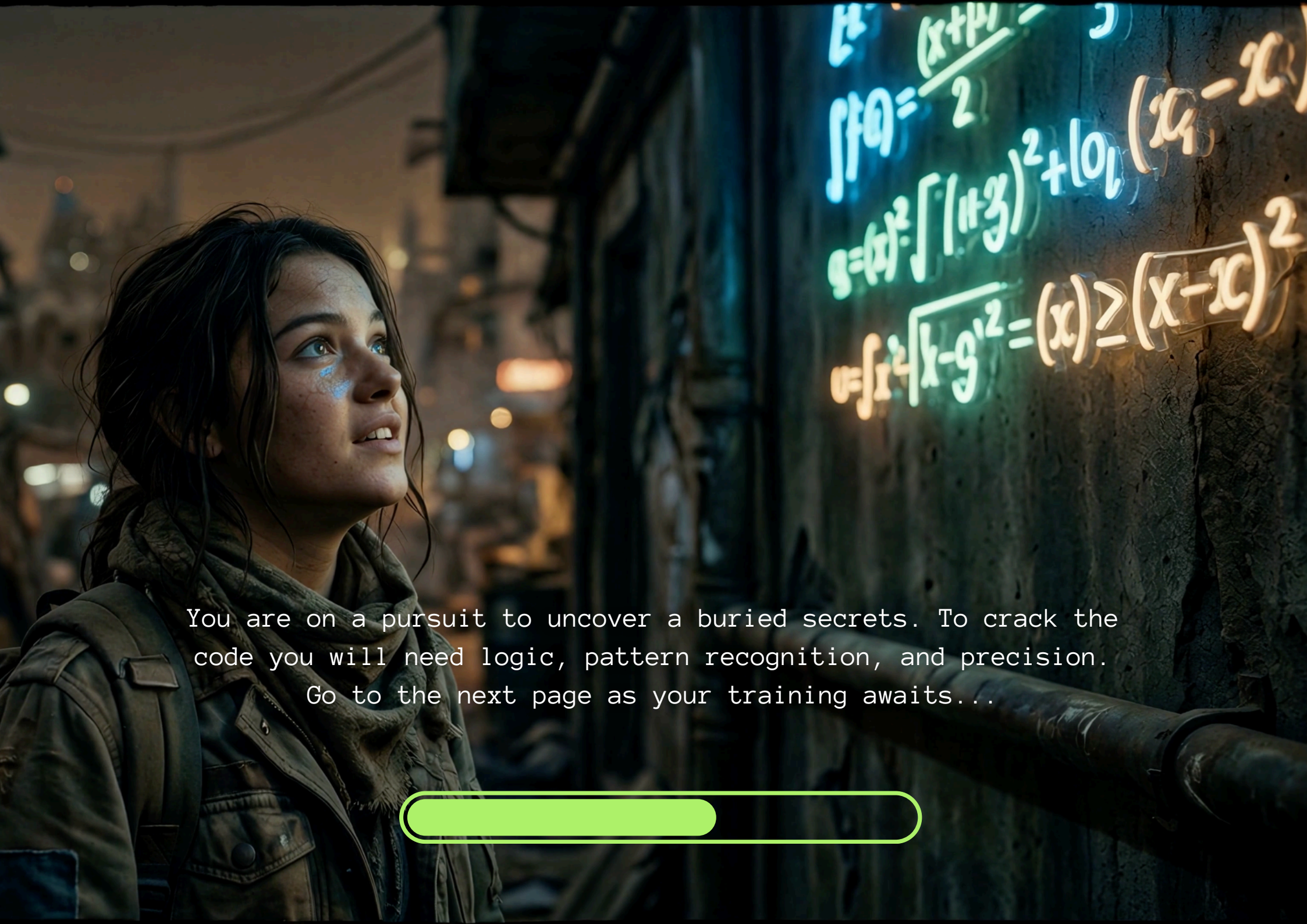
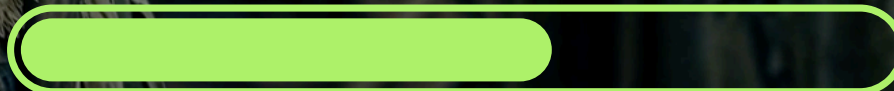




You are on a pursuit to uncover a buried secrets. To crack the code you will need logic, pattern recognition, and precision.
Go to the next page as your training awaits...



