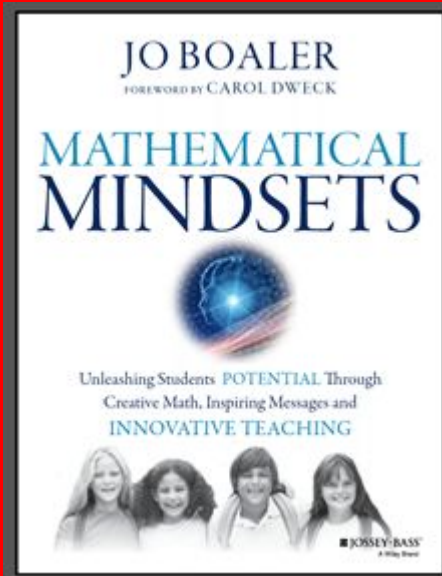
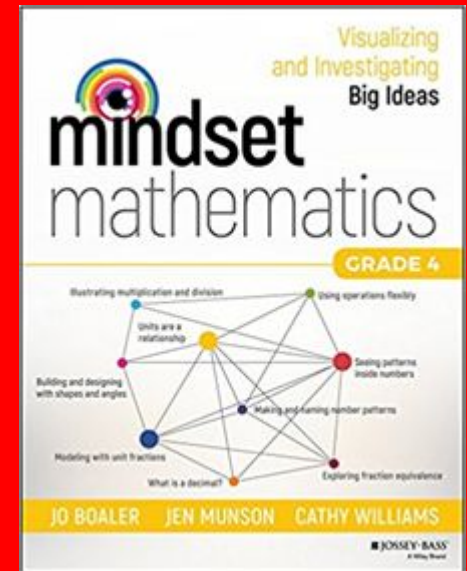


Mathematical Mindsets Presentation

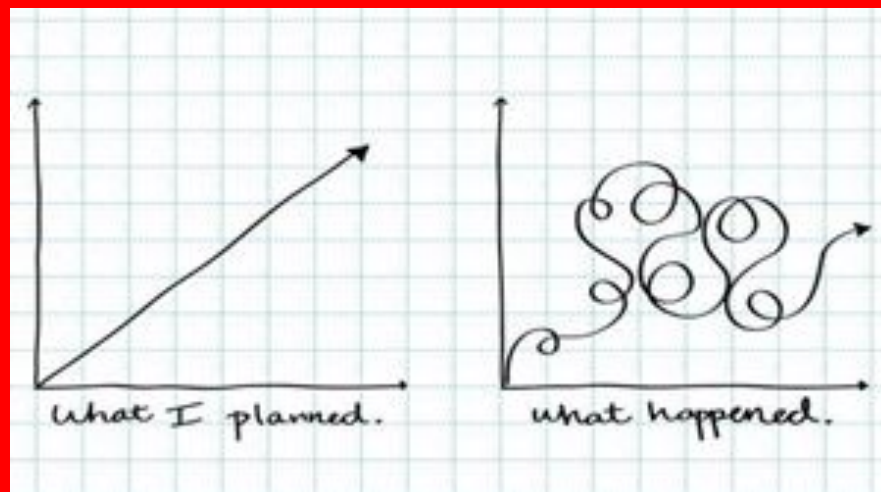
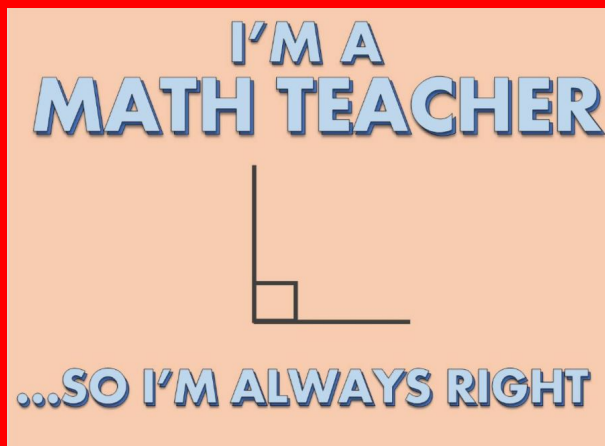
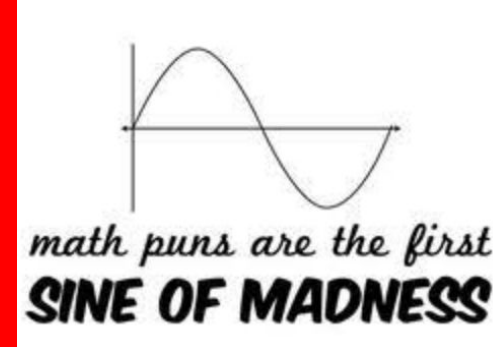
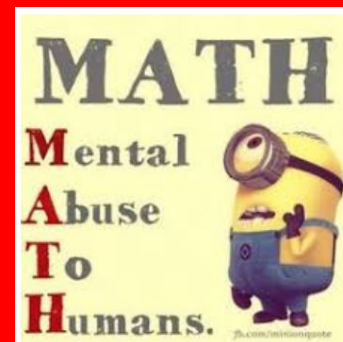
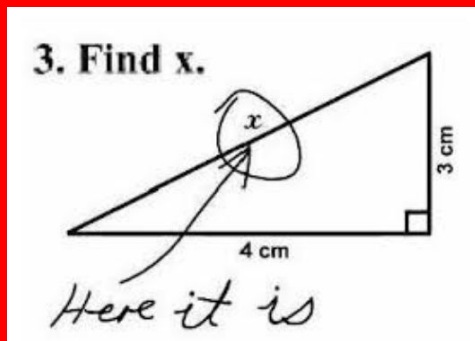
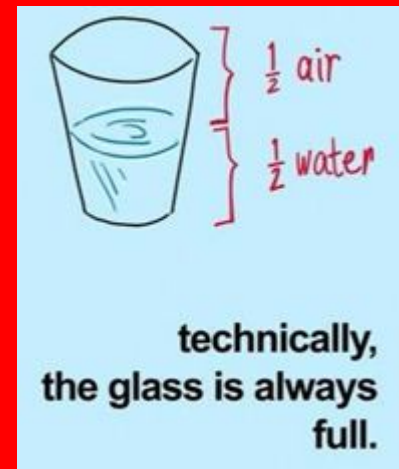


You have probably heard people say they are just bad at math, or perhaps you yourself feel like you are not “a math person.” Not so, says Stanford mathematics education professor Jo Boaler, who shares the brain research showing that with the right teaching and messages, we can all be good at math.



Mindfulness Maths Check In

4 OUT OF 3
PEOPLE
STRUGGLE
WITH MATH





Parkmore Primary School
Excellence, Resilience, Responsibility, Respect and Inclusiveness

Parkmore Primary Context



- Positive Psychology & Visible Wellbeing
- 2 Years of Trial In Developing Maths Curriculum Influenced By 'Mathematical Mindsets'
- Redesigned Curriculum & Assessment Tools
- Strong Student Relative Growth Results & Achievement Data in Mathematics
- Presentations to the Riversdale Network & Parkmore Parents
- Innovative School Awards 2016, 2017 & 2018



AUSTRALIAN EDUCATION
— AWARDS 2018 —

Do You Have A Maths Brain?

YES!



NO!





Everyone can
learn math
to the
highest levels

Mistakes are
valuable

Questions are
really important

Math is about
creativity and
making sense

Math is about
connections and
communicating

Math class is
about learning not
performing

Depth
is more important
than speed



Parkmore Primary School

Excellence, Resilience, Responsibility, Respect and Inclusiveness



Jo Boaler is a professor of mathematics education at Stanford and the co-founder of YouCubed, She is also the author of the first massive open online course on mathematics teaching and learning. Her book *Experiencing School Mathematics* won the Outstanding Book of the Year award for education in Britain. A recipient of a National Science Foundation "early career award" she was recently named by BBC as one of the eight educators changing the face of education.

What is a Mathematician's Work?

- So what is **Multidimensional Mathematics**? It is real Mathematics. Let's consider the work of a mathematician:
 1. First they pose an important problem.
 2. Then map out a mathematical approach.
 3. They will probably collaborate with others on ideas.
 4. Mathematicians engage in a zig-zagging process of conjecturing, refining counter examples and proving.
 5. They form a mathematical model, apply methods, draw diagrams, connect ideas, reason about connections and communicate in different forms.

