Nau mai

haere mai

Hui 7 – Six Top Tips

THE LEARNER FIRST™

Create a rich balance using EXISTING resources

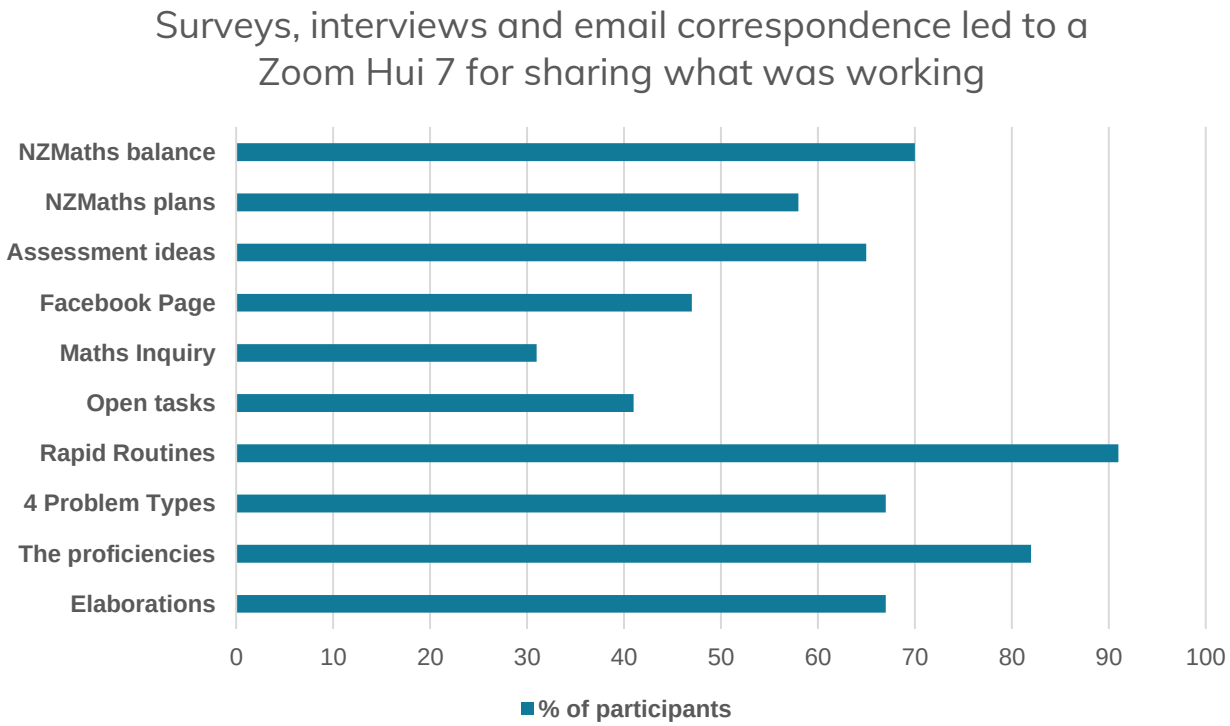
Workshops & School visits

4 regions
3 live sessions
3 school visits

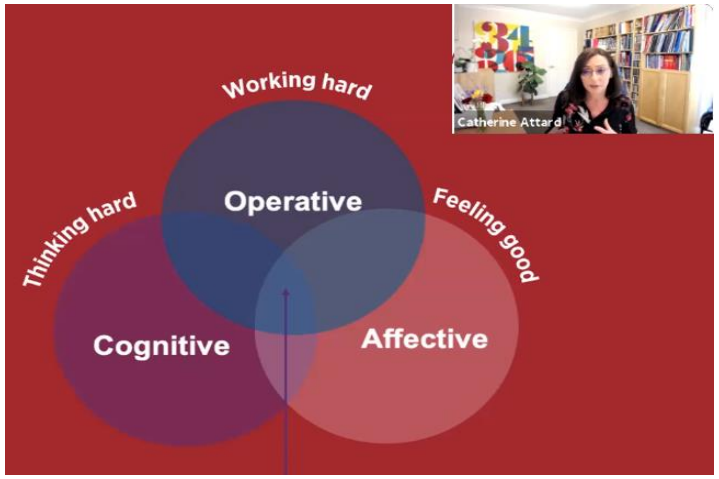
Zoom Hui

All regions
6 National Hui

Responsive
Immediate
Intentional
3 months



Restoring balance has been the game



Professor Catherine Attard
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President of Mathematics Education Research Group of Australasia (MERGA)

A good curriculum, in any country, shouldn't mandate pedagogy but instead promote good practice

It is not a case of competing, extreme view points (inquiry versus traditional)

Problem solving should be embedded into the curriculum but,

- there is a place for explicit teaching
- there is a place for ākonga to work collaboratively
- there is a place for ākonga to work individually
- there is a place to think about the social context of our ākonga, schools, and community

We need to think about a balance and not be influenced by binary view points

1.
Maths Proficiencies

The Royal Society report on refreshing Maths

RECOMMENDATION 8.

Ensure that teachers in all schools kura have equitable access to a suite of high-quality resources to support teaching at each of Years 0–13.

The widely accepted definition of mathematics proficiency[112] includes five interrelated strands:

- Conceptual understanding: comprehension of mathematical concepts, operations, and relations.
- Procedural fluency: skill in carrying out procedures flexibly, accurately, efficiently, and appropriately.
- Strategic competence: the ability to formulate, represent, and solve mathematical problems.
- Adaptive reasoning: ability for logical thought, reflection, explanation, and justification.
- Productive disposition: habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

Do our ākonga experience all these in their maths?

