting results to fit a preferred conclusion.

## Write and Refine Your Research Article

A research article generally includes the following sections:

1. **Title:** Clearly communicates the subject of the research.
2. **Abstract:** Summarises the research question, methodology, key findings, and conclusion.
3. **Introduction:** Explains the background, purpose, and research gap.
4. **Literature Review:** Examines relevant existing studies.
5. **Methodology:** Describes how the research was conducted.
6. **Results and Discussion:** Presents the findings and explains their significance.
7. **Conclusion:** Summarises the key findings, limitations, and possible future directions.
8. **References:** Acknowledges the sources used.

The exact structure may vary depending on the subject and the requirements of the intended publication. Throughout the process, maintain research integrity, respect privacy, obtain necessary permissions, and acknowledge all sources accurately.

## From Our School to the World

Dear students, meaningful research does not always require expensive equipment or a sophisticated laboratory. Sometimes, it begins with an observation made in our own surroundings.

Our fort, its biodiversity, and the sustainability initiatives undertaken by our school provide opportunities to investigate real-world questions and develop studies that may be valuable to a wider scientific community.

**Our surroundings provide the opportunities, curiosity helps us identify the questions, and systematic research enables us to search for answers.**

Let us look around with a scientific mind, identify meaningful research gaps, collect reliable data, and transform our observations into research articles that contribute to knowledge and make a difference to the world.

**Pushpesh Pandey**
**The Fort School Research Initiative**

# BEYOND NUMBERS WHY MATHEMATICS MATTERS

**What if Mathematics is not about being right, but about learning how to think?**

"I hate Maths."
"I can never understand this."
"I'm just not a Maths person."

**How often have we heard—or even said—these words?**

For many students, Mathematics becomes difficult not because they cannot learn it, but because they begin to fear it. One wrong answer becomes a reason to stop trying; one difficult chapter becomes a label: **"I am weak in Maths."**

But Mathematics is not a subject that demands perfection. It demands participation.

Every time you attempt a problem, make a mistake, rethink your approach and try again, you are training your mind.

**More Than Numbers**

A Mathematics problem rarely asks us simply to calculate. First, we must understand the situation. Then we decide what information matters, choose an approach and test whether our answer is reasonable.

**This develops a valuable sequence of thinking:**

**Understand → Question → Connect → Solve → Check**

These habits are useful far beyond Mathematics. They help us approach unfamiliar situations with greater clarity instead of immediately giving up. Research also supports the importance of mathematical reasoning. The OECD's PISA framework considers reasoning, strategy selection, logical conclusions and evaluation to be central elements of mathematical literacy.

**What Do the Numbers Say?**

There is an interesting irony here: Mathematics itself helps us understand the fear of Mathematics. **PISA** 2022 found that mathematics anxiety is widespread among students internationally. Across **OECD** countries, many students reported worrying about poor marks and feeling nervous while solving Mathematics problems.

But anxiety does not mean inability. A student who struggles today can improve tomorrow through practice, effective strategies and confidence. The important question is not **"Am I naturally good at Maths?"** but:

**"Am I willing to work through the problem?"**

**Do Strong Mathematics Students Think Differently?**

Not necessarily because they are born more intelligent, but because they have often developed useful habits through practice.

They do not stop at:
**"What is the answer?"**
**They ask:**
- Why does this method work?
- Can I solve it another way?
- Where did my reasoning go wrong?
- Does the answer make sense?

This habit of questioning encourages logical and analytical thinking. And sometimes, the most valuable part of solving a problem is not reaching the answer—it is discovering how you arrived there. **Maths Is Already Around You**

**Planning a journey?** You are using distance, speed, and time.
**Comparing prices?** You are using percentages.
**Following sports statistics?** You are using averages and probability.
Reading a graph or judging a claim based on data? You are using mathematical reasoning. In an increasingly data-driven world, mathematical literacy helps us not only calculate numbers but interpret them intelligently.

**So, What Should Students Do?**
Don't wait until you "become good at Maths" to start practising.
**Instead:**
Attempt the difficult question.
Ask when you don't understand.
Learn from the wrong answer.
Try a different method.
Explain your reasoning.
Practise consistently, even for a short time.
The goal is not to solve every problem instantly.
**The goal is to become the student who can look at an unfamiliar problem and say:**
"I don't know the answer yet. But I'll figure out where to begin."
That is where Mathematics becomes more than a subject.
It becomes a way of thinking.