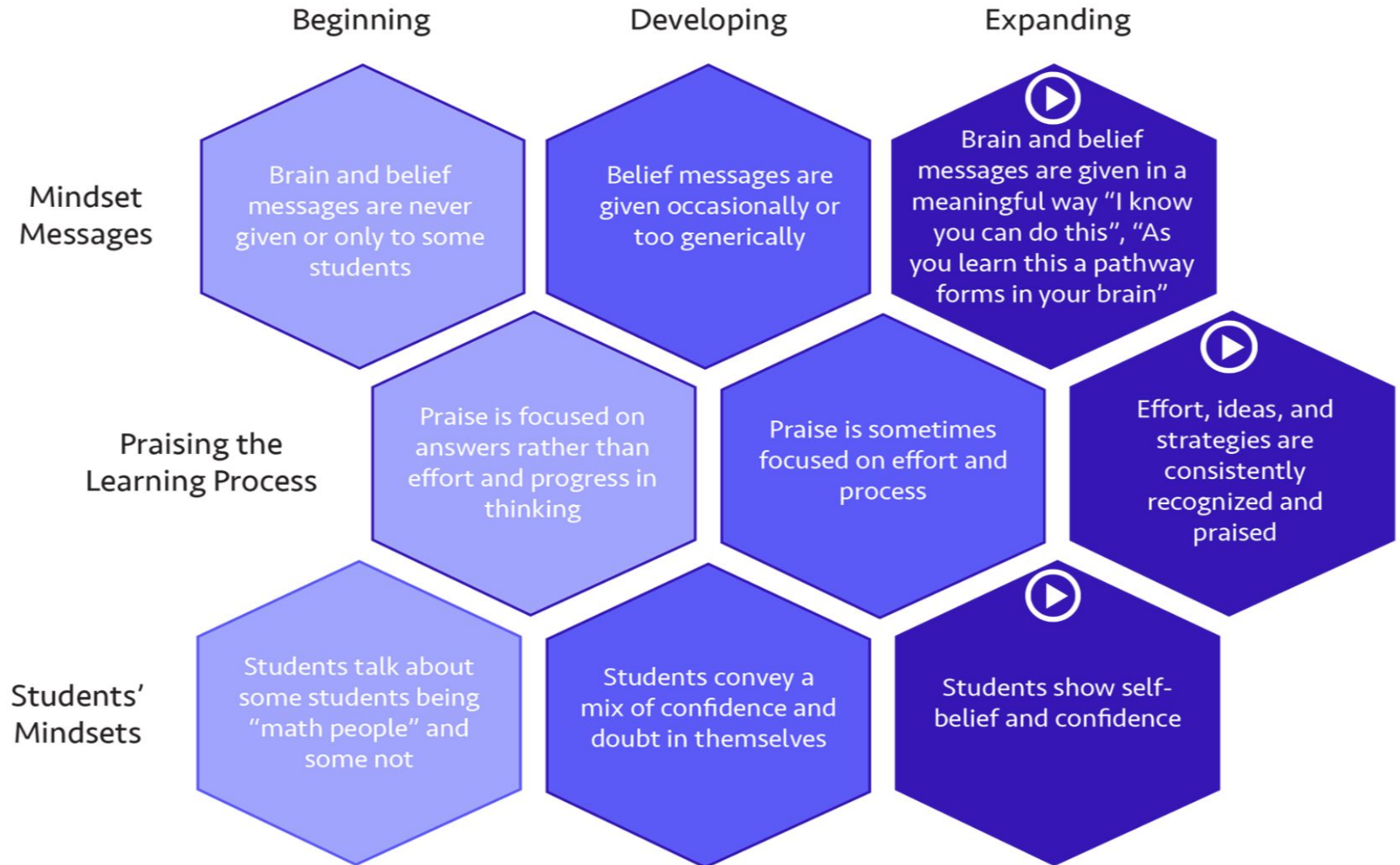


The work is multidimensional. When mathematics is taught as a multidimensional subject in classrooms students engage more, enjoy math more and achieve at higher levels. (Jo Boaler)

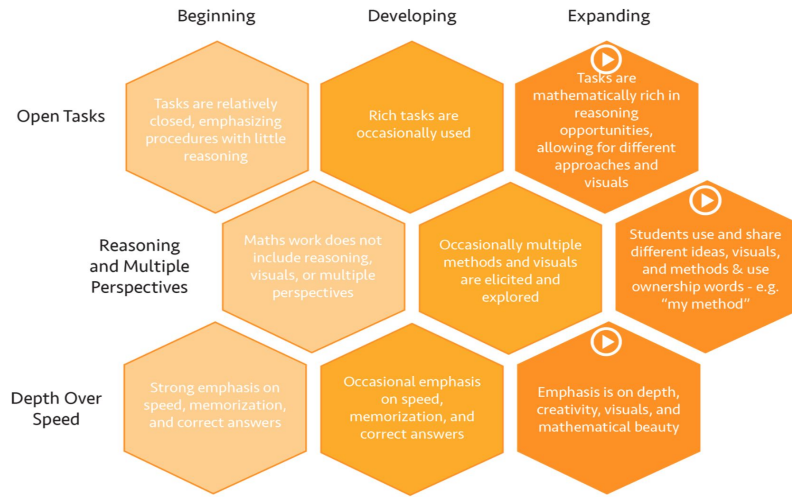
1970	
1	Writing
2	Computational Skills
3	Reading Skills
4	Oral Communications
5	Listening Skills
6	Personal Career Development
7	Creative Thinking
8	Leadership
9	Goal Setting
10	Teamwork
11	Organisational Effectiveness
12	Problem Solving
13	Interpersonal Skills

2010	
1	Teamwork +9
2	Problem Solving +10
3	Interpersonal Skills +10
4	Oral Communications
5	Listening Skills
6	Personal Career Development
7	Creative Thinking
8	Leadership
9	Goal Setting
10	Writing -9
11	Organisational Effectiveness
12	Computational Skills -10
13	Reading Skills -10

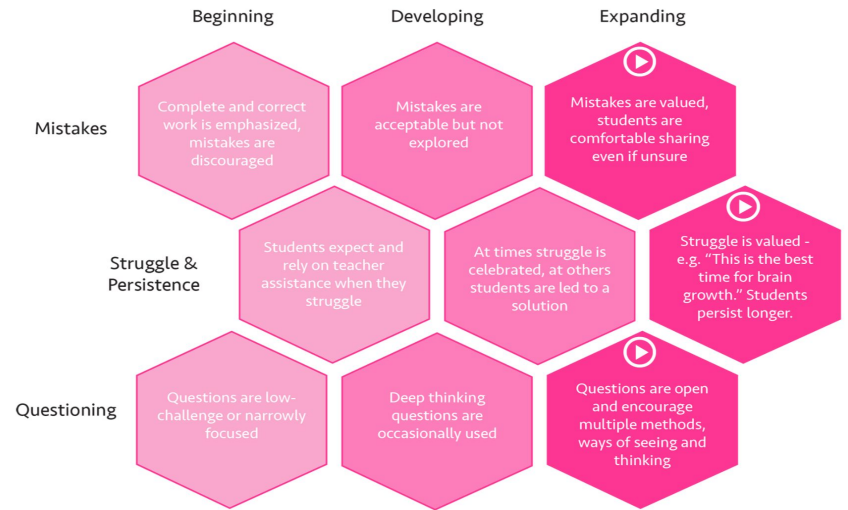
Mathematical Mindset Practice 1: Growth Mindset Culture



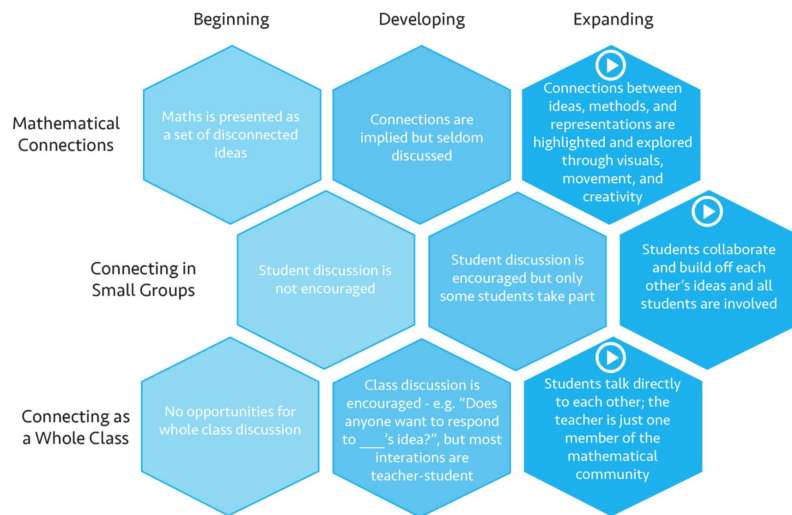
Mathematical Mindset Practice 2: Nature of Mathematics



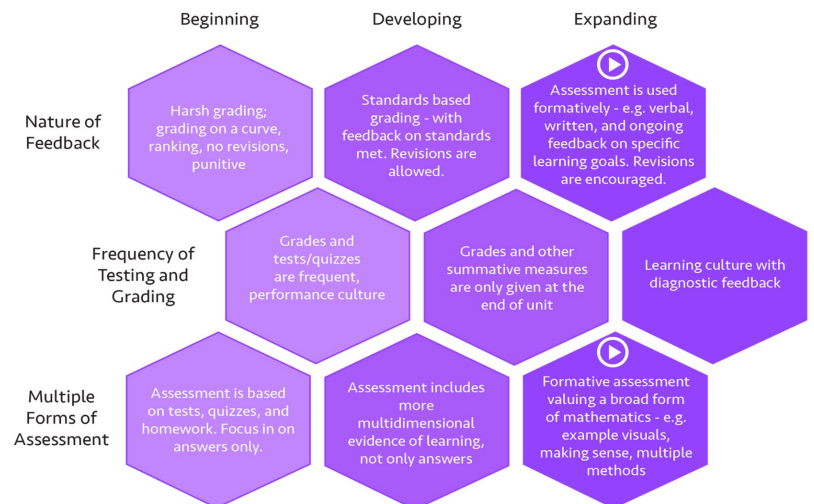
Mathematical Mindset Practice 3: Challenge & Struggle