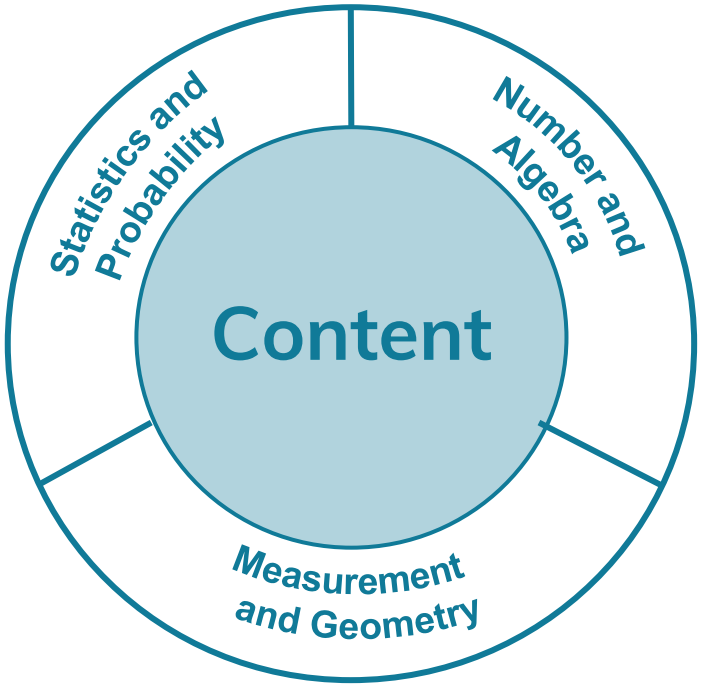
Procedural Fluency

Calculate with precision

Estimate with reasonableness

Recall definitions/facts

Use appropriate methods & measures



Deduce & defend arguments

Form logical conclusions

Prove generalisations

Identify and explain patterns

Adaptive Reasoning

Conceptual Understanding

Recognise representations

Describe & **express** ideas

Connect related concepts

Predict outcomes, relationships

Find & use a model

Solve & pose 'real' problems

Evaluate & adapt strategies

Justify reasonableness

Problem Solving

Productive Disposition

See mathematics as worthwhile

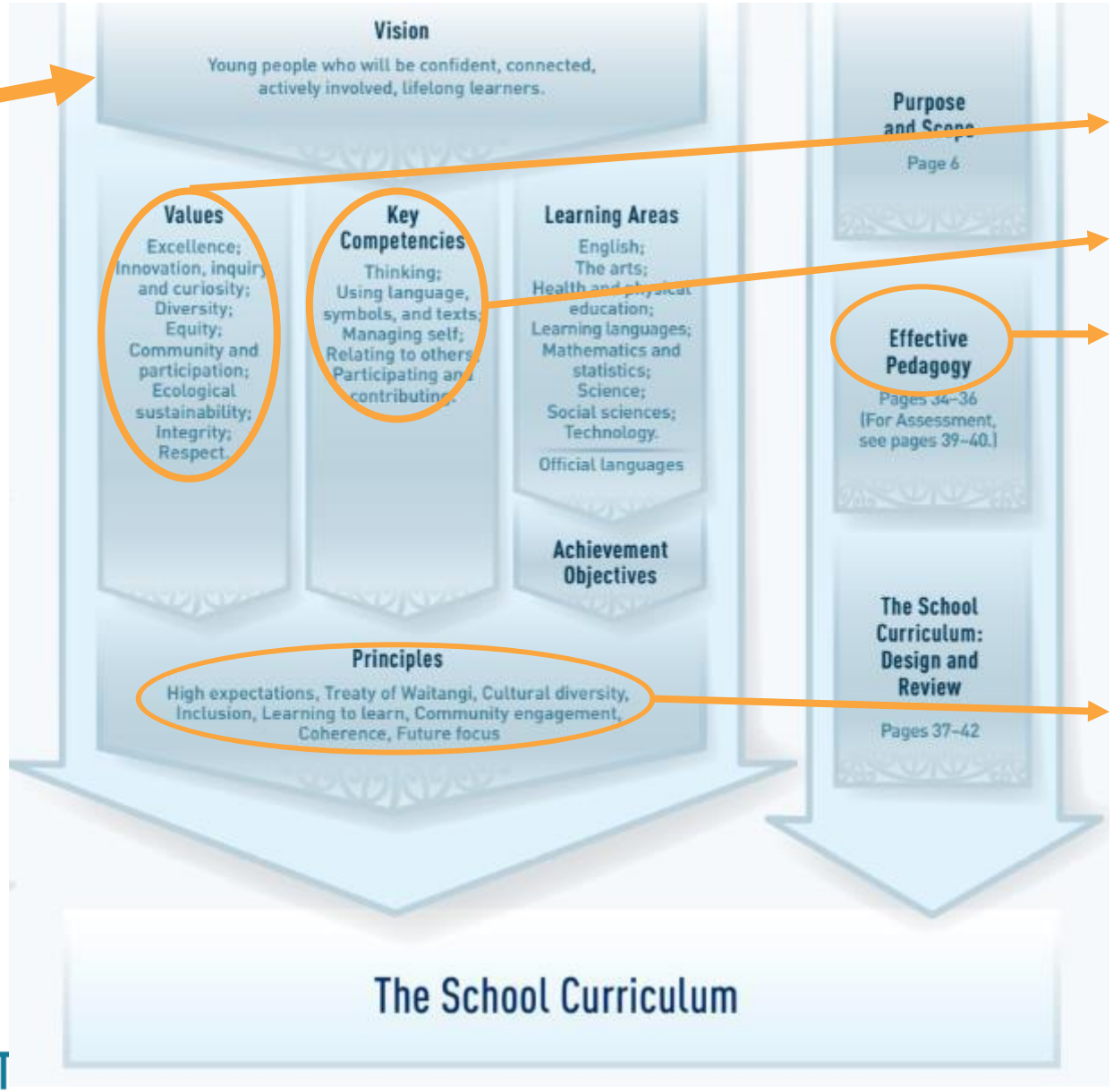
Identify meaning in their world

Believe in one's own efficacy

Participate effectively in groups

A real strength here in Aotearoa NZ

Productive Disposition



Managing Self, relating to others, participating and contributing

Innovation, inquiry, curiosity, diversity, equity, sustainability, integrity, respect

Make connections to prior learning, Reactivate & practise, relevance of new learning

High expectations, Treaty of Waitangi, Cultural diversity, inclusion, community engagement, coherence, future focus

A spotlight on Conceptual Understanding

Procedural Fluency

$$\frac{1}{3} + \frac{1}{5}$$

- I can draw a picture or use materials
- I can use a number line or create a story
- I could rename the fraction to arrive at a common measure

Conceptual Understanding

$$8 \times 7$$

- I can represent this as an array
- I can represent this as a social situation
- I can derive new facts from this fact

A further example

Estimate and explain why this is right or wrong

9.83 x 7.65 = 7519.95

Students with only procedural fluency may

- withdraw from doing it without a calculator
- revert to pen and paper methods (not understanding estimate)
- if calculating this have a 50% chance of a procedural error

Students with both procedural and conceptual understanding of place value concepts may immediately know it is not right

This is 10 x 8 so I think they have just put the decimal in wrong place.
I am thinking its meant to be 75.1995

They are also helping kaiako with

planning

extending

inclusion

ākonga agency

embedding competencies

They can help with mathematical inquiry

Cohen & Lotan (1994, 2014)

Multiple-ability orientation
• Launch the objectives at the start • Makes visible the array of intellectual strengths; *skills*, *understandings*, *practices*, in a groupworthy task

Assigning Competence
• Publicly naming an intellectual strength that is being bused by student(s). • It must be specific and connected to learning.

When teachers focus on strengths, they position young people as competent learners **(Cohen, 1994)**. In the process, they support students to create positive math identities **(Jilk, 2014)**, and help them value their peers as intellectual resources **(Boaler, 2008; Cohen 1994)**

First and foremost, the key to managing status and affecting students' assumptions about who is smart and who is not is by creating a "mixed set of expectations' for competence **(Cohen & Loten, 2014)**

Raising awareness

	Number strategies	Num & Alg knowledge	Measurement & Geometry	Statistical inquiry
Procedural Fluency				
Conceptual Understanding				
Rich Problems				
Routine Problems				
Reasoning				
Productive Disposition				

2.
Ideas & Elaborations

These can help build a working knowledge of the skills

Maths consists of skills, processes and dispositions
The skills are what we are familiar with and are largely found in the strands and sub strands

Procedural Fluency

Conceptual Understanding

Curriculum elaborations

Click the arrows at each level and strand for more detailed descriptions of the achievement objectives.

NZC	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
Number and Algebra	↗	↗	↗	↗	↗	↗	↗	↗
Geometry and Measurement	↗	↗	↗	↗	↗	↗		
Statistics	↗	↗	↗	↗	↗	↗	↗	↗

What we need to understand, value, teach and measure

NA3-4 Know how many tenths, tens, hundreds, and thousands are in whole numbers.

- Have a multiplicative view of whole number place value. In 239 456 the 3 means 3 groups of 10 000 (3 x 10 000)
- Understand the **Base 10** scaling view- **10 of these is 1 of those**- as digits move right or left
- Understands the **nested view** e.g., **239 456 has 23 ten thousand, 2394 hundreds, and 23 945 tens.**
- Exposure to exercises like this: 2004 – 700 requires us to think of 1000 as ten hundreds so 20 hundred take 7 hundred and 4 ones stays the same.
- Know **one hundred thousand is ten times as much as ten thousand**, and one hundred is result of dividing one thousand by ten. Eg **4200 is ten times more than 420, 43 divides by 10 is 4.3**

Key ideas can support differentiation

	Number Strategies
Level 1	Counting can be used to solve number problems.
Level 2	Numbers can be partitioned and combined to solve simple addition and subtraction problems.
Level 3	Numbers can be partitioned and combined to solve more complex (multi step) problems with four operations.
Level 4	Rational numbers can be represented and operated on in a variety of ways to solve problems

Key ideas can highlight the “need to know”

	Shape
Level 1	Objects can be sorted by their appearance
Level 2	Shapes can be sorted by their geomteric properties
Level 3	Shapes can be defined by their geometric properties
Level 4	3D objects can be shown by a variety of 2D representations