CHALLENGE 2 | YEARS 5 & 6

THE MATHEMATICIAN'S VAULT

Focus: Mathematics
Creator: Dr Indramohan Singh



Click on the content
you would like to view



Training Challenge 2 | The Mathematician's Vault

Introduction	1
Activity 1: Equal Sides Sums	2
Activity 2: Crack the number	7
Activity 3: Decode the values	15
Activity 4: Mathematical security layer: Algebra	22

Materials and resources needed for Challenge 2 training activities:

- paper and pencil
- The Mathematician's Vault Worksheet
- The Mathematician's Vault Answer Sheet

Please note that the training activities have been designed to be viewed as slides which increases the number of pages. Please consider the number of pages before printing.

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



INTRODUCTION

The Mathematician's Vault

Somewhere deep in a hidden chamber, a legendary mathematician has sealed away their greatest discovery, protected by a three-letter code that only the sharpest mathematical minds can unlock. The vault will not budge for guesswork. It demands logic, pattern recognition, and precision.

"The numbers hold the secret. Arrange them, analyse them, decode them and the vault is yours."

In this challenge, students become code-breakers. They must work through three escalating stages.

Every step demands both mathematical skill and careful reasoning. Get it right, and the vault opens. Rush it, and the secret stays buried.



CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 1

Equal Side Sums

Adult assistance:

None required.

Preparation time:

None

Activity time:

20 minutes

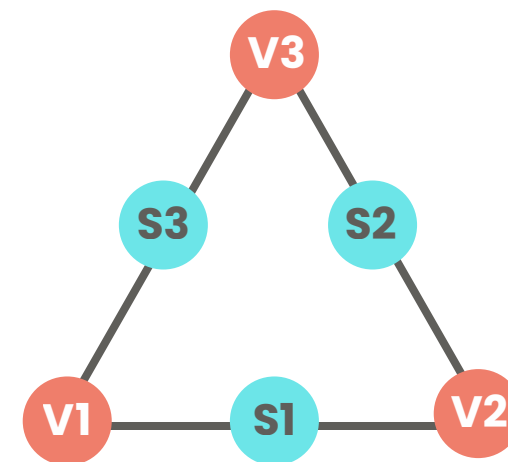
Materials required:

- **Worksheet**

Your mission today is to crack the mathematical code of the **Magic Triangle**.

Your target is to arrange the code numbers 4, 5, 6, 7, 8, and 9 into the triangle layout below.

The Rule: The three numbers along **any single side** must add up to the exact same total.