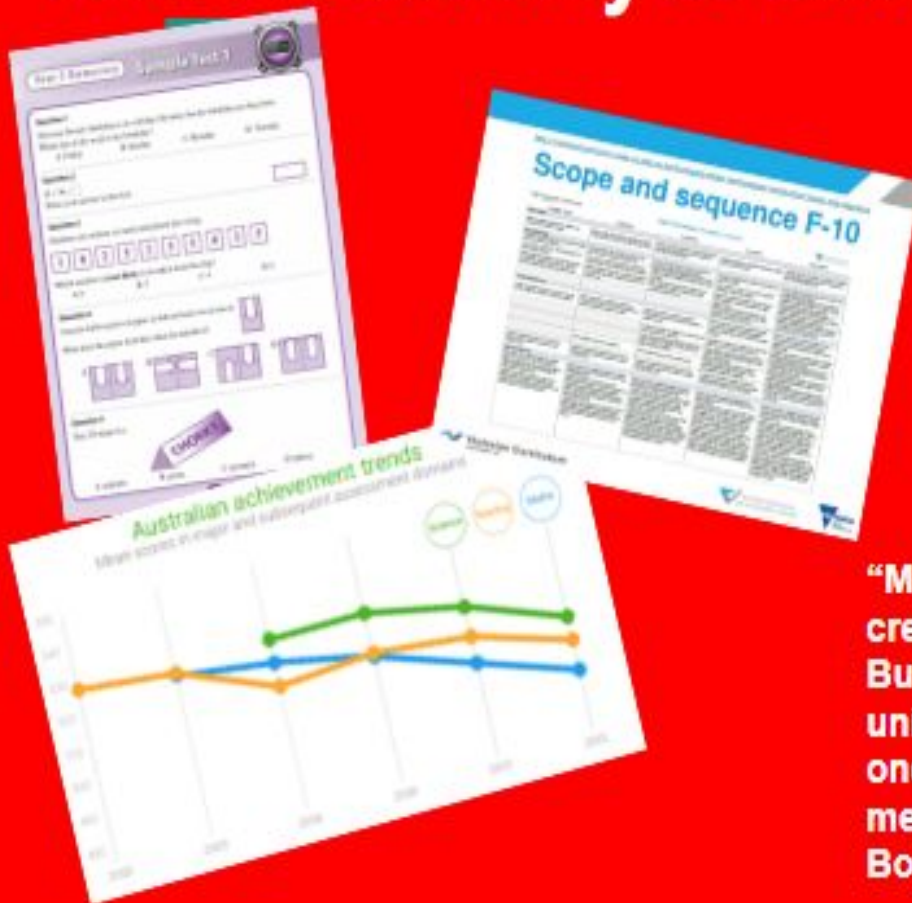
Mathematical Mindset Practice 4: Connections & Collaborations



Mathematical Mindset Practice 5: Assessment



The Creativity & Beauty In Maths

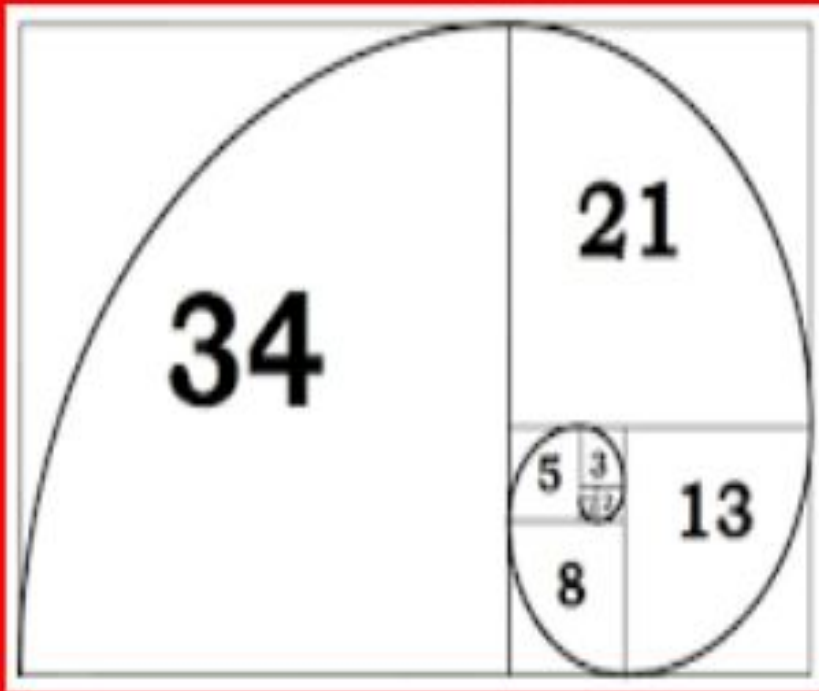


“Mathematics is a beautiful, open, creative, and multi-dimensional subject. But school mathematics is often uninspiring, procedural and one-dimensional – it is all about memorizing methods and procedures” (Jo Boaler).