The deeper the understanding the easier to teach

Vision of Instructional Practice

Level 1 Deep Dive – Key ideas and elaborations

Number Strategies – key ideas	Number knowledge – key ideas	Equations & Expressions – key ideas	Patterns and relationships – key ideas
Counting can be used to solve number problems. Students see numbers as made up of ones, and to operate with numbers need to count the individual items. There are two main counting strategies: **Counting from one.** **Counting on**	**Objects in a set can be counted.** Students identify "how many' in sets of objects. They must produce word sequence accurately. One to-one matching-one word assigned to one object. Once counting by ones they can learn to skip count **e.g., 2s, 5s, 10s**	**Counting, grouping and equal sharing strategies can be recorded using words, numbers and pictures.** Students need opportunities to explain and represent their number strategies using combinations of words, numbers etc Using number lines to represent equations **4 + 3 = 7 (plus) 10 – 6 = 4 (minus) use "same as'**	**Some patterns are repeating, and some are sequential** Students learn that a repeating pattern has a consistent element of repetition. They identify this element and extend the pattern using symbols, numbers, shapes, sounds, moves. Students can also explore growth patterns and see and identify in the built and natural environment.
Number Strategies – elaborations NA1-1 Use a range of counting (on, back, double), grouping, and equal-sharing strategies with whole numbers and fractions.	**Number knowledge – elaborations** NA1-2 Know the forward and backward counting sequences of whole numbers to 100. NA1-3 Know groupings with five, within ten, and with ten	**Equations & Expressions – elaborations** NA1-4 Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures.	**Patterns and relationships – elaborations** NA1-5 Generalise and explain counting, grouping, and equal sharing strategies, using words, numbers and pictures. NA1-6 Create and continue sequential patterns
NA1-1 Use counting on, back, double counting and skip counting. Eg **6 + 5; count 7,8,9,10,11** **12 – 3 counts back 11,10,9.** Grouping and equal sharing are simple ways to solve four operations and fractions of sets problems without counting every object. **Eg Knowing 4 + 4 is the same as 8** Skip counting, 5,10,15,20 to count four groups of five Sharing objects in ones, twos or threes to **find a quarter of a set of 12** At level solving 6 + 3, ākonga count on from 6	**NA1-2** Know fwd number word sequence to 100 as **0,1,2,3,4.....** Know bkd number word sequence from 100 as **100,99, 98.** Name the number before and after any given number **NA1-3** Learn visual and symbolic patterns for numbers to ten so they can be recognised without counting. Groupings within and with five **(2 + 3, 5 + 4)** Names for ten **(6 + 4 therefore 10 – 4)** Doubles to at least ten **(3 + 3, 4 + 4)** Groupings with ten **(10 + 6, 8 + 10 teen numbers)**	**NA1-4** Explain to others the number strategies they use (words, numbers or pictures). Write equations to express their findings **Eg (5 + 9 = 14)** Use their own and mathematical language. Develop diagrams to represent their strategies **Eg number lines**	**NA1-5** Understand link between cardinal and ordinal aspects of counting. Ordinal aspect involves the position of something Cardinal aspect involves how many of something. This count can be trusted and built upon. **NA1-6** Explore sequential patterns so further members are predicted. Reproduce a give pattern using objects, drawings, symbols Create and continue patterns with justification Communicate the rule of their patterns to others.

Measurement – key ideas	Shape – key ideas	Position & Orientation – key ideas	Transformation – key ideas
Objects have measureable attributes that can be compared. It is all about making comparisons - Direct comparison can be used for length and area as two objects are easily compared. Indirect comparison where string to measure circumference used to compare this to height Students understand what units of measure might be used for the particular attribute in question e.g., toothpicks along the length of the book.	**Objects can be sorted by their appearance.** (number of sides, size, looks like..., has sharp corners etc. Language is colloquial. Geometric language can be developed.	**Position and movement can be described.** Use everyday language to describe where something is; in front of, left of behind. Directions are given in simple units e.g., 8 steps, half turns, quarter turns. Imagining the shape or endpoint of movements help spatial reasoning.	**The position and appearance of an object can be changed by reflecting (flipping), translating (sliding) and rotating (turning) it.** Objects can be moved in space. Changes can be described in terms of transformation eg Reflect(flip)- described as mirrored Translate(slide) – shifts along a line look the same Rotate (turn)- circular motion, inside or outside the shape. The amount of the turn is called the angle of rotation.
Measurement – elaborations GM1-1 Order and compare objects or events by length, area, volume and capacity, weight (mass), turn (angle), temperature, and time by direct comparison and/or counting whole numbers of units	**Shape – elaborations** GM1-2 Sort objects by their appearance.	**Position & Orientation – elaborations** GM1-3 Give and follow instructions for movement that involve distances, directions, and half or quarter turns. GM1-4 Describe their position relative to a person or object.	Transformation – elaborations GM1-5 Communicate and record the results of translations, reflections, and rotations on plane shapes.
GM1-1 Through experiences for objects being brought physically together, students will appreciate the need for units of measure to compare objects. Units must be the same size, combined and counted. Eg hand spans to measure door and table.	**GM1-2** Characteristics include shape, size, colour, texture, weight and temperature. Justification and increasingly sophisticated classifications must be encouraged.	**GM1-3** Follow instructions eg Distance; 14 steps Direction; face the library Angle: do a half turn clockwise Proficient at following and able to give	**GM1-5** Discuss what patterns they see from reflect, translate, rotate on shapes. Important that rotations can be described as fractions of a full turn.

3.
Types of Problems

These can help build a working knowledge of processes

The processes are how we use the skills
Problem Solving is a mathematical process- alog with logic, reasoning and communicating

Exercise

Routine procedural tasks.
Usually without words

Application

Routine, worded problems
1 or 2 steps involved
Usually transparent

Open ended

Non-routine, worded or visual
Multiple solution pathways
and/or solutions

Unfamiliar

Non-routine,
more than 2 steps

Research has documented that when students are primarily asked to solve tasks of low-cognitive demand, they have few opportunities to develop:

- an understanding of ***why*** particular procedures are appropriate;
- disciplinary practices like **flexible problem-solving**;
- the ability to explain/connect their mathematical thinking
- a conceptual understanding of mathematical ideas (connect)

Boaler & Staples

These can help build a working knowledge of processes

In a range of meaningful contexts, students will be engaged in **thinking mathematically and statistically**.

Exploring
Questioning
Conjecturing
Explaining
Proving
Justifying
Generalising

They will **solve problems** and **model situations** that require them to ..*[link to Level objectives]*

Adaptive Reasoning

Problem Solving

A cyclical process where authentic problems are:

- **translated into mathematical language, symbols and representations and,**
- **the solutions and solution pathways evaluated and communicated**

The Royal Society recommendation 8

Exercise

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Usually without words

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To support teachers to engage with all of these strands, we recommend the following resources are made available to all teachers:

- Tasks that are mathematically and statistically rich and meaningful

- Engaging activities that support the learning of basic facts, general procedural fluency and computational fluency

NA 2-4

Know how many ones, tens, and hundreds are in whole numbers to at least 1000.

Exercise

What is the value of 5 in 524?

What is the largest 3-digit number you can make with the digits 3 8 2?

500 is the same as [ ] hundreds

Expand 1250

Application

You scored 950pts on Bubble Blast and your friend scored 775pts. How many points were scored altogether and how many more points did your friend score?

* Use PV to support mental computation

Open ended

How many 3-digit numbers can you create that have 22 tens nested in them?

Choose any 3 or 4 digit number and represent this is as many ways using expansion, nesting and regrouping.

Unfamiliar

What is the third largest 3-digit number you can make with the digits 3 8 2?

Find three 3 or 4-digit numbers from the article and place these on a number line.