CHALLENGE 2 : THE MATHEMATICIAN'S VAULT

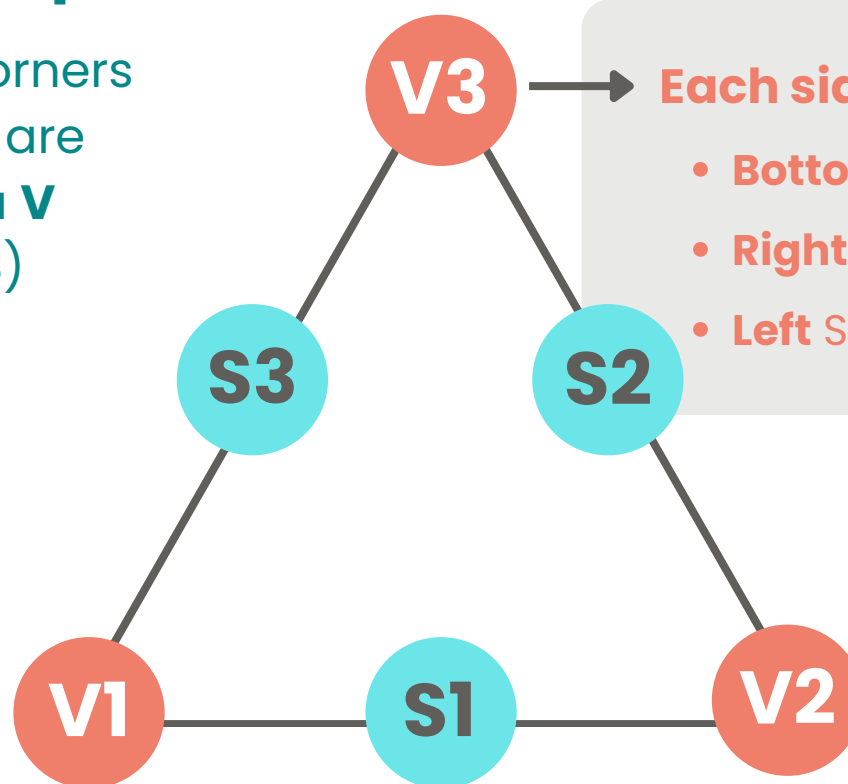


ACTIVITY 1

Equal Side Sums

The Layout Map

- **Verticies** — Corners of the triangle are labelled with a **V** (**V1**, **V2** and **V3**)
- **Midpoints** are labelled **S1**, **S2** and **S3**



Each side contains 3 numbers:

- **Bottom Side:** **V1** + **S1** + **V2**
- **Right Side:** **V2** + **S2** + **V3**
- **Left Side:** **V3** + **S3** + **V1**

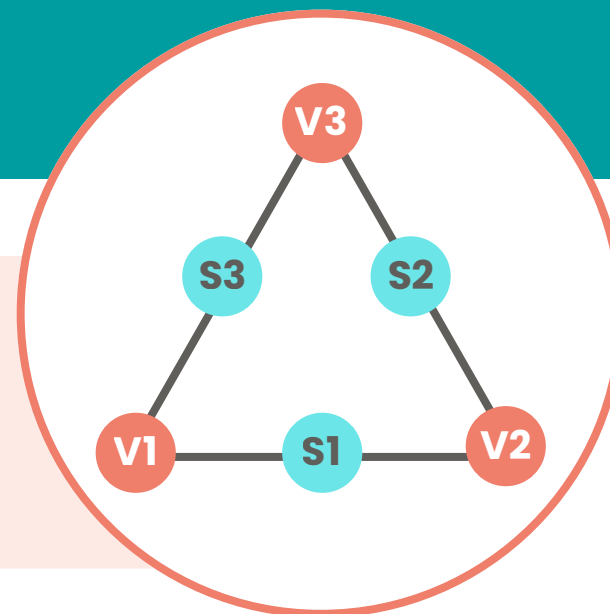
CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 1

Equal Side Sums

Before placing your numbers randomly, answer these **strategic questions** to unlock the cheat code for this puzzle.

**1.1**

What is the total sum of all six numbers combined?

Calculation: $4+5+6+7+8+9=?$

1.2

Arrange these six numbers into three separate pairs (triplets of a different kind) so that each pair adds up to the exact same total (Check the Layout map)

Pair 1: (____ + ____)

Pair 2: (____ + ____)

Pair 3: (____ + ____)

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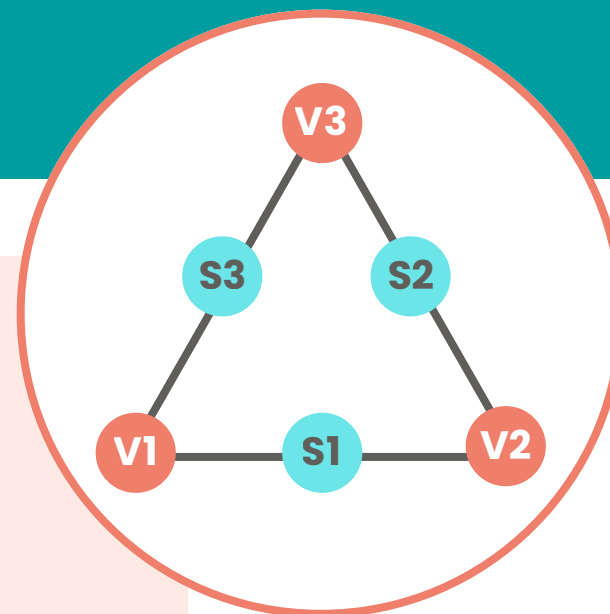