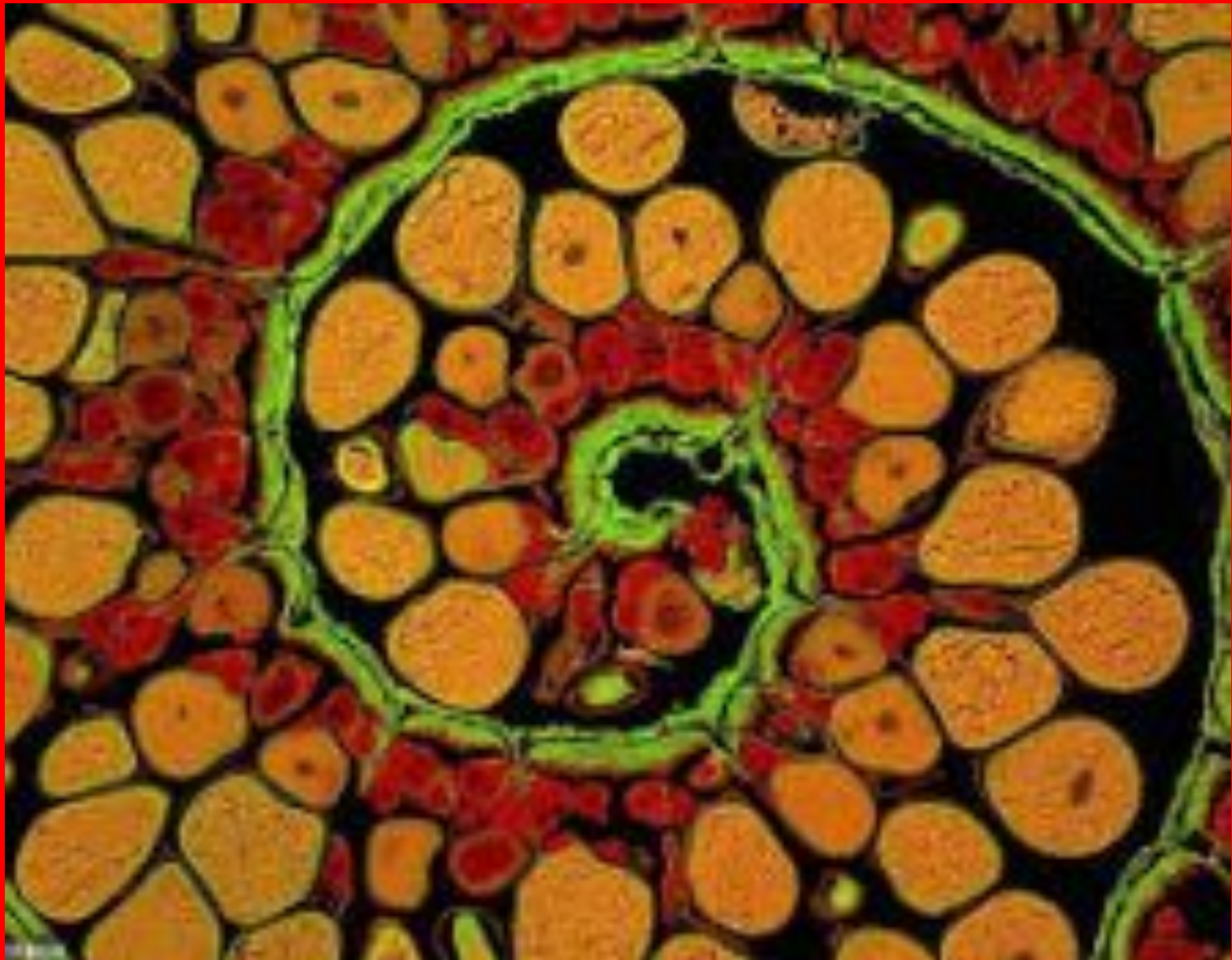


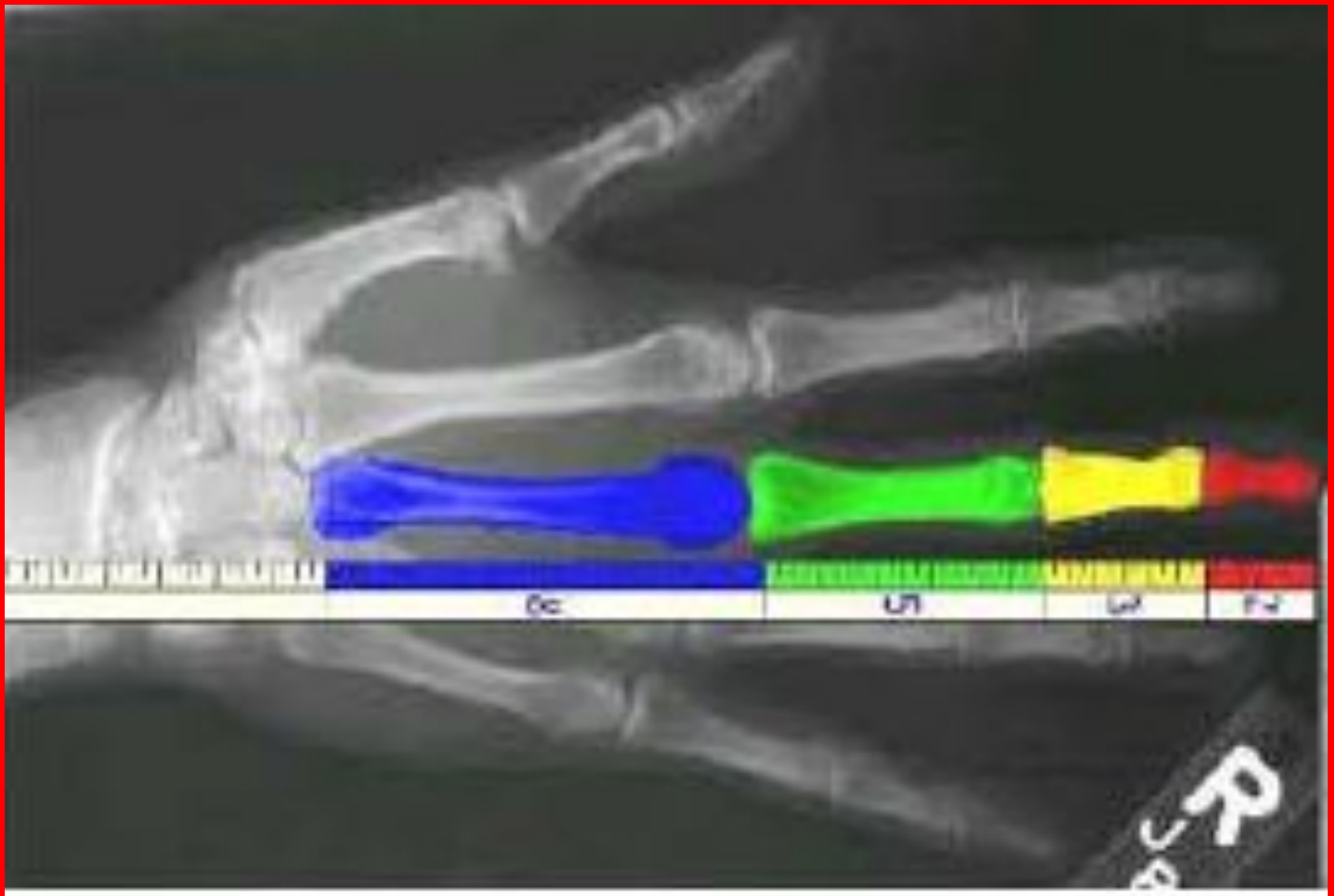
The Fibonacci Sequence

Exploring the Beauty of Maths & the Connection to Nature



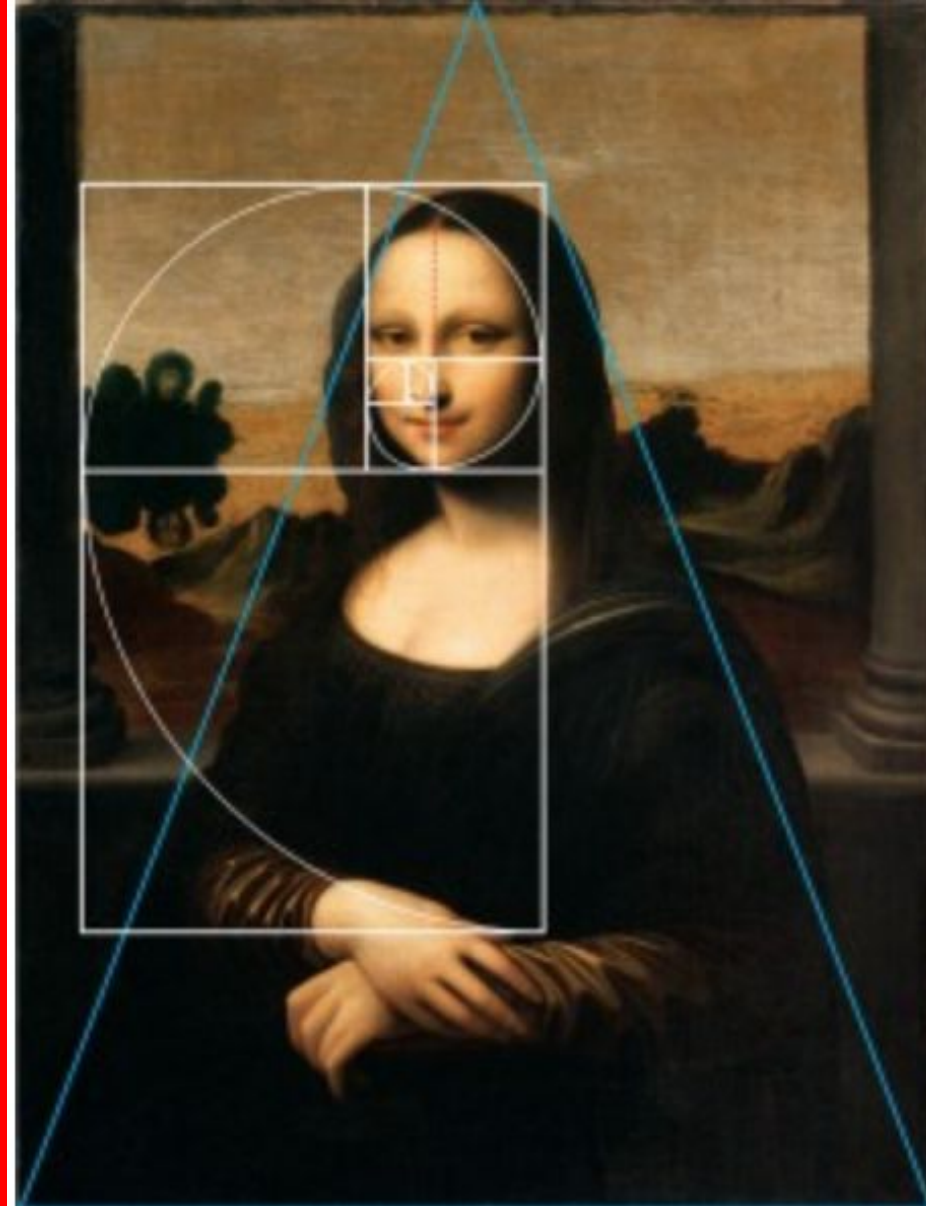
The Fibonacci sequence is a series of numbers where a number is found by adding up the two numbers before it. Starting with 0 and 1, the sequence goes 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, and so forth. Written as a rule, the expression is $x_n = x_{n-1} + x_{n-2}$.