NA2-1 : exploring additive strategies

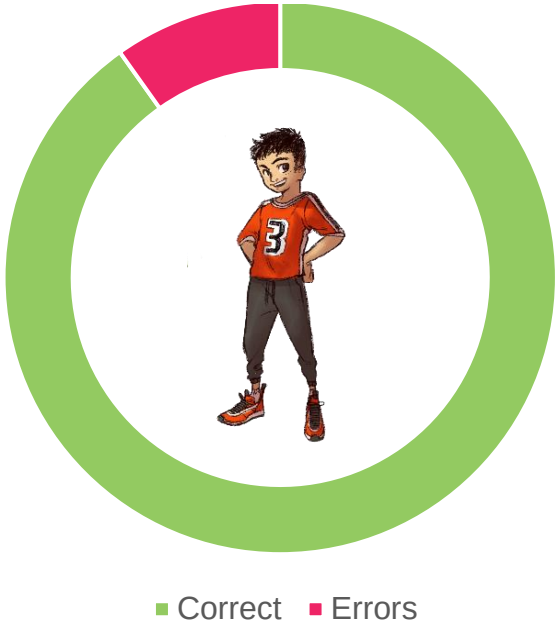
NA2-6 : explaining strategies

NA2-2 : counting using PV 1245, 1345, 14

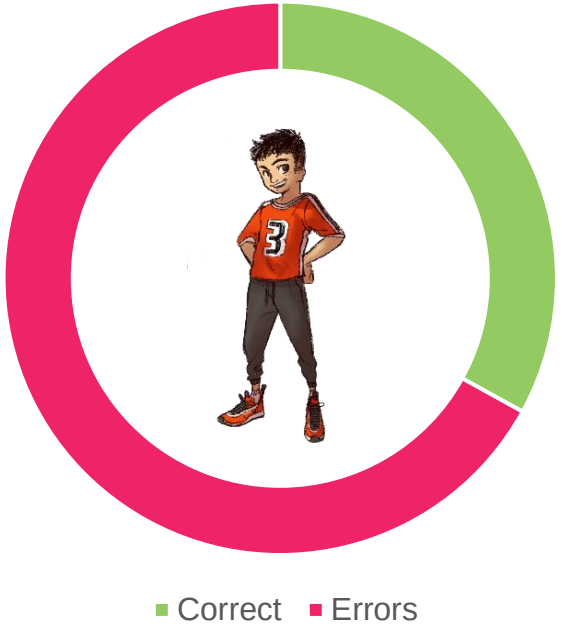
NA2-6 : using number lines

Data snapshot: Year 7 and 8 ākonga (n = 193)

What is the largest 4 –digit number you can make using these digits: 3 7 2 5 ?



What is the third largest 4 – digit number you can make using these digits: 3 7 2 5 ?



What opportunities are your ākonga given to show the depth of their understanding?

4.
Ideas for Planning

Long Term Plans are creating a central stem

Planning space

Manage and create teaching plans.

Long-term plans.

Long-term plans

These long-term plans provide a starting point for planning a mathematics teaching programme for a year.

	Full-year plans	Plans, by term, in the Planning Space			
		Term 1	Term 2	Term 3	Term 4
Early level 1					
Late level 1					
Early level 2					
Late level 2					
Early level 3					
Late level 3					
Early level 4					
Late level 4					

THE LEARNER FIRST

A sequenced and connected central stem – 50%

Term One	Term Two	Term Three	Term Four
Figure me out (Thematic Unit)	Getting partial to decimals Addition and Subtraction of decimals to three places)	Areas and volumes (Areas of quadrilaterals, and triangles, volumes of cuboids)	Representing 3D objects in 2D drawings (Geometry of 3D shapes, drawing 3D shapes in 2D)
Cuisenaire rod fractions: Level 4 (Ordering and comparing fractions)	Fitness or Tessellating art (Two dimensional shapes, angles, properties, tessellation)	Equivalent fractions (Equivalent fractions as numbers, fractions of sets, equal sharing)	Balancing Acts (Expressing relationships using algebraic symbols)
Cool times with heat (Measuring temperature)	What are the chances? (Probability)	Travel to school (Statistical inquiry cycle with category data)	Getting partial to fractions (Fractional numbers)
What's going on? Properties of multiplication and division. (Multiplication and division of whole numbers)	Down on the farm (Linear relationships, tables, graphs, equations, word rules)	Getting partial: Fractions of sets (Fractions as operators)	Oranges or Weighty Problems (Measurement of length, area, volume, capacity, mass)
Measuring up (Statistical Inquiry Cycle)	Matariki - Level 4 (Thematic Unit)	Marble roll (Measurement of length and time, relationships between variables)	Map It (Co-ordinates, Maps)

Term One	Term Two	Term Three	Term Four
Whakataukī (Thematic Unit)	All about angles (Measuring angles, reasoning with angles as measures of turn)	Integers (Integers)	Time Zones (Measuring time, calculating with 24-hour time)
Multiplication and Division Pick n' Mix 1 (Multiplication and division with whole numbers)	You can count on squares! (Area of rectangles and triangles)	Getting partial to percentages (Percentages)	X marks the spot (Cartesian co-ordinates, representing location)
Transformations (Symmetry)	How much bullying? (Statistical inquiry cycle, conducting surveys)	Solid Understanding (Properties of 3-D solids, nets of polyhedral, symmetry)	Flip and Roll (Probability)
Solving linear equations (Linear relationships)	Spaced out (Volume of cuboids, metric units of volume and capacity)	Getting partial: Multiplying decimals (Multiplication of decimals)	What's going on? Fractions (Ordering, adding, and subtracting fractions, mixed numbers)
Addition, subtraction, and equivalent fractions (Adding and subtracting fractional numbers, equivalent fractions)	Matariki – level 4 (Thematic unit)	Cubic Conundrums (Probability, growing patterns, drawing 3D models, volume of cuboids)	Choices (Representing linear relationships)

A sequenced and connected central stem – 50%

Search

GM

Fitness

Level Four | Geometry and Measurement | Units of Work

This unit examines regular tessellations, that is, tessellations that can be made using only one type of regular polygon, and semi-regular tessellations, where more than one type of regular polygon is involved. Students are required to investigate what properties tessellating shapes must have in...

GM

Quadrilaterals

Level Four | Geometry and Measurement | Units of Work

In this unit we conduct a couple of investigations looking at the relationship between the angle between two diagonals of a quadrilateral, the sides of the quadrilateral, and the type of quadrilateral. The main emphasis is on rectangles.

GM

Solid Understanding

Level Four | Geometry and Measurement | Units of Work

In this unit students make and investigate various solids, including regular and semi-regular polyhedra, and cylinders and cones. They look for patterns in the numbers of faces, edges and vertices they see whether they can “discover” Euler’s famous formula. By truncating the vertices of the Platonic...

Sets out purpose and outcomes

Quadrilaterals

Purpose

In this unit we conduct a couple of investigations looking at the relationship between the angle between two diagonals of a quadrilateral, the sides of the quadrilateral, and the type of quadrilateral. The main emphasis is on rectangles.

Achievement Objectives

GM4-5: Identify classes of two- and three-dimensional shapes by their geometric properties.
AO elaboration and other teaching resources

Specific Learning Outcomes

- Investigate the relationship between the diagonals and lengths of a rectangle.
- Investigate the relationship between the angle of the diagonal and length of rectangles sides.
- Use rulers, compasses and protractors accurately.

Links back to the elaborations

GM4-5: Identify classes of two- and three-dimensional shapes by their geometric properties.

Elaboration on this Achievement Objective

This means students will use geometric properties to identify classes of shapes. Classes are categories of two or three-dimensional shapes. Shapes are sorted into classes according to defined geometric properties, such as number and relationship of sides (for example equal and parallel); number and nature of angles (for example four right angles); symmetry, number, nature, and shape of faces and surfaces (for 3-dimensional shapes). Classes can be included within other classes, can intersect or be disjoint, for example all squares are rectangles or no triangles are pentagons. At Level Four students should be familiar with:

1. classes of polygons defined by the number of sides; triangles (3 sides), quadrilaterals (4 sides), pentagons (5 sides), hexagons (6 sides)...octagons (8 sides)...
2. classes of 3-dimensional shapes defined by the nature of faces and surfaces; prisms (constant cross-section) and cylinders, pyramids and cones, regular polyhedral (identical faces)
3. classes of 2-dimensional closed curves and their 3-dimensional equivalents by rotation; circles and spheres, ellipses and ellipsoids
4. sub-classes that are included within classes: squares within rectangles, rectangles within parallelograms, parallelograms within quadrilaterals, circles within ellipses, cubes within rectangular prisms
5. classes that are disjoint, scalene and isosceles triangles, prisms and pyramids.

Sequenced sessions allow flexibility but maintain rigour

Session 4

In this session we tackle the reverse problem to Session 3 – given the angle between two diagonals, what are the lengths of the sides.

1. Remind the class of what has happened in the last session.
2. Let them investigate the problem: given the angle between two diagonals, what are the lengths of the sides of the rectangle?
3. From session 3 they should realise that, at best, they will only be to find the ratio between the two side lengths. They should also tackle the problem by taking specific angles and determining the ratio by measurement. The best that they will be able to do will be to find approximate ratios for each angle (say from 10º to 90º in tens). The actual result is that $\tan \theta/2 = a/b$, where a and b are the lengths of the sides with $a < b$, but this will be a little beyond this level.
4. They might also like to find out which angles come from rectangles where the sides have a ratio of 1, 2 and 3.
5. Let the class agree on the various ratios and angles and make posters to illustrate what they have done. You might want to talk about the tan of an angle as an introduction to the work of the next level.