ACTIVITY 1

Equal Side Sums

Choose one of the Strategies —

The Minimalist or Maximalist and place your numbers into the triangle to solve the puzzle so that each side adds to the same value.

**1.3**

Strategy A : The Minimalist

Which three numbers work best at the vertices to get the **smallest possible** side sum?

1.4

Strategy B : The Maximalist

Which three numbers work best at the vertices to get the **largest possible** side sum?

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT

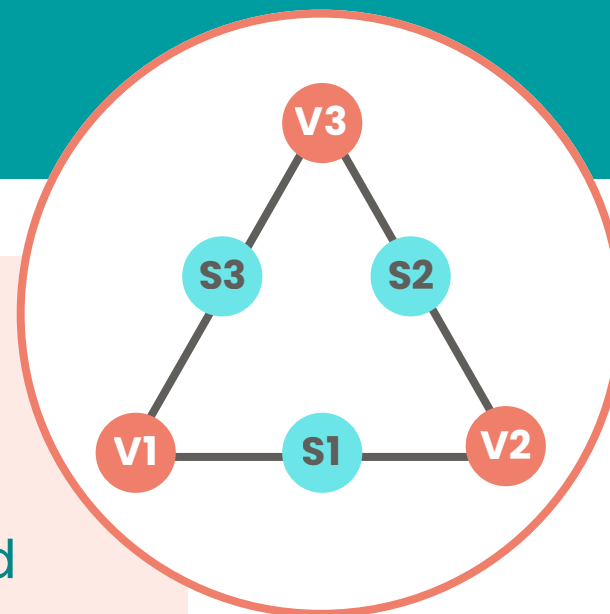


ACTIVITY 1

Equal Side Sums

The Elite Extension Challenge

Now, try the same exercises with a much heavier sequence: 20, 21, 22, 23, 24, and 25. Using the vertex secrets you have discovered to crack this larger triangle.

**1.5**

Find the equal side sum and then go on to activity 2 to find out about factorisation and prime factors before coming back to **find**:

- **The prime factorisation of the side sum**
- **Total number of prime factors of the side sum**

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 2

Crack the Number

Adult assistance:

None required.

Preparation time:

None

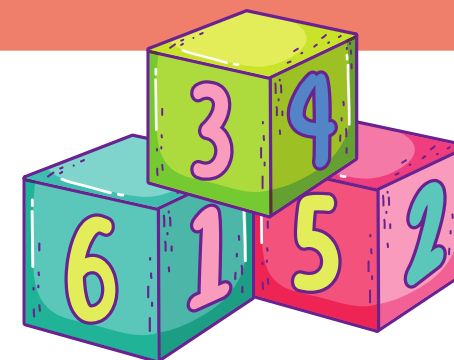
Activity time:

20 minutes

Materials required:

- Worksheet

Your mission is to take large, complex composite numbers and split them until only their fundamental building blocks remain: the **Prime Numbers**.



CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 2

Crack the Number

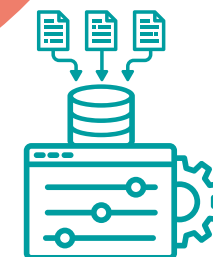
What is a prime number?

A prime number is a **whole number greater than 1** that has exactly **two distinct factors: 1 and itself**.

It **cannot be divided evenly** by any other numbers.