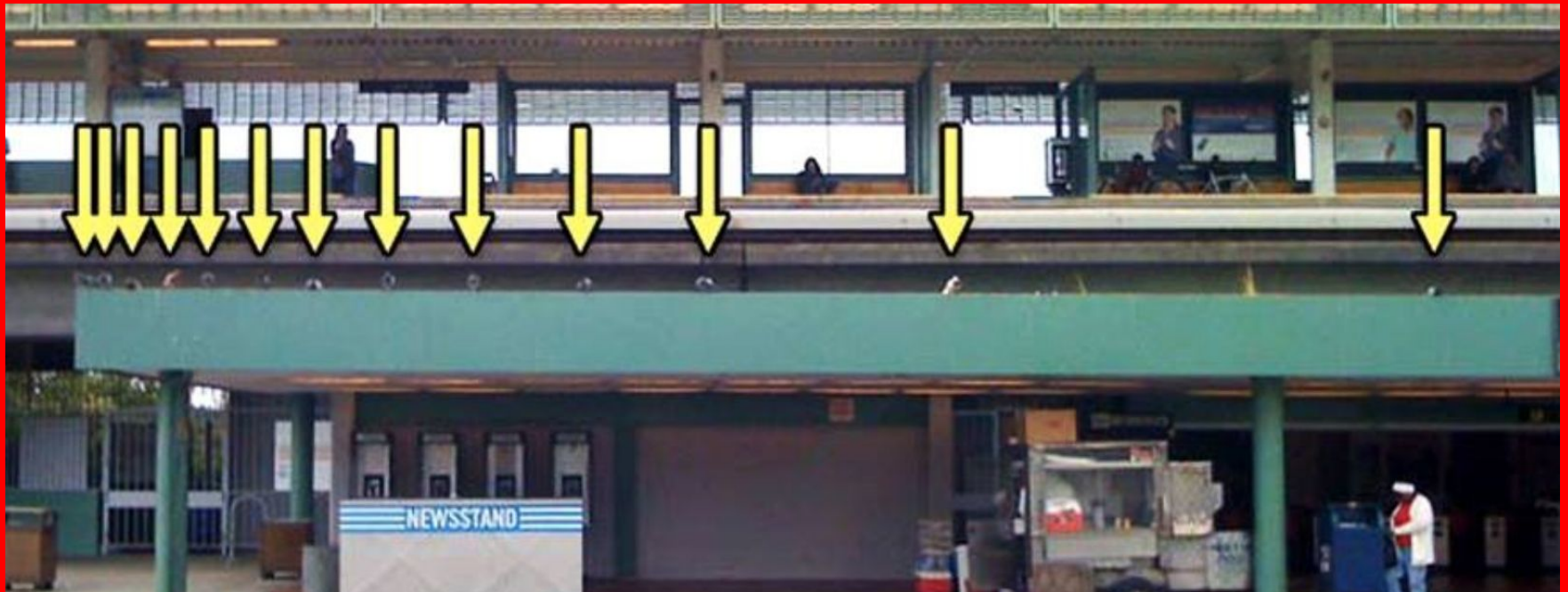




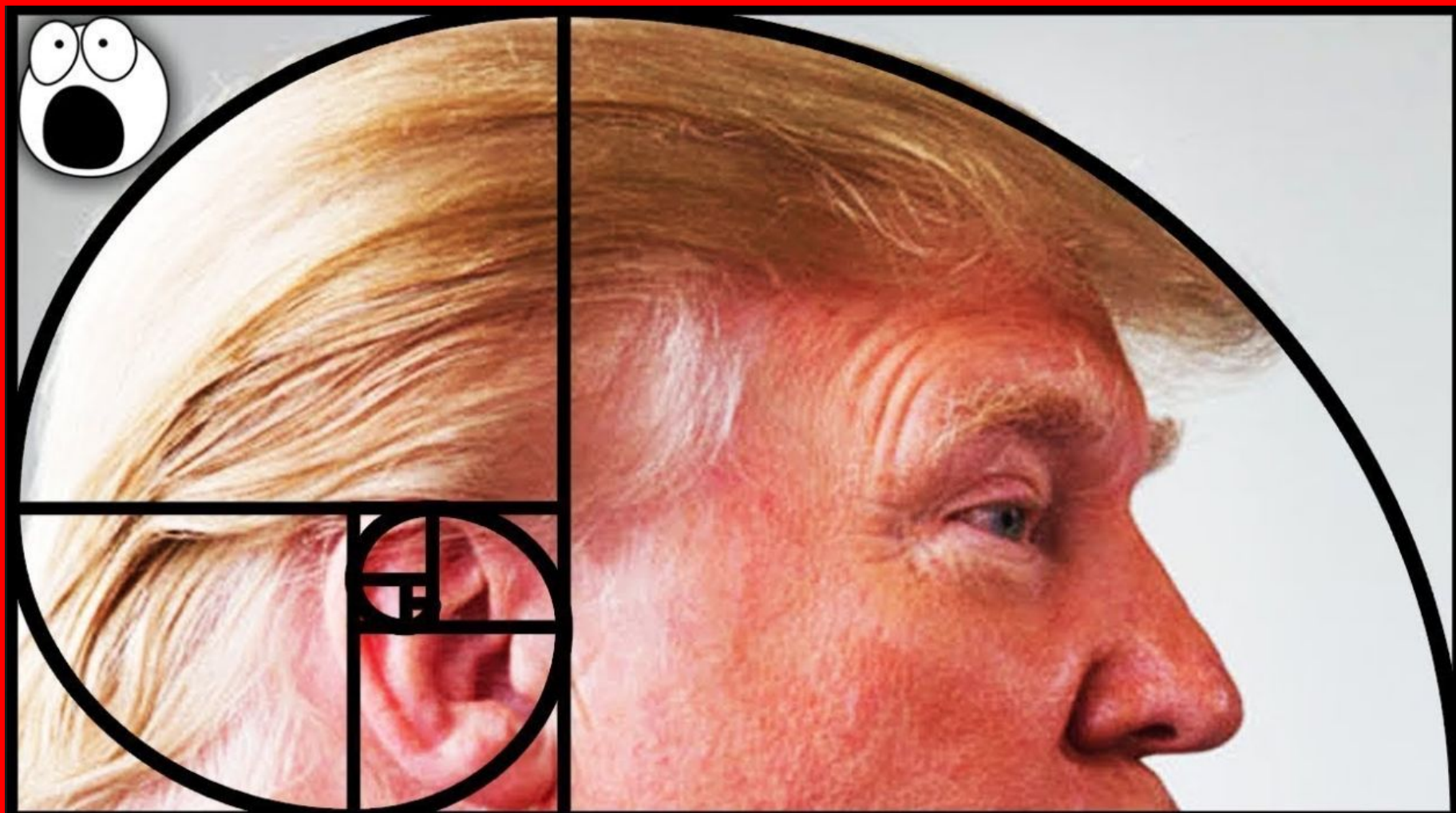












Mathematical Freedom

Mathematical Openness

How students...



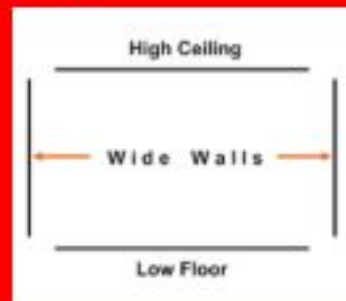
What Do Activities That Promote A Mathematical Mindset Look Like?

- Open & Creative
- Allow students to make connections to other mathematical and real life concepts
- Foster a passion for Maths
- Demand an application of knowledge
- Encourage curiosity
- Model a Mathematician's Work
- Celebrate struggle
- Provide opportunities for teamwork
- Allow multiple interpretations
- Provide opportunities for students to experience the 'Learning Pit'

Low Floor, High Ceiling Tasks



- Imagine a room.
 - You can get into the room easily, without any problem
 - . Once inside the room there are lots of possibilities to do some activities.
 - Many of these activities are unproblematic, while others are more challenging.
 - The only limit placed on your choice of activity is the space of the room and the height to which you can rise.
-
- So, a LTHC task is a mathematical activity where everyone in the group can begin and then work at their own level, yet the task also offers lots of possibilities for learners to do much more challenging mathematics too.

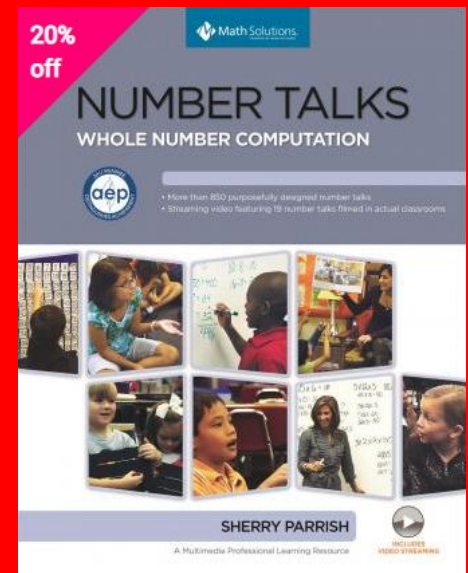


How High  can you
count
on your
Fingers?

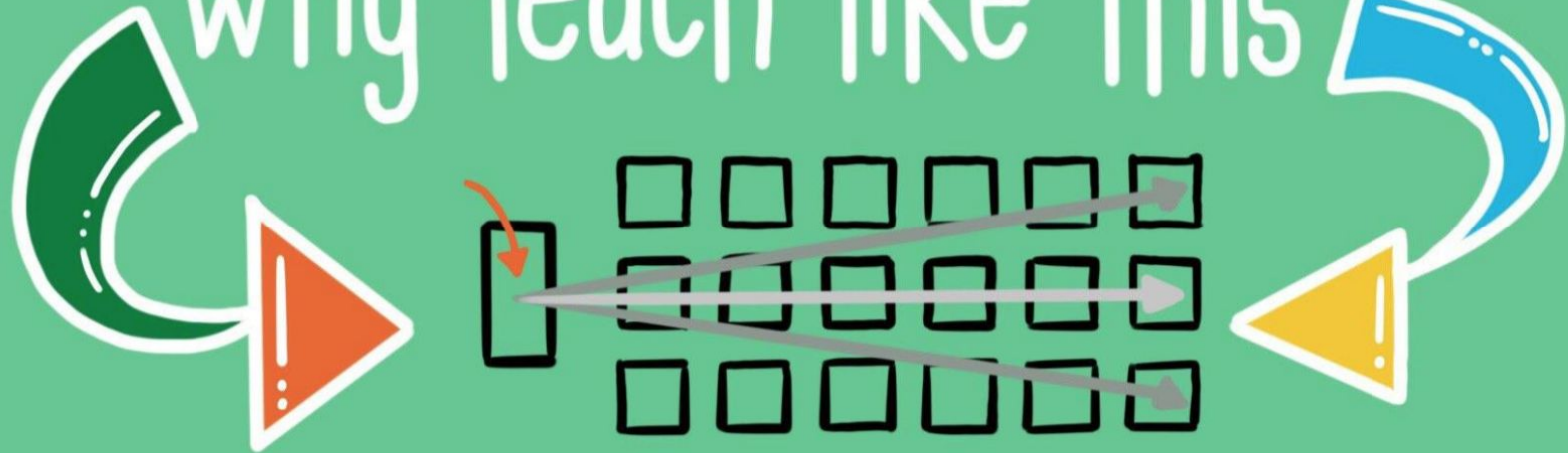
TEDEd

*SPOILER:
MUCH HIGHER
THAN 10

- Student Led Conversations
- Flexibility In Strategies & Thinking
- Students are Explaining, Justifying & Critiquing
- Teacher Records the Thinking.
- Student Hand Signals



Why teach like this



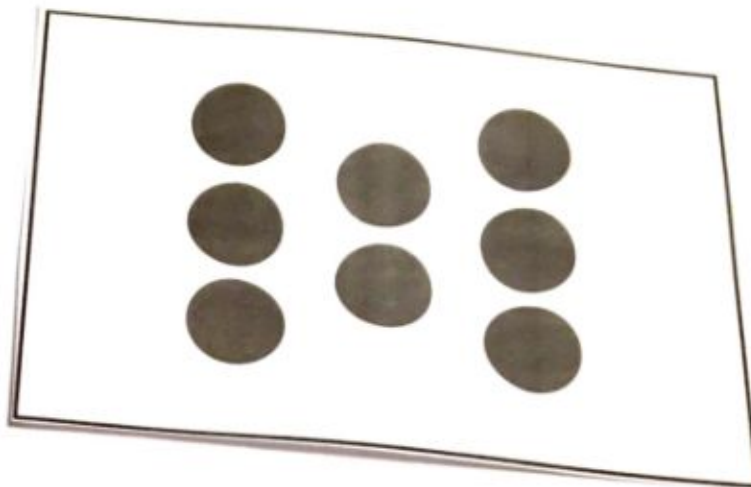
when learning looks like this?