Session 5

Here we fix the angle between the diagonals of a quadrilateral and see what properties of sides give what quadrilaterals when their diagonals intersect at 90º.

1. Recall the problems of the previous sessions and the methods used to solve them.
2. Now look at quadrilaterals more generally. Ask and discuss each of the following in turn. Allow different students the chance to show (i) their answers, and (ii) their methods of construction, on the board to help the discussion:
   Is it possible to find a quadrilateral all of whose sides are different and whose diagonals intersect at right angles?
   Is it possible to find a quadrilateral all of whose sides are different and whose diagonals intersect at 60º?
3. Send them away in their pairs to discuss the following questions. Tell them that in each case if their answer is 'yes' they will need to be able to construct one of the quadrilaterals. If the answer is 'no' they will need to be able to explain why. (However, all of these can be constructed. Some can be constructed in more than one way.)

Rich learning tasks and Problem Solving activities

Rich learning activities

Differentiated activities at Levels 1 to 5 of the NZC.

Activities have been developed at Levels 1 to 5 of the NZC.

- **Level 1 rich learning activities**
- **Level 2 rich learning activities**
- **Level 3 rich learning activities**
- **Level 4 rich learning activities**
- **Level 5 rich learning activities**
- **Counting Collections** (number sense activities for levels 1 to 5)
- **Differentiated units** (level 4 and 5 units with cross-curricular links)

Geometry and Measurement

- How long is a piece of string? (GM3-1)
- Standing order (GM3-1, NA3-1)
- Sugar rush (GM3-1, NA3-1)
- Parking cars (GM3-1, GM3-4)
- Where is the epicentre? (GM3-1, GM3-5)
- Across Lake Taupo (GM3-1, NA3-1)
- Noah's mystery parcel (GM3-1, GM3-2)
- Folding Boxes (GM3-2)
- Platonic crackers (GM3-3)
- Polygon puzzle (GM3-3, GM3-4)
- Banana cake (GM3-5)
- A case for a new phone (GM3-6)

Statistics

- Big Feet (S3-1)
- Books vs Bean Bags? Part i (S3-1)
- Books vs Bean Bags? Part ii (S3-1)
- Books vs Bean Bags? Part iii (S3-1)
- Listening to music (S3-2)
- What are we eating? (S3-2)
- Penalty shoot-out (S3-3)

Number and Algebra

- Carbon offset (NA3-1, NA3-2)
- Standing order (NA3-1, GM3-1)
- Sugar rush (NA3-1, GM3-1)
- Bill's dollars (NA3-1, NA3-2, NA3-6)
- Cricket with no ticket (NA3-1, NA3-6)
- WiFi units (NA3-1, NA3-2, NA3-6)
- Loads of sugar (NA3-1, NA3-4, NA3-6, GM3-1)
- A share of the spoils (NA3-1, NA3-5)
- Fraction circles (NA3-1, NA3-5)
- Domino donuts (NA3-1, NA3-6)
- A close game (NA3-1, NA3-7)
- Across Lake Taupo (NA3-1, GM3-1)
- Camping groups (NA3-2, NA3-6)
- Vege rows (NA3-3, NA3-8)
- The seventh wave (NA3-3, NA3-8)
- Sports tops (NA3-3, NA3-7, NA3-8)
- Broken Sparkles (NA3-4)
- Lunchtime Activities (NA3-5)

Refreshed to link to procedural and conceptual insights

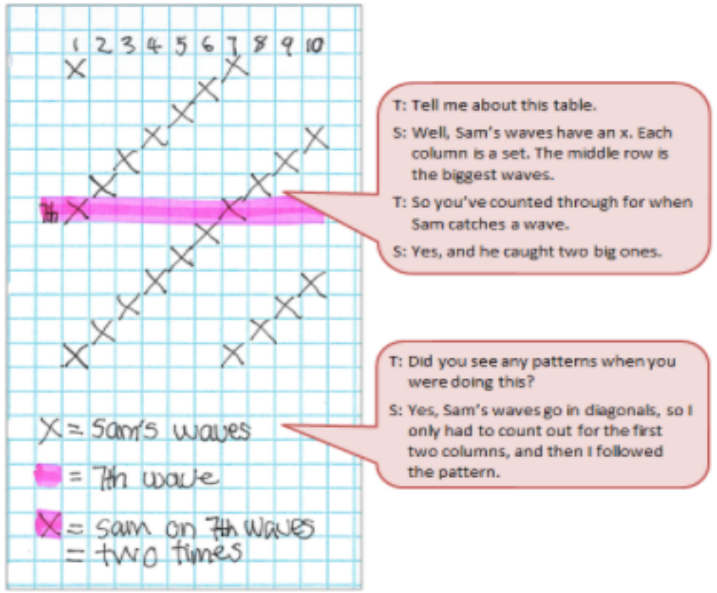
The procedural approach (hide)

- The student is able to use appropriate strategies, including imaging and skip counting to solve a problem involving sequences.

Prompts from the teacher could be:

1. How many waves are there in each set?
2. Could you make a table or a sequence of images to represent of each set of waves?
3. Use your table or images to mark out which of the waves will be Sam's.
4. Find how many of the waves that Sam rides, are the seventh (biggest) wave.

Click on the image to enlarge it. Click again to close.



T: Tell me about this table.

S: Well, Sam's waves have an x. Each column is a set. The middle row is the biggest waves.

T: So you've counted through for when Sam catches a wave.

S: Yes, and he caught two big ones.

T: Did you see any patterns when you were doing this?

S: Yes, Sam's waves go in diagonals, so I only had to count out for the first two columns, and then I followed the pattern.

NZMaths: A strong start for a balance

High Order
rich tasks
open ended

Low Order
Exercisess
simple word

Project:

Estimate the volume of your house, then make measurements and calculate the volume as accurately as you can.

Problem 1:

Can you design two dice so that if you roll them and add their totals only 6 and 12 come up?

Can you design two dice so that the only possible sums are 6 and 12 and both are equally likely?

How many different pairs of dice can you design that will work?

Problem 3:

Peni takes 30 hours to paint a fence. Harry takes 20 hours to paint the same fence. How long does it take them to paint the fence together?

Number facts:

Complete the number facts on the attached sheet. You can complete one box each day. On the fifth day, make up some examples of your own.

Quick questions:

1. What is 8^2?
2. What fraction is halfway between $\frac{2}{3}$ and $\frac{3}{5}$?
3. What is the formula for the area of a circle?
4. List the prime numbers less than 10.
5. Which is more, 1.22 or $\frac{7}{6}$?
6. How many equal length sides does a rhombus have?
7. If you toss a coin three times, what is the probability that it lands the same way up all three times?
8. If you have one of each New Zealand coin, what is their total value?
9. What is the square root of 144?
10. What is 26 ÷ 8?

Running speed challenge:

The New Zealand record for running a marathon (42 kilometres) is about two hours. The New Zealand record for the 200 metre sprint is about 19 seconds. Which is faster, and by how much?

Problem 2:

A cube has a surface area of 54cm². What is its volume?