Examples of
prime numbers
include:

**2, 3, 5, 7, 11, 13,
17, 19, 23,
etc.**



CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 2

Crack the Number



6 and 8 are numbers that are **NOT** prime because they have factors other than 1 and itself.

- $6 = 2 \times 3$
- $8 = 2 \times 4$

Note:
The **number 2** is unique because it is **the only even prime number**.

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 2

Crack the Number



A **composite number** is a **whole number greater than 1** that has more than two factors. This means **it can be broken down and divided evenly** by numbers other than 1 and itself.

Examples:

because 4 can be written as $4 = 1 \times 4 = 2 \times 2$

so

- 4 has the factors: 1, 2 and 4
- 6 has the factors: 1, 2, 3 and 6
- 9 has the factors: 1, 3 and 9

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



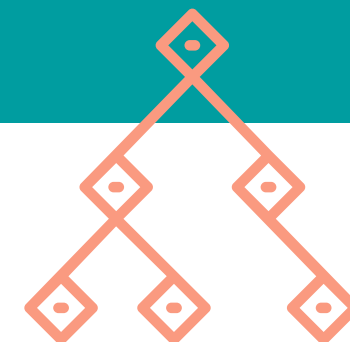
ACTIVITY 2

Crack the Number

- **Prime factorisation** is the process of breaking down a composite number into a product of only prime numbers.
- Every composite number has a **unique set of prime factors**, think of it like a number's mathematical DNA.

Examples:
The prime factorisation of 12 is

$$2 \times 2 \times 3$$
$$(\text{or } 2^2 \times 3)$$



CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 2

Crack the Number

How to build a factor tree

STEP 1

Choose any composite number
(you can't factorise a prime number!)

STEP 2

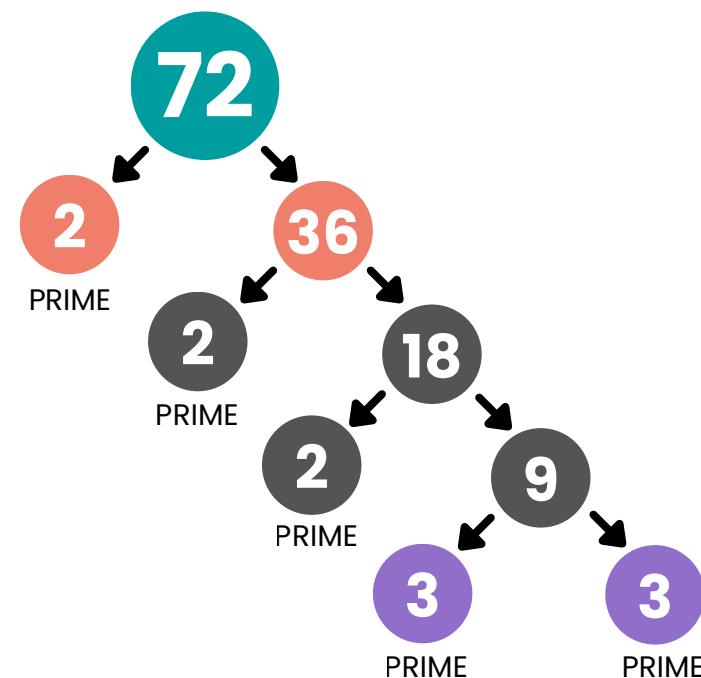
Divide your composite number by
the smallest possible prime factor.

STEP 3

Repeat – keep splitting and dividing
by the smallest possible prime factor.

STEP 4

Stop when all terminal numbers
are prime.



CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 2

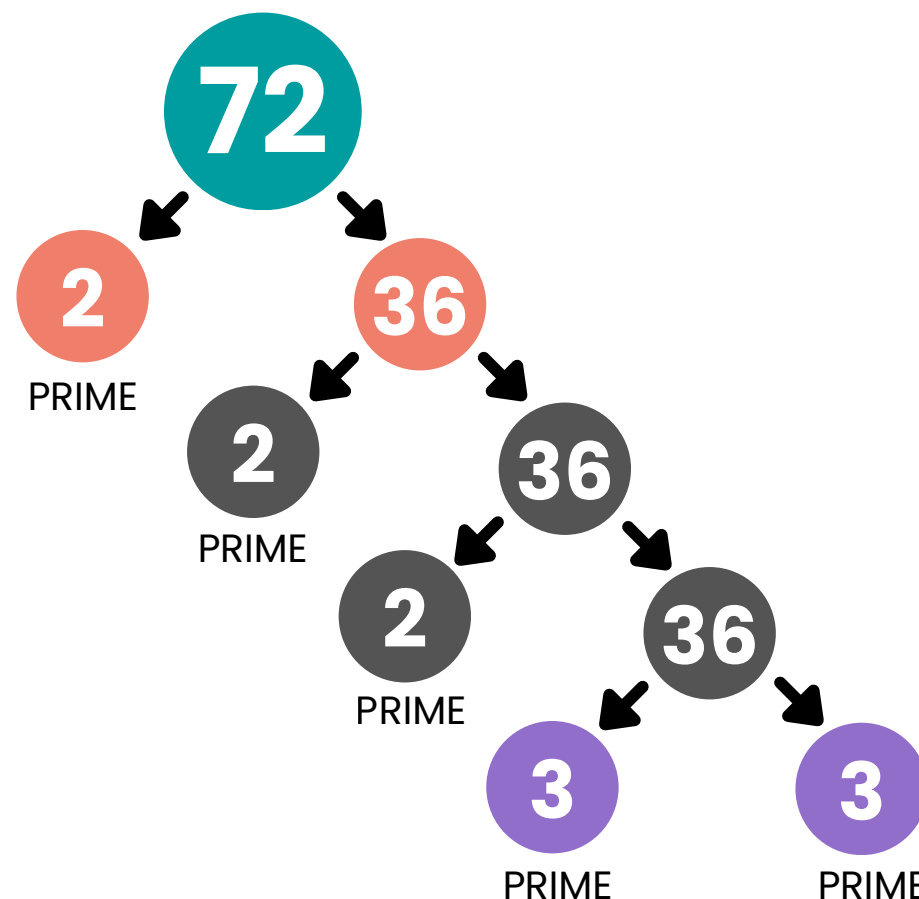
Crack the Number

How to build a factor tree

This shows that the Prime factorisation of 72 is

$$2 \times 2 \times 2 \times 3 \times 3$$

and the **total number of prime factors** is 5.



CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 2

Crack the Number**Your turn:**

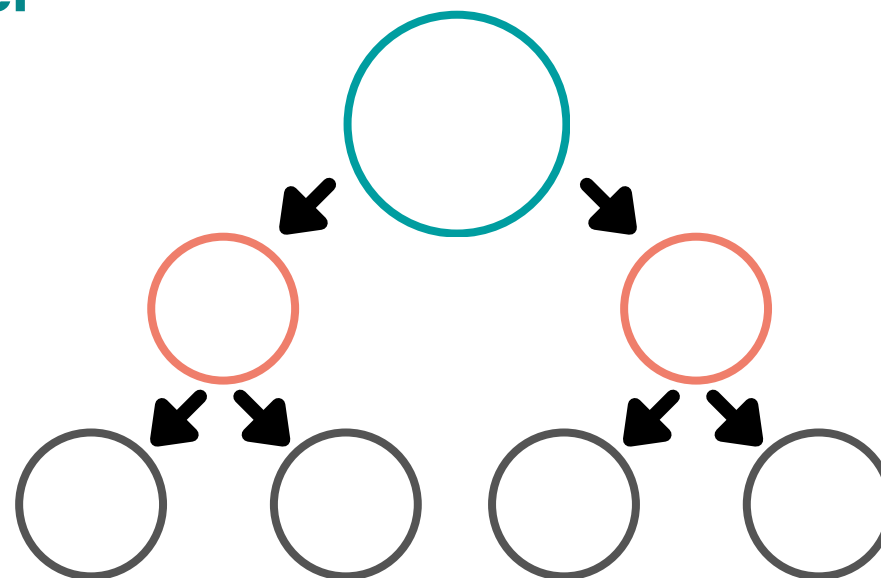
For each of these numbers, **find the prime factors and the total number of prime factors.**