@woodard_julie

Number Talks

Julia
:0: } 8
6 and 2
 $6 + 2$



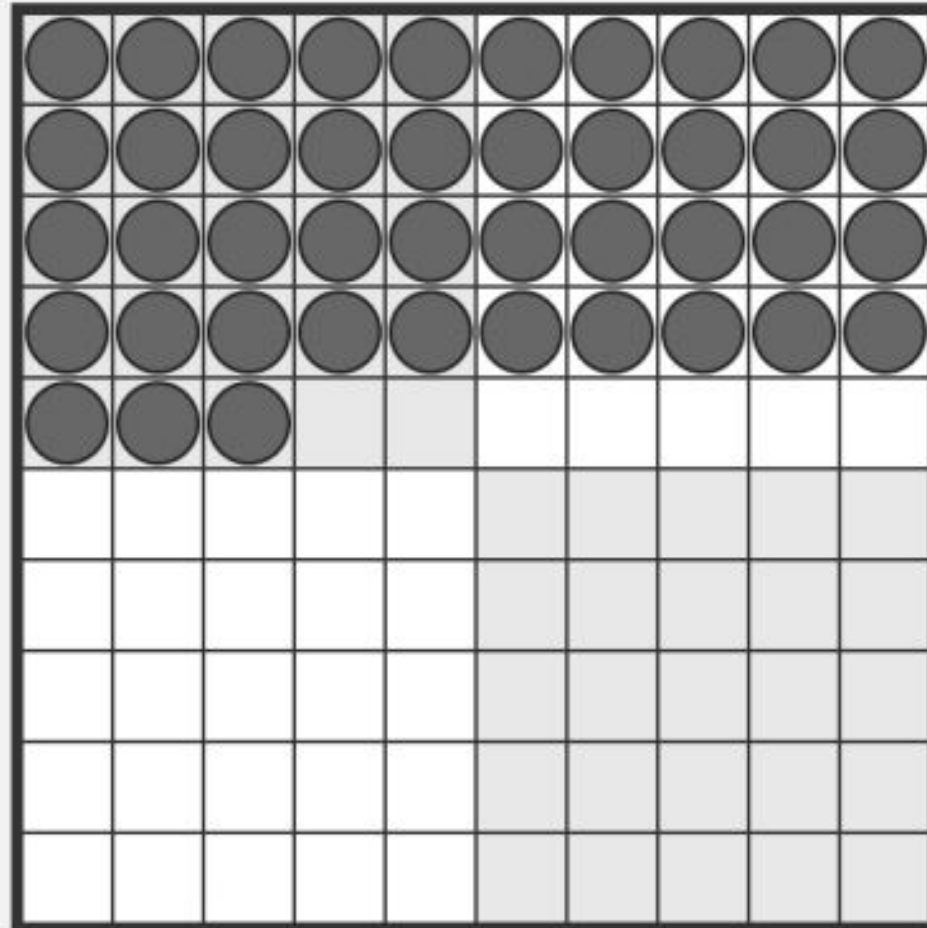
Jessie
:0: } 8
3 and 2 and 3
 $2 + 2 + 3 = 8$

Robbie
1 2 3 4 5 6 7 8
8
counting by 1's

Number Talks

Dot Pattern 27

How many shaded dots do you see? How do you see them? Does anybody see them differently?



3 Act Problems

Act One (The Problem)

Introduce the central conflict of your story/task clearly, visually, viscerally, using as few words as possible.

Act Two (The Strategy)

The protagonist/student overcomes obstacles, looks for resources, and develops new tools.

Act Three (The Solution)

Resolve the conflict and set up a sequel/extension.

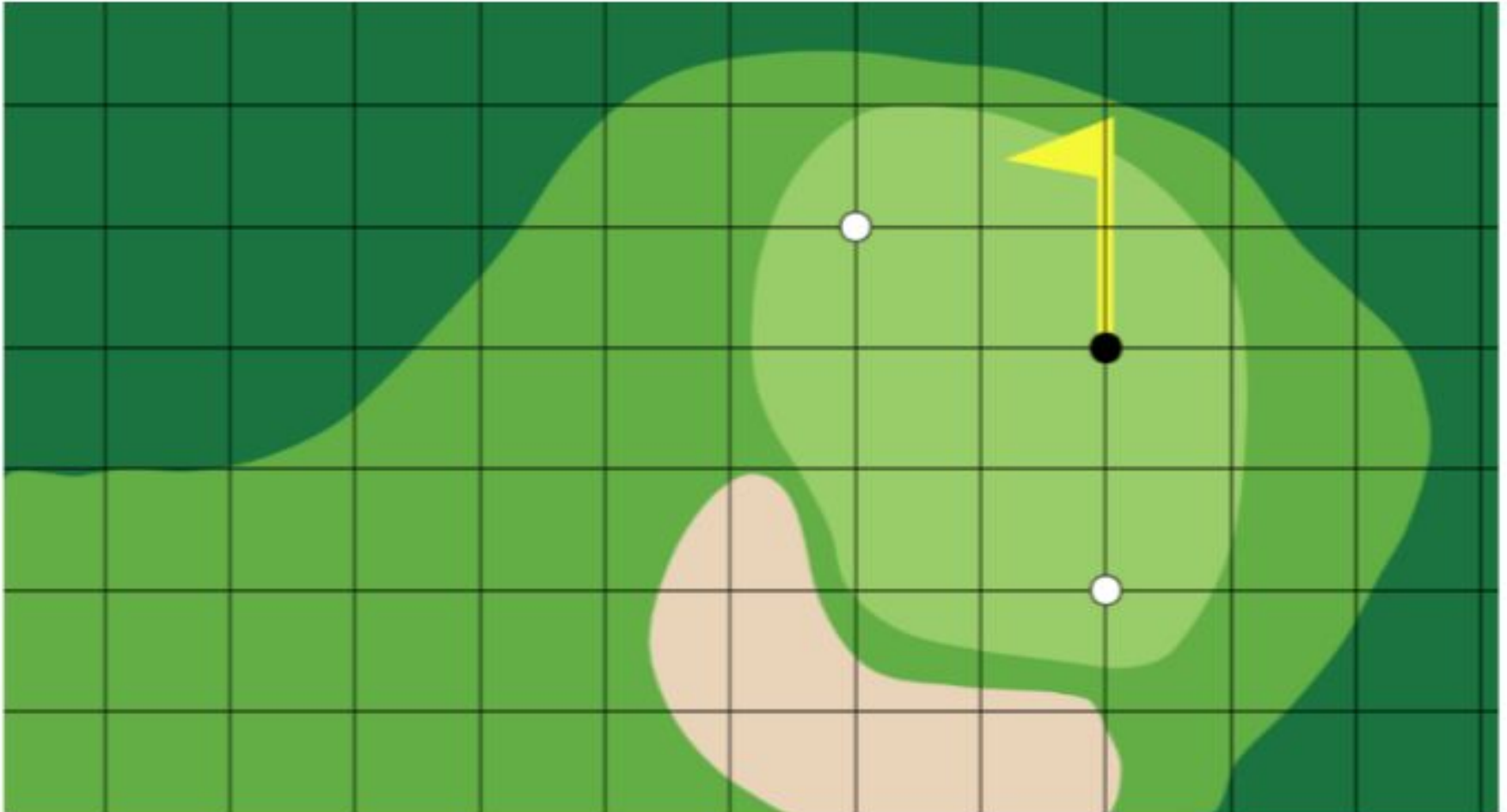
Act 1



1. Which ball is closest to the hole?
2. Write down a guess.

Act 2

3. What information would be useful to figure this out?
4. Write down some questions you have in your head right now.



Act 3 Possible Solution



Inspirational Week of Maths

- A specialised week of lessons designed to set the tone for the year
- Designed by Jo Boaler
- Supports different year levels
- Open, visual creative mathematics
- Accompanying 'Mindset Videos' aimed at engaging students

Inspirational Week of Maths

Day 1

The Many Ways We See Mathematics (Grades K-2)

Day 1 begins with a film that explains how our brains grow and change. After the film all grade level students are asked to do the same dot card number talk. We chose this because we believe all learners should experience the different ways we see and visualize numbers. We use these number talks with people of all ages including college students and CEO's of companies; they are powerful and thought provoking. For K-2 the dot card is followed by a new collection of finger activities. We also included a rich activity that shows students another open and creative way to try to fill an area with squares.

Content: Number sense, finger discrimination, number representations



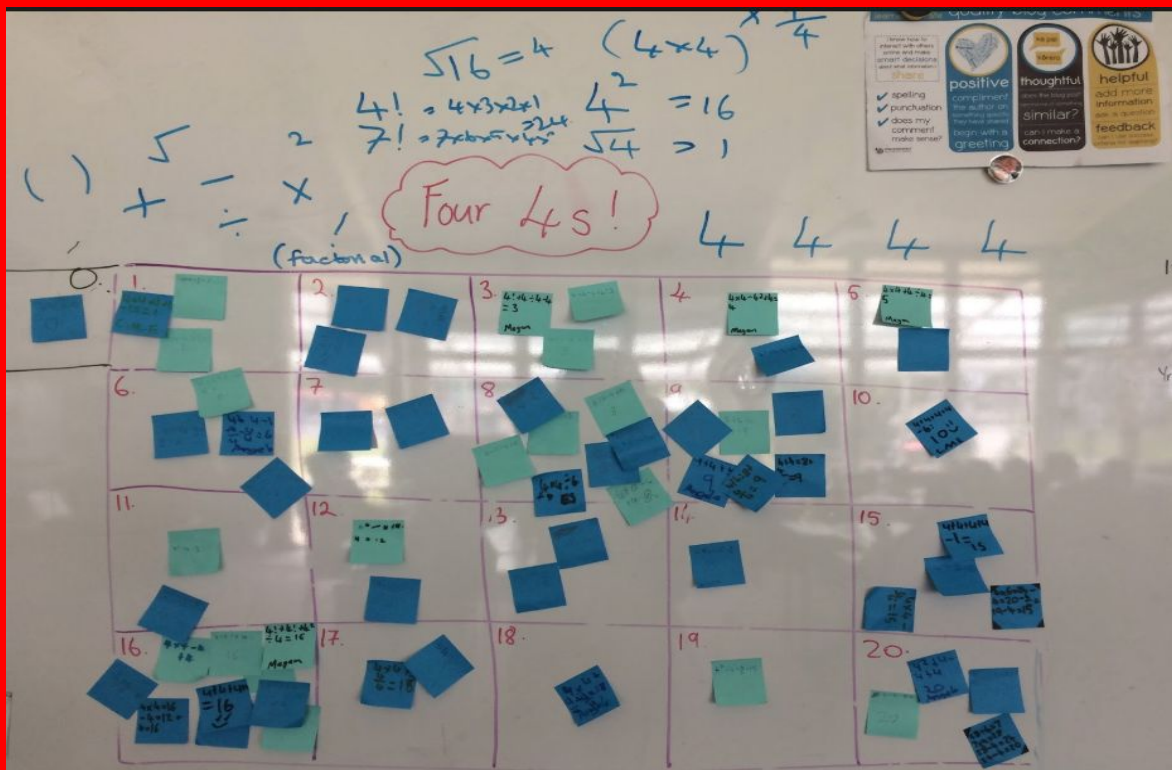
What if we changed Pascal's Triangle to have a different number along one side of the triangle?
What patterns do you notice? What do you wonder?