Procedural Fluency

Conceptual Understanding

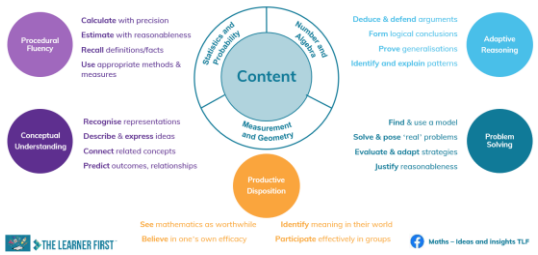
Adaptive Reasoning

Problem Solving

THE LEARNER FIRST

Exploring effective planning ideas

Mon	Tue	Wed	Thu
In the week kaiako have been securing two or three 20 min sessions to work with a focus groups. The independent ākonga are set tasks that could be: • Individual practice and deepening of new procedures (paper or online) • Open ended tasks (indiviudal/group) to transfer skills and report back • Working on a weekly group worthy task This ensures kaiako have that time for 1. Explicit teaching of procedures with conceptual understanding 2. Supporting ākonga with problem solving processes 3. Extending ākong with unfamilar tasks and new skills 4. Formatively assessing a group with assessment tool (existing or created)			



5.
Rapid Routines

Rationale behind routines

Recommendation 8

To support teachers to engage with all these strands, we recommend the following resources are made available to all teachers:

- Engaging activities that support the learning of basic facts, general procedural fluency and computational fluency

Effective Pedagogies

- **Opportunities to learn**
  - Planning reactivation
  - Sequencing tasks/lessons
  - Assessing ‘on the run’

Peter Sullivan’s Principle 6: Promote fluency and transfer through two ways:

- short everyday practice of mental processes
- reinforcing and prompting transfer of skills

Routines are NOT connected to current unit

NZMaths Unit Plans

5 lessons over 2 weeks

Rapid Routines

3 x 10 min each week

	Concept	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10
Number & Algebra	Number Strategies										
	Number Knowledge (place value)										
	Number Knowledge (frac/%/ratios)										
	Equations and expressions										
	Patterns and relationships										
Measurement and Geometry	Measurement (conversions)										
	Measurement (length, mass)										
	Measurement (angles)										
	Measurement (time)										
	Measurement (perimeter & area)										
	Measurement (volume)										
	Shape										
	Position and direction										
	Transformation										
Statistics	Statistical Investigations										
	Statistical literacy										
	Probability										

Our Aotearoa/Australia community

Maths: Ideas and Insights TLF

Private group · 810 members

Joined | + Invite

A 45 sec video from One Tree Point on a snapshot of their MovenProve for 7 + 4 = [ ] = 5. Thanks OTP😀

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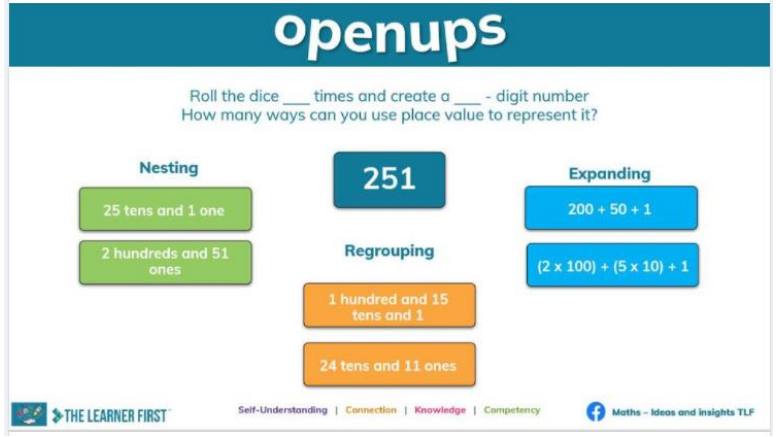
Move n Prove 3



One common type of routine

Rapidroutines

- 3 - 5 procedural questions
- 2 or 3 times a week
- Whole class on whiteboards
- Teacher facilitates
- One question chosen
- Whole class promotes reasoning

Using elaborations to create our own

Rapidroutines

Level 3 Key Ideas and Elaborations (Number and Algebra)

Number knowledge – key ideas

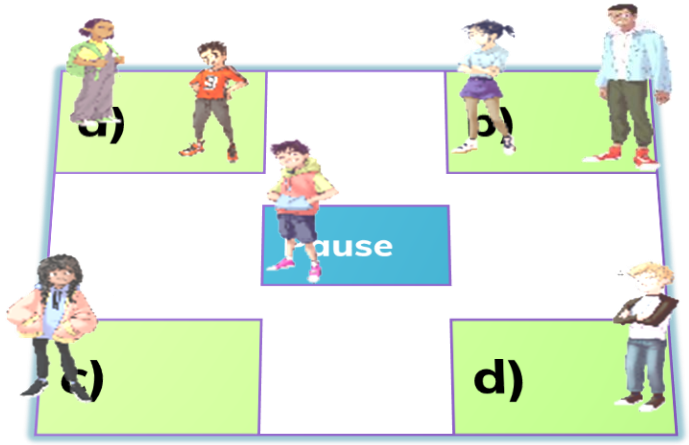
Numbers can be represented in a variety of ways incl fractions, decimals and percentages for representing small numbers.
The fraction ¾, 4 is division of equal parts, 3 is no. of the parts
Decimals extend the PV system. Each column to the right of point is worth ten times less (a tenth of)
Percentages thought of as fractions (out of 100 parts)

Number knowledge – elaborations

NA3-2 Know from **0 x 0 = 0 to 9 x 9 = 81** and all division.
Commit to memory when the understand meaning of = and use properties to work them out eg
"Eight sets of seven" can be worked out by 4 x 7 and doubling it.
Know 56 ÷ 7 is both 56 shared among 7 and how many 7s in 56
NA3-3 Know fwd 0,1,2, 3. and bwd 1 000 000, 999 999, 999 998
Know multiples of one, ten, hundred, thousand 1250, 2250 ...
Know 701 000 results in 691 000 if 10 000 is taken from it.
Know sequences in tenths e.g., 4.7, 4.8, 4.9, 5....
NA3-4 Have a multiplicative view of whole number place value.
Understands the nested view e.g., **239 456 has 23 ten thousand, 2394 hundreds, and 23 945 tens.**
Best demonstrated by 2004 – 700, so 20 hundred take 7 hundred
Know one hundred thousand is ten times as much as ten thousand, and one hundred is result of dividing one thousand by ten.
Eg **4200 is ten times more than 420, 43 divides by 10 is 4.3**
NA3-5 Fractions are repeats of a unit fraction e.g., **3/5 = 1/5 +1/5 + 1/5**,
Fractions can be greater than 1 whole e.g., **5/3 = 1 2/3**, they have counting order if denominator is the same. The size of the denominator affects the size of the parts. Eg **2/7 < 2/5 < 2/3**. Know simple common fraction/% e.g., 1/5 = 50%, 1/10 = 10%, 1/5 = 20% and use this to work out non-unit fractions as % **e.g., ¾ = 75%**

Monday	Wednesday	Friday
How many tens altogether in 450?	How many hundreds altogether in 15 000	How many tenths altogether in 1.5?
What number comes next? 1250, 1150, 1050, ?	What number comes next? 0.7, 0.8, 0.9, ?	What number comes next? 10 200, 10 100, 10 000
What has been added to 750 000 to make 850 000?	What has been subtracted from 1 000 000 to make 100 000?	What has ten thousand been divided by to make one hundred?
Choose one question where ākonga have opportunities to communicate and share their thinking, their methods, their langauge. Kaiako can use insights to assist future planning of questions.		

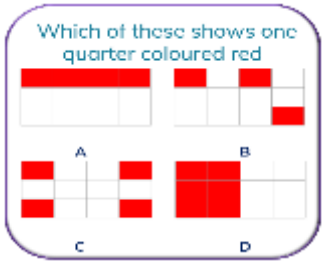
The moveNprove



Ākonga have opportunities to **think mathematically** and **critically** about a question.

Kaiako can elicit a whole class snapshot of what levels of understanding their ākonga have

A corner denotes a child can communicate their reasoning
The centre is for unsure or answers without reasoning



A question is posed with 4 answers – 1 being correct

Ākonga have 20 seconds to individually think

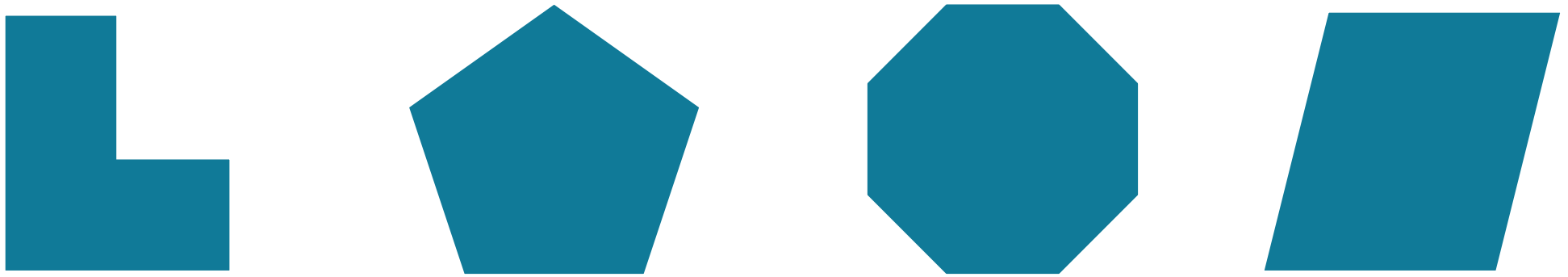
Ākonga move to their places and one or two in each corner is asked to explain choice. Talk moves used.