2.1 **36**

2.3 **54**

2.2 **48**

2.4 **90**



CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 3

Decode the Values

Adult assistance:

None required

Preparation time:

None

Activity time:

20 minutes

Materials required:

Worksheet

Your mission:

We have intercepted an encrypted broadcast. Our analysts have determined that the message is locked behind a set of mathematical firewalls.

To crack the code, you must solve each arithmetic puzzle below to find a **Target Number**. Once you have the number, use your mini code chart on the next slide to convert it into its secret letter.

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 3

Decode the Values



Mini Code Chart

1 A	2 B	3 C	4 D	5 E
6 F	7 G	8 H	9 I	10 J

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 3

Decode the Values**3.1 Firewall 1: The Prime Factor Core**

Find the total number of prime factors for the number

384

Use the code to find the secret letter

Clue: Think back to your factor tree branches!

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 3

Decode the Values**3.2 Firewall 2: The Division Partition****Calculate:**

$$45 \div 5$$

Use the code to find the secret letter

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 3

Decode the Values**3.3 Firewall 3: The Even Array**

Count the number of even numbers in this specific sequence:

2, 5, 8, 16, 17, 18, 23, 37, 97, 99

Use the code to find the secret letter

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT

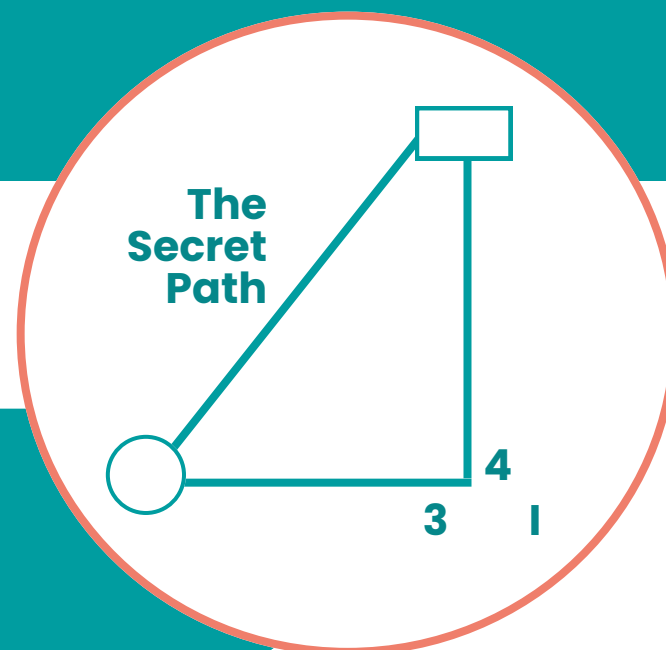


ACTIVITY 3

Decode the Values

3.4 Firewall 4: The Hidden Shortcut

You are standing at the corner of a secret path (at the circle in the given map).



A

First, look at the number 3 and square it to find the area of your first secret zone. Next, look at the number 4 and square it to find the area of your second zone.

B

Now, combine the power of both zones by adding their squares together.

C

For your final challenge: take the square root of that combined total to unlock the exact number of steps you need to take along the ultimate shortcut. How many steps are needed to reach the destination (the rectangle) using the secret path?

CHALLENGE 2: THE MATHEMATICIAN'S VAULT



ACTIVITY 3

Decode the Values**3.5 The final decryption**

Put together your answers from the previous questions to reveal the secret word.

Letter 1 from 3.1: _____

Letter 1 from 3.2: _____

Letter 1 from 3.3: _____

Letter 1 from 3.4: _____

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 4

Mathematical Security Layer: Algebra

Adult assistance:

None required

Preparation time:

None

Activity time:

30 minutes

Materials required:

Worksheet

Welcome to the final stage of your training, Elite Teams. You've cracked the Magic Triangle and decoded the encrypted broadcast.