$$\begin{array}{ccccccc} & & 1 & 3 & & & \\ & 1 & 4 & 3 & & & \\ 1 & 5 & 7 & 3 & & & \\ 1 & 6 & 12 & 10 & 3 & & \\ . & . & . & . & . & . & . \end{array}$$

Inspirational Week of Maths

The 4 Fours Activity

- Can you find every number between 1 and 20 using only four 4's and any operation?



$$0 = 4 - 4 + 4 - 4$$

$$1 = 4 \div 4 + 4 - 4$$

$$2 = 4 \div 4 + 4 \div 4$$

$$3 = (4 + 4 + 4) \div 4$$

$$4 = 4 \times (4 - 4) + 4$$

$$5 = (4 \times 4 + 4) \div 4$$

$$6 = 4 \times .4 + 4.4 = 4 + (4 + 4) \div 4$$

$$7 = 4 + 4 - (4 \div 4)$$

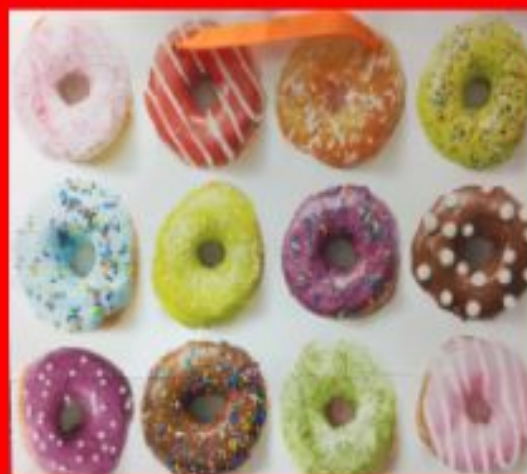
$$8 = 4 + 4.4 - .4 = 4 + 4 + 4 - 4$$

$$9 = 4 + 4 + 4 \div 4$$

$$10 = 4 + \sqrt{4} + \sqrt{4} + \sqrt{4}$$



Visual Maths Problems



Fraction Talks



- What fraction of the design is coloured?
- Which has the most colour?



Authentic Tasks



SEAT DESIGN INVESTIGATION

Seat design information:

5 bricks long

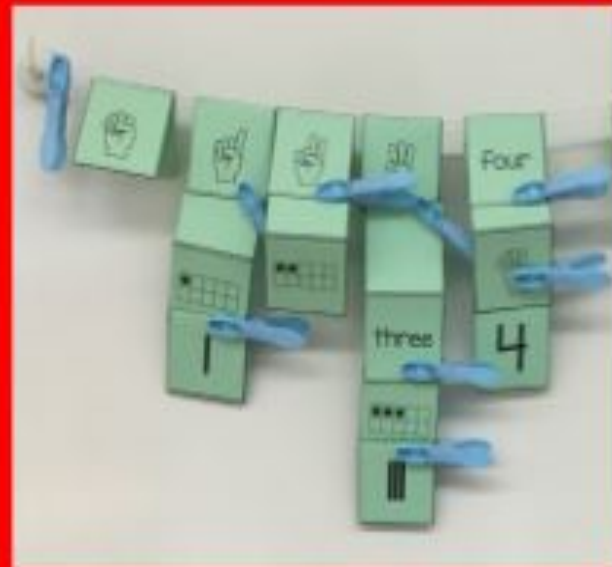
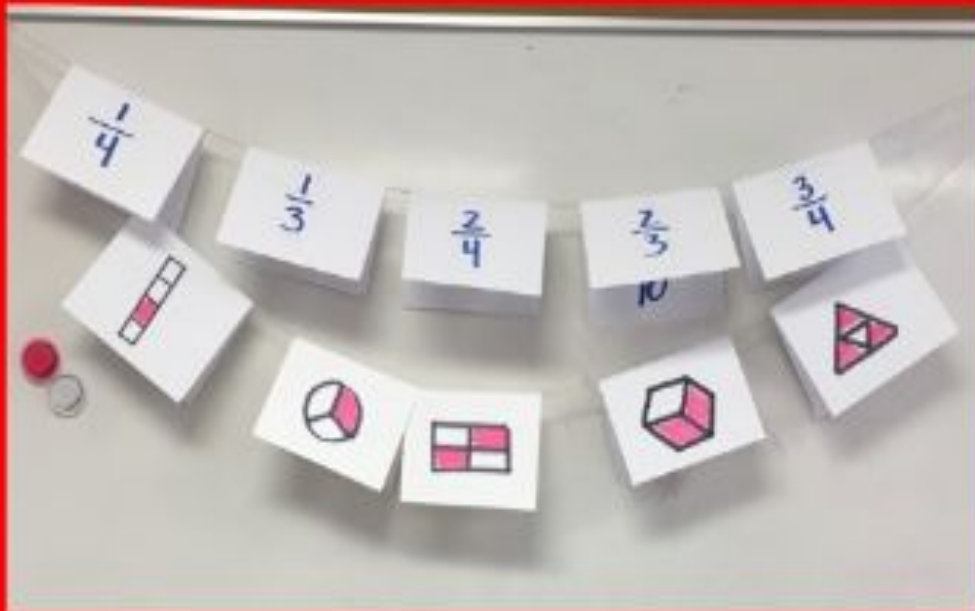
4 courses (or layers of bricks up)

1.5 bricks wide

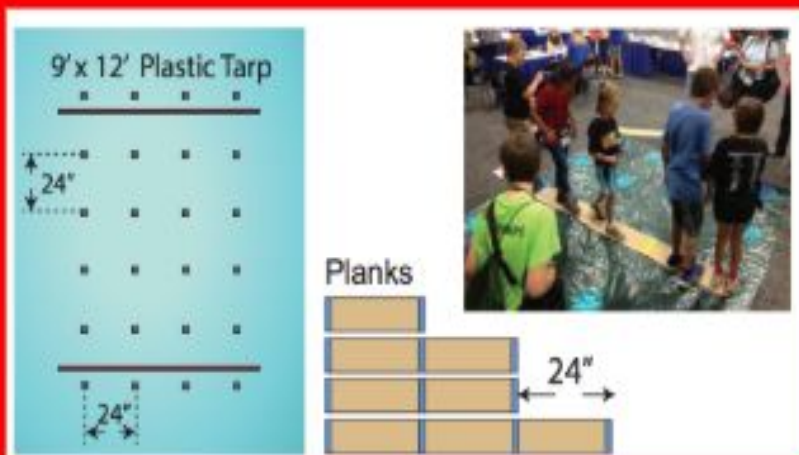
- Make a model of the seat.
- With the current design and using interlocking bricks, how many different brick layouts are possible?
- How many bricks in total will be needed for the seat?
- Using graph paper, with a consideration to scale, draw a bird's eye view, front view, back view and side view of the seat.
- Make another model, twice the size of the current design. What do we double? Height? Length? Width? All of them? Explain.
- If you increased the length of the seat by 'x' bricks how much would you increase the sides by to keep it to scale?



Clothesline Problems



Team Maths & Physical Play



ACTION

- Set up planks and islands on the grid according to the positioning on the challenge cards. Not all planks and islands are used in all challenges.
- Instruct players to use the planks to cross the river.

Rules: No crossing open water, no diagonal bridges, no crossing planks, no removing a plank from the river, and you can only hold one plank at a time.

- Planks must be connected to the plank or island you are standing on for you to be able to pick them up.







What Doesn't Belong?

NUMBERS

Find a reason why each one does not belong.

9	16
25	43

NUMBER 1

from Pam Wilson

3	27
123	31

NUMBER 2

from Mary Bourassa

17	26
44	65

NUMBER 3

from Mary Bourassa



Same But Different



What is the same?

Thousands	Hundreds	Tens	Ones
	54	8	2

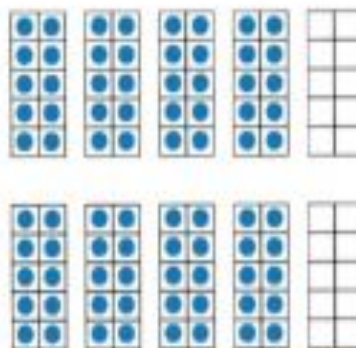
Thousands	Hundreds	Tens	Ones
5		48	2

What is different?