Ākonga given option to stay or move. Kaiako asks 'movers' to explain why. Kaiako makes note of who is where.

The answer is not given. Kaiako have to use the week to try and convince 'us' to unanimously understand and explain the solution.

Kaiako find this one insightful

Which of these shapes is the hexagon?

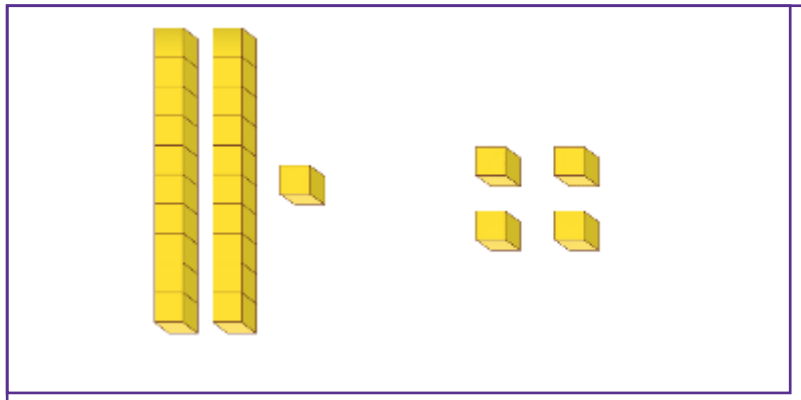


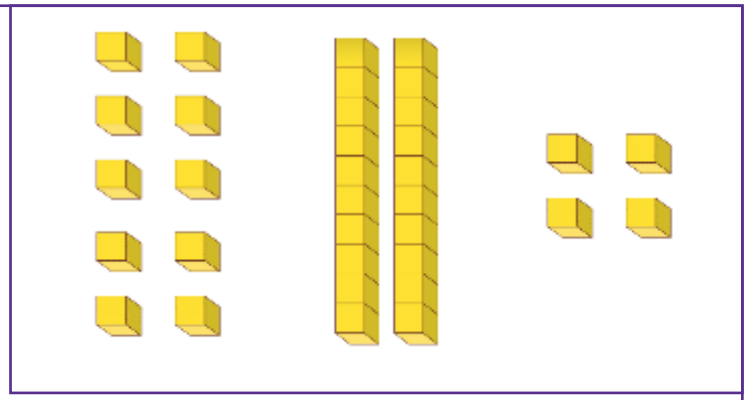
a	b	c	d

A polygon *(taparau)* has six angles *(koki)* and six sides *(tapa)*

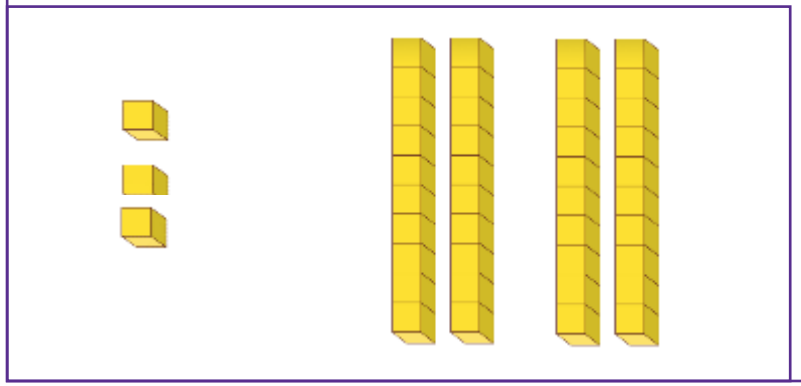
Creating their own

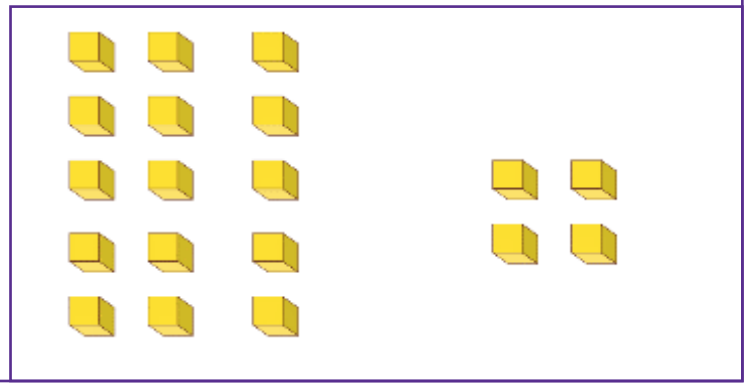
Which one of these shows **34?**



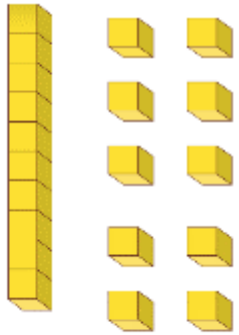


Pause





A rich task to explore concepts



1. Choose any 2-digit number
2. Create an example and non-example of it
3. Think of a way to make the wrong answer look right
4. Can you trick another group, another teacher?

How many ways are there to represent a 2-digit number with place value?

Try with a 3 digit or 4 digit number

If the  is worth 100, what numbers can you make now?

Ideas and insights from the sector

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Joined + Invite

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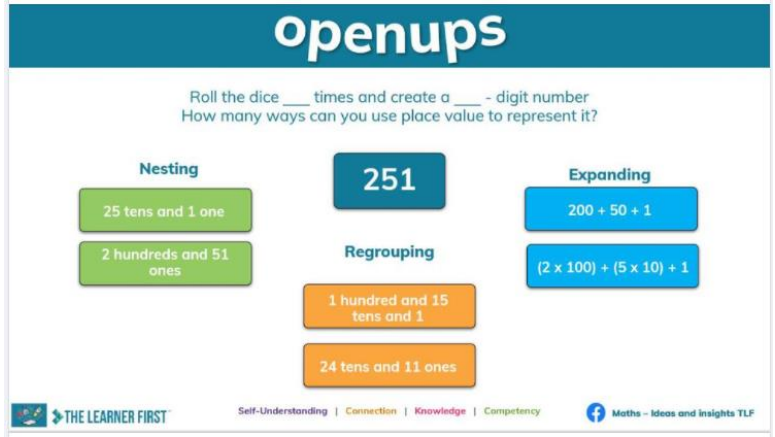
Move n Prove 3



Ideas for Maths week

Monday	Tuesday		Wednesday		Thursday	Friday
Rapid routine	Explict Teaching Lesson to enable	Open Tasks for extending	Open Tasks for enabling	Explict Teaching Lesson to extend	Rapid routine	Rapid routine
Rich task to diagnose what students know	Rapid routine		Grp A and B connect		Whole Class Explict Teaching	Student Choice *Reasoning Games* *Online Gaming* *Open tasks*

Monday	Tuesday		Wednesday		Thursday		Friday
Rapid routine	Group A Inquiry Problem 1	Group B Consolidate	Group A Consolidate	Group B Inquiry Problem 1	Rapid routine		Rapid routine
Open Tasks Rich investigation	Rapid routine		Grp A and B connect		Consolidate	Teacher with targeted suppport	Point in time assessment Samples collected. Moderated amd discussed with learners

6.
Assessment Capability

Assessment can remain unbalanced

	Number strategies	Num & Alg knowledge	Measurement & Geometry	Statistical inquiry
Procedural Fluency				
Conceptual Understanding				
Problem Solving D				
S				
Reasoning				
Productive Disposition				

Would it be fair that ākonga get an OTJ based on this?