**BY YPS RAMAKRISHNA**

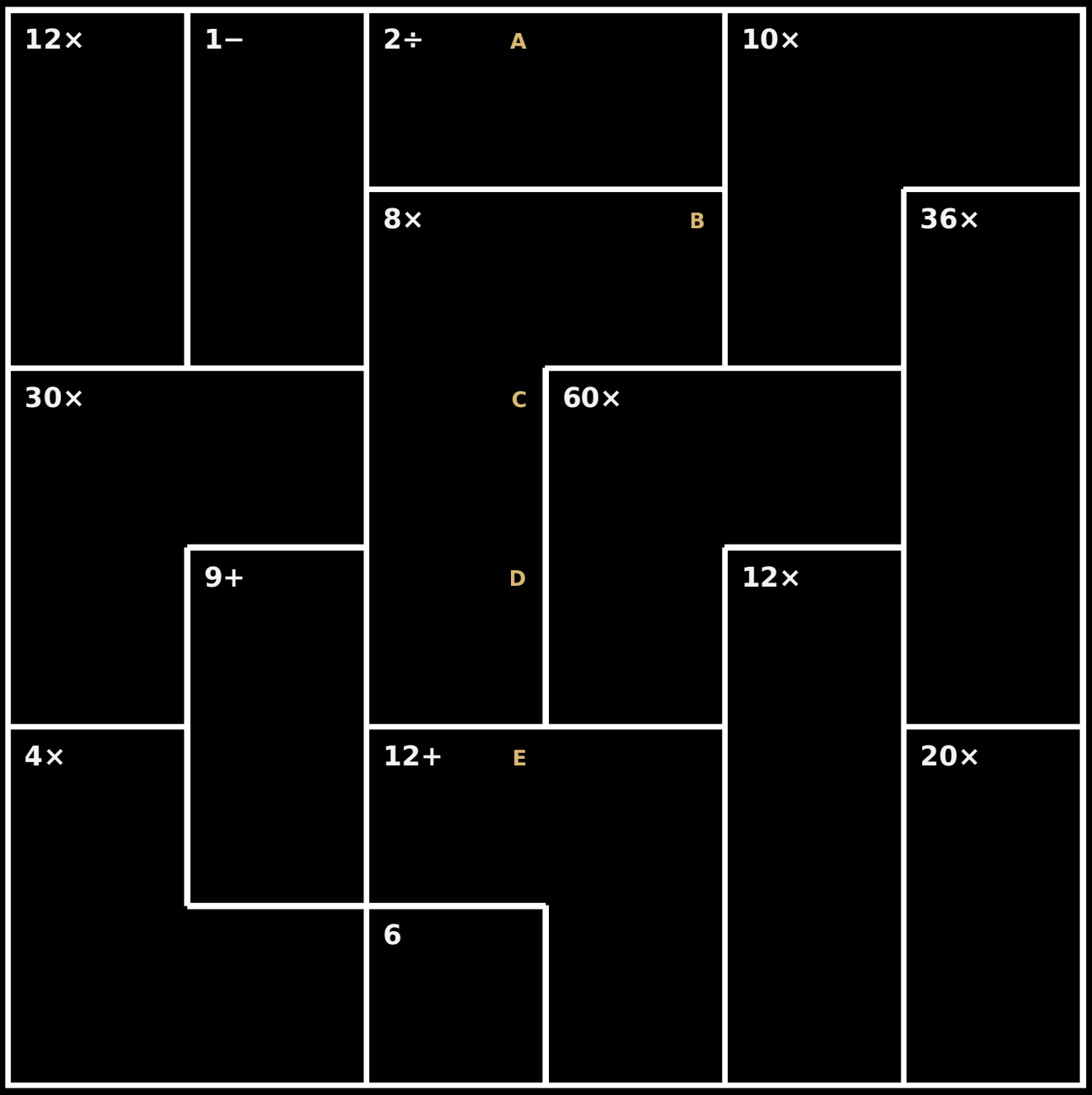
# A slice of π

Six numbers. Four operations. One hidden constant.

## HOW TO PLAY

- Fill each row and column with 1 to 6, using each number once.
- Combine all numbers in each bold cage using its operation to reach its target.
- For − and ÷, either order works. A one-cell cage gives its number.
- A cage may repeat a number if it is in a different row and column.

**KENKEN / 6 × 6** **LOGIC + ARITHMETIC**




## THE π TRAIL

- Read the marked cells A to E.
- Place a decimal point after A.
- What familiar number begins this way?

# The π code.

Nine digits. One grid. An irrational twist.

## HOW TO PLAY

- Fill the empty cells with 1 to 9. Each row, column and bold 3 × 3 box
- must contain every digit exactly once. The letters mark a bonus trail.