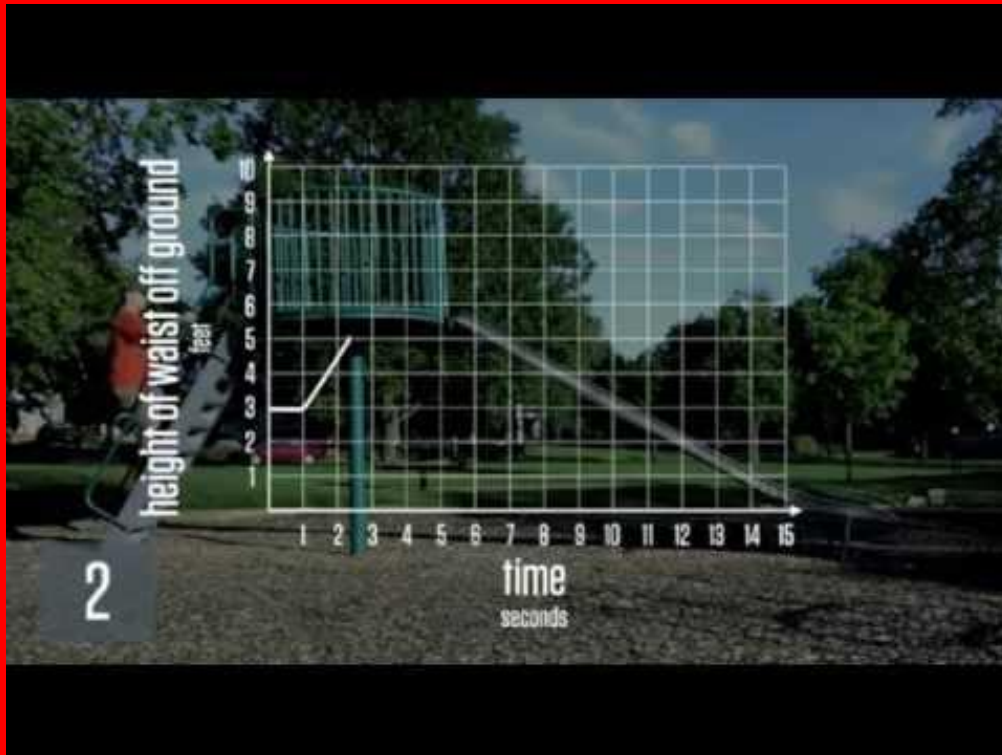
What is the same? What is different?



What is the same? What is different?

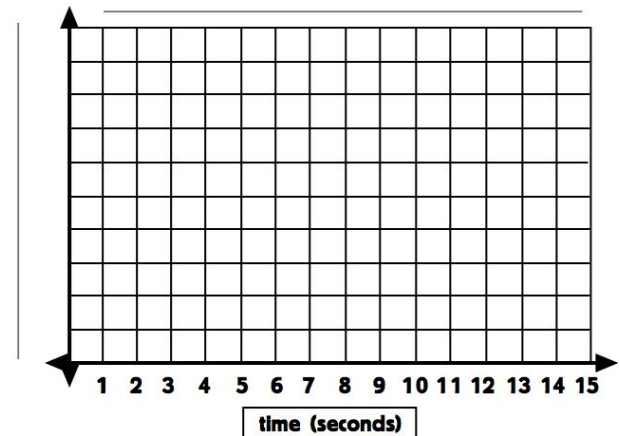


Graph The Story



GRAPHING STORIES

1.




Parkmore Mathematical Mindset Survey For Students

- 10 Point Rating Scale
- Google Forms
- Pre and Post Data
- Comparison of Mindsets of LOW, MID & HIGH range students
- VS Growth & Achievement
- Statements matching Mathematical Mindset Values
- Share IPPA 2019

Survey Questions

Take your time to answer the questions thinking only about your thoughts and feelings about your preferred learning style in Mathematics

Image S...



What is your name? *

Show answer first

Anyone can learn Mathematics to the highest levels. *

1 2 3 4 5 6 7 8 9 10

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

I was born with a 'Maths Brain'. That's why I'm good at Mathematics. *

1 2 3 4 5 6 7 8 9 10

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

There is often more than one way to correctly solve a problem in Mathematics. *

1 2 3 4 5 6 7 8 9 10

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

I am okay with making mistakes in Mathematics. Mistakes are important. *

1 2 3 4 5 6 7 8 9 10

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

I find myself in the learning pit often in Mathematics lessons. *

1 2 3 4 5 6 7 8 9 10

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

Getting the answers correct on a worksheet is how I demonstrate I'm good at Mathematics. *

1 2 3 4 5 6 7 8 9 10

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

Listening to how other students solve problems in Mathematics helps me to improve my own understanding. *

1 2 3 4 5 6 7 8 9 10

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

I can communicate my ideas in Mathematics easily. I am able to ask questions that help me get the solution to problems. *

1 2 3 4 5 6 7 8 9 10

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

I believe using an efficient mental strategy is more important than being right all the time in Mathematics. *

1 2 3 4 5 6 7 8 9 10

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

I believe that understanding Mathematics deeply is more important than being the quickest at solving sums. *

1 2 3 4 5 6 7 8 9 10

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

I can make connections to other BIG ideas when I work in Mathematics. *

1 2 3 4 5 6 7 8 9 10

Strongly Disagree ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ Strongly Agree

Evaluate & Diagnose

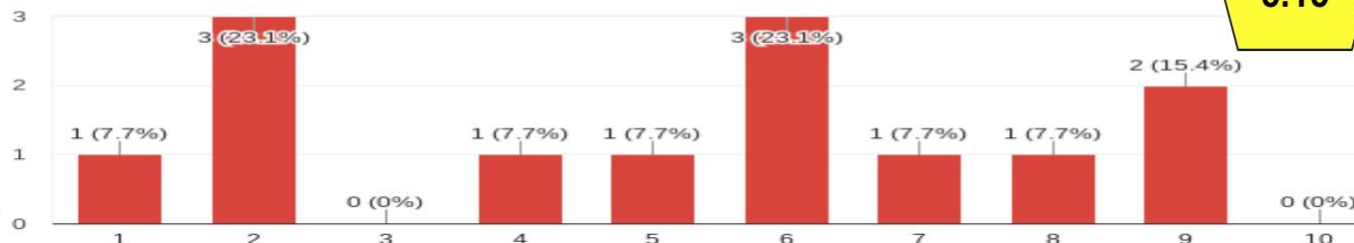
Google “Learning Pit”

Students articulated that they are not being challenged enough therefore we perceived that they are not being taught in the ZPD.

I find myself in the learning pit often in Mathematics lessons.

13 responses

Pre

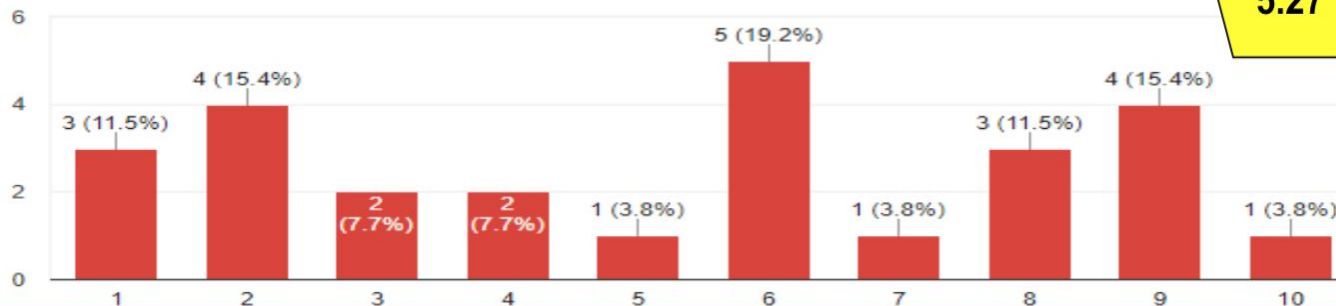


Av
5.15

I find myself in the learning pit often in Mathematics lessons.

26 responses

Post



Av
5.27

+2%
Growth



Evaluate & Diagnose

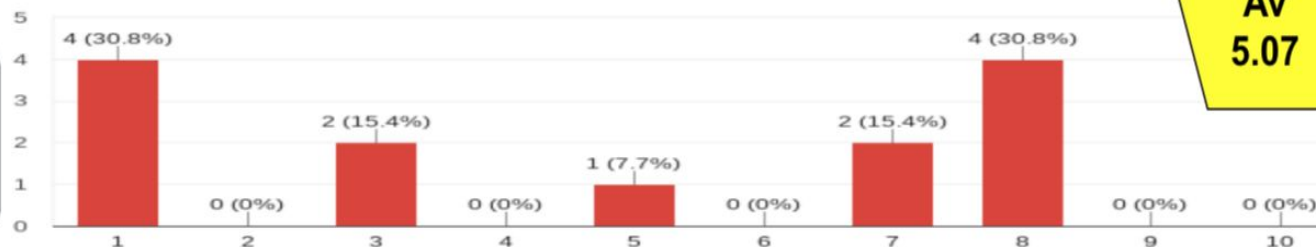
Google "Maths Brain"

This data demonstrates that a high proportion of students still exhibit a fixed mindset towards their ability to achieve in mathematics.

I was born with a 'Maths Brain'. That's why i'm good at Mathematics.

13 responses

Pre

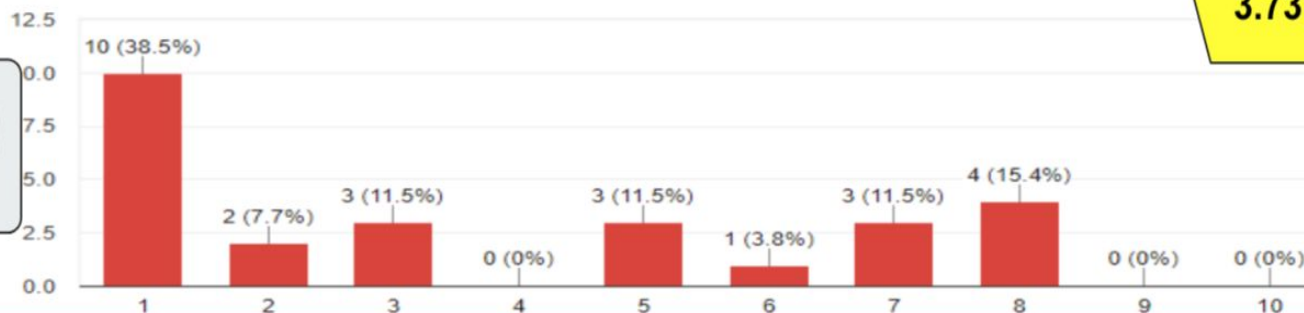


Av
5.07

I was born with a 'Maths Brain'. That's why i'm good at Mathematics.

26 responses

Post



Av
3.73

-27%
Growth



Get In Contact

mcintosh.simon.j@edumail.vic.gov.au

Book a Tour At Parkmore Primary

Join the