Now, you face the final mathematical security layer: **Algebra**.

Don't let the letters scare you. Letters are just placeholder masks hiding secret numbers. Your job is to rip off the mask.

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 4

Mathematical Security Layer: Algebra



The Golden Rule of Algebra

Imagine an equation is a balance scale. The equals sign (=) means both sides weigh exactly the same.

To keep the scale perfectly level, whatever you do to one side of the equation, you **MUST do to the other side.**

CHALLENGE 2: THE MATHEMATICIAN'S VAULT



ACTIVITY 4

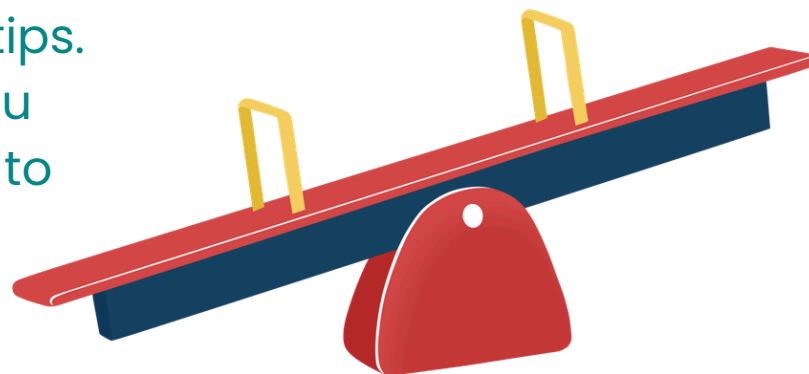
Mathematical Security Layer: Algebra

**Your mission is always the same: Isolate the Variable
(get the letter completely by itself on one side of the = sign).**

Think of the equals sign as the center pivot of a playground see-saw.

If you add 5 kg to one side, the see-saw tips.

To level it out, you have to add 5 kg to the other side.



If you multiply one side by 2, you must multiply the other side by 2. Keep it balanced!

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 4

Mathematical Security Layer: Algebra

If you see...	Undo it by...	Example
Addition	Subtraction	Undo + 4 with - 4
Subtraction (-)	Addition (+)	Undo - 7 with + 7
Multiplication (×)	Division (÷)	Undo 2x (2 times x) with ÷2
Division (÷)	Multiplication (×)	Undo x÷3 with ×3
Square Root ($\sqrt[2]{x}$)	square	Undo $\sqrt[2]{x}$ with $(\sqrt[2]{x})^2 = x$

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 4

Mathematical Security Layer: Algebra**Examples:**

$$z + 9 = 20$$

undo the + 9 by
taking 9 from both sides

$$z = 11$$

$$3x + 1 = 13$$

undo the + 1 by
taking 1 from both sides

$$3x = 12$$

undo the 3X by
dividing by 3 on both sides

$$x = 4$$

CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 4

Mathematical Security Layer: Algebra

Mission:

In the field, you won't always be given the numbers for your Magic Triangle or your Code Chart. Sometimes, you have to extract them from balanced equations.

To "solve" an equation, you must keep the scale balanced. Whatever you do to one side (add, subtract, multiply, or divide), you must do to the other side to find the value of the unknown variable.



CHALLENGE 2 : THE MATHEMATICIAN'S VAULT



ACTIVITY 4

Mathematical Security Layer: Algebra

The Variable Extraction: Solve the Constants x, y and z

$$4.1 \quad z + 4 = 11$$

$$4.2 \quad y - 6 = 6 - y$$

$$4.3 \quad 2x - 7 = 9$$

$$4.4 \quad \sqrt[2]{x} - 4 = 12$$

Remember that $2x$ is really $2 \times x$ (two times x)

CHALLENGE 2: THE MATHEMATICIAN'S VAULT

Congratulations, you have completed this training and you are now ready to unlock the Mathematician's Vault!