	Number strategies	Num & Alg knowledge	Measurement & Geometry	Statistical inquiry
Procedural Fluency	YES	SOME	NO	NO
Conceptual Understanding	YES	SOME	NO	NO
Problem Solving D	NO	NO	NO	NO
S	YES	SOME	NO	NO
Reasoning	SOME	SOME	NO	NO
Productive Disposition	SOME	SOME	NO	NO

Shattering assumptions

JAM: Designed for the first three years of schooling. It replaces NumPA. It does not assess al concepts in domains or strands

GloSS: It assists in determining a student's best fit on the Number Framework

IKAN: An alternative to NumPA. It shows what ākonga need to quickly recall without needing to strategise. Its a best fit on Number Framework

E-asTTle: A multiple choice for Years 5 to 10 that cab be used to inform planning and learning

On their own they all give useful insights

On their own they cannot give an OTJ

On their own they deny ākonga access to a rich balance

Learning progressions is one way to triangulate

Mathematics Framework

Multiplicative thinking

This progression combines elements from both the multiplicative and proportional domains of the Number Framework. However, as with additive thinking, the sets of exemplars are not a direct match to the stages of the Number Framework. This progression focuses on students' ability to think multiplicatively as they solve multiplication, division, and proportional problems involving an extended range of whole numbers, decimals, fractions, ratios, and percentages, and in a range of contexts.

Download all PDFs from this set

5th signpost

5 illustrations for the All context

View as:

What are the big ideas behind the illustration set?

The students use their known multiplication basic facts and place-value knowledge to solve multiplication and division problems involving single-digit multipliers or divisors.

Dragon teeth Core

James uses his place value knowledge to partition the 2-digit number in this problem. He understands that he can use his known multiplication facts, including his knowledge of multiples of ten, to solve this problem. He is able to recombine numbers and explain his solution. Open full illustration

Tennis balls Core

Mari uses her knowledge of known multiplication facts to solve this division problem. She understands the context of the problem, the commutative property of multiplication and checks that her solution answers the problem. Open full illustration

End of Level 3 – Multiplicative Thinking Milestone 5

The students use their known multiplication basic facts and place-value knowledge to solve multiplication and division problems involving single-digit multipliers or divisors.

There are 3 dragons. Each dragon has 21 teeth. How many teeth are there altogether?

How did you do it?

I know that 21 is just 20 and 1. So I said 3 x 20 and that's 60 because 3 x 2 is 6. Then I added 3 because it's really just 3 x 1. So it's 63.

Why did you do it that way?

Well I know that 20 is 10 x 2. So when I am 'timesing' a number with zero on the end I can just use the simple thing I know and make it 10 times bigger.

There are 40 relay teams competing in the interschool sports. Altogether there are 120 competitors. How many are in each team?

How did you do it?

Well I thought, what I would times the 40 by to get 120? When I looked at the numbers while you were reading, the 4 and the 12 jumped out at me kind of like the zeros weren't there. I know 4 x 3 = 12, so I figured that 40 x 3 would be 120.

What do you know that helped you?

Well I just know 4 x 3 and I know how to times by 10. The 40 is really just 4 x 10 and the 120 would be 12 x 10. It's kind of neat really to use your tables like that. I know that I can go 40 times 3 is 120.

End of Level 3 – Multiplicative Thinking Milestone 5

The students use their known multiplication basic facts and place-value knowledge to solve multiplication and division problems involving single-digit multipliers or divisors.

Farmer Croft is shifting 125 dairy cows to another paddock. 25 of them have already gone through the gate. What fraction is this of the herd?

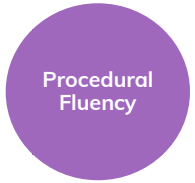
How did you do it?

Well I thought 10 x 10 is 100 and I know that's like 5 times 20. And there's 25 more to make 125. Straight way I knew that's 5 times 5. So I can see that the five twenties and the five fives is 5 lots of 25, making 125. So another way to say that is that 25 is one fifth of 125.

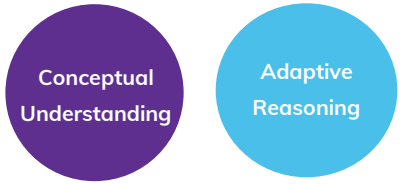
Why did you do it that way?

Well I just know my tables and I know that something in five equal parts is the same as saying it's in fifths.

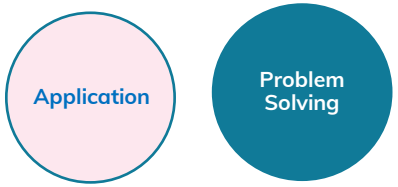
Asking how will elicit evidence on



Asking why will elicit evidence on



The application (transaprent) problem will go some way towards



Formative ways #1a

The school hall has 120 chairs inside. 30 of them need stacking away. What fraction of the chairs need stacking?

The bike park has 3 races today. There are 16 cyclists in each race. How many cyclists are there altogether

On Netflix there are 20 episodes of equal length of a new show. If the series is 860 minutes in total. How many minutes long are each of the episodes?

Formative ways #1b

MILESTONE 1

They can compare quantities using informal language. They know some number names and parts of the number-word sequence, and they may subitise small quantities.

MILESTONE 2

They can use one-to-one correspondence, their knowledge of the number-word sequence, cardinality, and ordinality as they count sets of objects

MILESTONE 3

They count all the objects to solve simple addition or subtraction problems. They do this with real objects or by imagining the objects.

Formative ways #2

Mon	Tue	Wed	Thu
In the week kaiako have been securing two or three 20 min sessions to work with a focus groups. The independent ākonga are set tasks that could be: • Individual practice and deepening of new procedures (paper or online) • Open ended tasks (indiviudal/group) to transfer skills and report back • Working on a weekly group worthy task This ensures kaiako have that time for 1. Explicit teaching of procedures with conceptual understanding 2. Supporting ākonga with problem solving processes 3. Extending ākong with unfamilar tasks and new skills **4. Formatively assessing a group with assessment tool (existing or created)**			

Teacher aides being skilled up with milestones to target groups

Bringing the balance back

Exercise

Application

Unfamiliar

	Number strategies	Num & Alg knowledge	Measurement & Geometry	Statistical inquiry
Procedural Fluency	✓	✓	✓	✓
Conceptual Understanding	✓	✓	✓	✓
Problem Solving	✓	✓	✓	✓
Reasoning	✓	✓	✓	✓
Productive Disposition				

Know the proficiencies, know mathematics

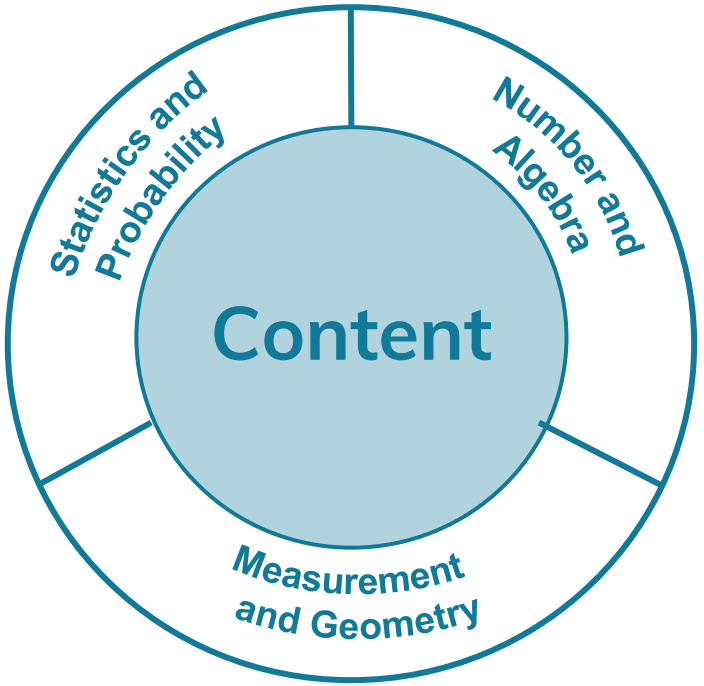
Procedural Fluency

Calculate with precision

Estimate with reasonableness

Recall definitions/facts

Use appropriate methods & measures



Adaptive Reasoning

Deduce & defend arguments

Form logical conclusions

Prove generalisations

Identify and explain patterns

Conceptual Understanding

Recognise representations

Describe & **express** ideas

Connect related concepts

Predict outcomes, relationships

Problem Solving

Find & use a model

Solve & pose 'real' problems

Evaluate & adapt strategies

Justify reasonableness

Productive Disposition

See mathematics as worthwhile

Identify meaning in their world

Believe in one's own efficacy

Participate effectively in groups