**SUDOKU / 9 × 9** **LOGIC + PATTERN**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| A | | 9 | | 5 | | | 1 | 8 |
| 4 | | 6 | B | | | 2 | | 3 |
| | | 7 | 9 | | 2 | | C | |
| 7 | 3 | 9 | | 2 | | D | | |
| | E 4 | | | | | | 3 | |
| | | | | 7 | F | 5 | 4 | 2 |
| | | | | 7 | 3 | G 4 | | |
| 9 | | 4 | H | | | 3 | | 1 |
| 1 | 7 | | | | 4 | | 6 | I |

## FOLLOW THE π TRAIL

- Read A to I in order, then place a decimal point after A. What appears?

| A | B | C | D | E | F | G | H | I |
|---|---|---|---|---|---|---|---|---|
| ___ • | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ |

# A birthday hidden in a *square.*

Row one is his birth date. Every other cell is a small nudge away from it — and every line adds to 139.

| | | | | |
|---|---|---|---|---|
| 22 | 12 | 18 | 87 | 139 |
| 88 | 17 | 9 | 25 | 139 |
| 10 | 24 | 89 | 16 | 139 |
| 19 | 86 | 23 | 11 | 139 |
| 139 | 139 | 139 | 139 | |

## HOW IT'S MADE

01 Write the date across the top: day, month, then the year split in two — 22, 12, 18, 87.

02 Fill every lower row with those same four numbers, each nudged up or down by a few units.

03 Choose nudges that cancel along every row, column and diagonal — +1, −1, −3, +3 adds to zero.

04 The magic total is just the date itself: 22 + 12 + 18 + 87 = 139.

## ROW ONE READS HIS BIRTH DATE: 22 · 12 · 18 · 87.

### THE RECIPE

| D | M | C | Y |
|---|---|---|---|
| Y+1 | C−1 | M−3 | D+3 |
| M−2 | D+2 | Y+2 | C−2 |
| C+1 | Y−1 | D+1 | M−1 |

D day · M month · C and Y the year

### TRY ANOTHER DATE

| | | | |
|---|---|---|---|
| 15 | 8 | 19 | 47 |
| 48 | 18 | 5 | 18 |
| 6 | 17 | 49 | 17 |
| 20 | 46 | 16 | 7 |

15 − 8 · 19 · 47 — every line adds to 89

### WHY IT WORKS

Each letter appears once in every row and column — the Latin-square skeleton behind sudoku and KenKen. The nudges then cancel to zero.

### ALSO ADDS TO 139

The four corners, the four centre cells and each 2×2 quarter.

*A date looks like the least mathematical thing there is. Ramanujan treated it as raw material.*

# Answer key

KenKen, Sudoku and the birthday magic square.

### 01 / KENKEN

## A slice of π

| | | | | | |
|---|---|---|---|---|---|
| 12× **4** | 1− **5** | 2÷ A **3** | **6** | 10× **2** | **1** |
| **3** | **4** | 8× **2** | B **1** | **5** | 36× **6** |
| 30× **5** | **1** | C **4** | 60× **2** | **6** | **3** |
| **6** | 9+ **3** | D **1** | **5** | 12× **4** | **2** |
| 4× **2** | **6** | 12+ E **5** | **3** | **1** | 20× **4** |
| **1** | **2** | 6 **6** | **4** | **3** | **5** |

**A-E: 3.1415…**

The opening digits of π.

### 02 / SUDOKU

## The π code

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| A 3 | 9 | 2 | 5 | 4 | 6 | 7 | 1 | 8 |
| 4 | 5 | 6 | B 1 | 8 | 7 | 2 | 9 | 3 |
| 8 | 1 | 7 | 9 | 3 | 2 | 6 | 5 | C 4 |
| 7 | 3 | 9 | 4 | 2 | 5 | D 1 | 8 | 6 |
| 2 | 4 | E 5 | 8 | 6 | 1 | 9 | 3 | 7 |
| 6 | 8 | 1 | 3 | 7 | F 9 | 5 | 4 | 2 |
| 5 | 6 | 8 | 7 | 1 | 3 | 4 | G 2 | 9 |
| 9 | 2 | 4 | H 6 | 5 | 8 | 3 | 7 | 1 |
| 1 | 7 | 3 | 2 | 9 | 4 | 8 | 6 | I 5 |

**A-I: 3.14159265…**

The opening digits of π.

### 03 / BIRTHDAY MAGIC SQUARE

## A birthday hidden in a square

Each row, column and both main diagonals share the same total.

**22 DECEMBER 1887**

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

**MAGIC TOTAL**

**139**

in every row, column and main diagonal.

**TRY ANOTHER DATE: 15 AUGUST 1947**

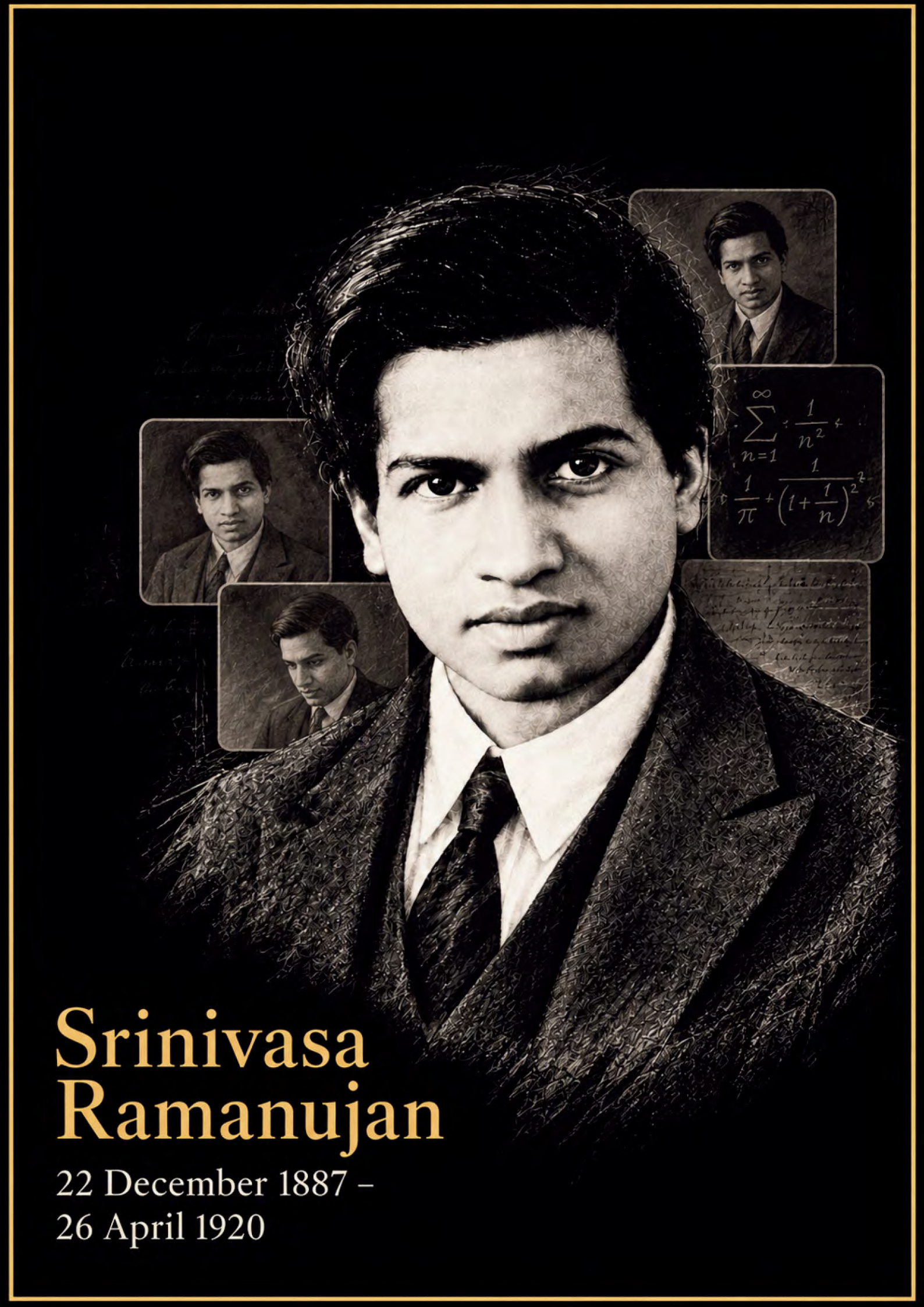
| | | | |
|---|---|---|---|
| 15 | 8 | 19 | 47 |
| 48 | 18 | 5 | 18 |
| 6 | 17 | 49 | 17 |
| 20 | 46 | 16 | 7 |

**MAGIC TOTAL**

**89**

in every row, column and main diagonal.

The four corners, centre 2 × 2 and each 2 × 2 quarter also match their square’s total.




# Srinivasa Ramanujan

22 December 1887 –
26 April 1920

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