Breaking Barriers
FF
NPC1, NPC 2

Numicon

NZ Curriculum

National Standards

Numicon – Breaking Barriers - Maths concept development

Counting	Patterns	Numbers (5, 1-4, 6 -10)	Add/sub/ mult/div
	Repeating Directions Complex Same and different Patterns with numbers Balance - Equal Odd and even Reasoning	Matching numbers and patterns Comparing amounts of pattern components Ordering patterns Ordering numbers How many by using pattern	Joining patterns Separating patterns Multiplying patterns Dividing patterns Finding parts of patterns (fractions

Link all these concepts to measurement, geometry and statistics as each concept is mastered.

Numicon – New Firm Foundations - Maths concept development

Daily Maths Opportunities	Daily Counting Opportunities	Pattern & Numbers (0 - 20)	Add/sub/ mult/div
		Repeating Directions Complex Same and different Patterns with numbers Balance - Equal Odd and even Reasoning Matching numbers and patterns Comparing amounts of pattern components Ordering patterns Ordering numbers How many by using pattern	Adding - Joining patterns Subtracting - Separating patterns Halving and sharing Parts and wholes - Adding and subtracting Finding parts of patterns (halving and doubling) How many more? How many less?

Links are provided to all these concepts for measurement, geometry and statistics.

Numicon – NPC1- Maths concept development

Daily Maths Opportunities	Daily Counting Opportunities	Pattern & Numbers (0 - 100)	Add/sub/ mult/div
		Repeating Directions Complex Same and different Patterns with numbers Balance - Equal Odd and even Matching numbers and patterns Comparing amounts of pattern components Ordering patterns Ordering numbers How many by using pattern Place value Logic and reasoning with numbers	Adding - Joining patterns Subtracting - Separating patterns Halving and sharing Parts and wholes - Adding and subtracting Finding parts of patterns (halving and doubling) Fractions – halves and quarters How many more? How many less?

Links are provided to all these concepts for measurement, geometry and statistics.

Numicon – NPC2- Maths concept development

Daily Maths Opportunities	Daily Counting Opportunities	Pattern & Numbers (0 – 100 and beyond)	Add/sub/ mult/div
		Exploring patterns Inverse patterns of + and – Odds and evens Patterns and sequences of 2, 3, 5, and 10 Place value Comparing and ordering numbers Rounding Fractions as numbers Logic and finding all possibilities	Adding – writing sentences, adding to 100 Subtracting - writing sentences, subtracting to to 100 Ordering + and – facts Strategies for mental problem solving Partitioning numbers and calculating Multiplying – repeated addition, arrays, bridging through multiples of 10 Division – How many groups of … in ... Fractions – halves, quarters and thirds of wholes

Links are provided to all these concepts for measurement, geometry and statistics.

NZCurriculum Level 1 Number and Algebra (Years 1, 2 (3))

Number strategies

AO1: Use a range of counting, grouping, and equal-sharing strategies with whole numbers and fractions.
This means students will use counting strategies including counting on and back, double counting, and skip counting. This corresponds to the counting stages of the number framework so achieving level one means that a student is at the Advanced Counting Stage. Examples of their strategies might be, to calculate 6 + 5 count 7, 8, 9, 10, 11, to calculate 12 – 3 count 11, 10, 9, or to calculate three groups of three double counting 1, 2, 3,...4, 5, 6,...7, 8, 9. Grouping and equal sharing strategies are simple ways to solve addition, subtraction, multiplication and division, and fractions of sets problems without counting every object. Examples of these strategies might be; knowing 4 + 4 equals 8, skip counting 5, 10, 15, 20 to count four groups of five, or sharing objects in ones, twos or threes to find one quarter of a set of 12 items.

- Finger counting is OK, link with patterns
- Grouping – link with patterns
- Equal sharing – link with patterns

Number knowledge

AO1: Know the forward and backward counting sequences of whole numbers to 100.
This means students will know the forward number word sequence to 100 is the counting pattern of words and symbols, 0, 1, 2, 3, 4,...; while the backward sequence is the pattern 100, 99, 98, 97,... Students will also be able to name the number before and after a given number since this relates to taking an item off or putting an item onto an existing set.

AO2: Know groupings with five, within ten, and with ten.
N3. This means students will learn visual and symbolic patterns for the numbers to ten so they can be recognised without counting), groupings within and with five, for example 2 + 3, 5 + 4, names for ten for example 6 + 4 therefore 10 – 4, doubles to ten at least, for example 4 + 4, and groupings with ten, for example 10 + 6, 8 + 10 (teen numbers).

- Link with patterns
- Concrete, then pictorial, then abstract
- Number sentences – make with word cards, then introduce the symbols

1. Three and seven makes ten
2. Three add seven balances ten
3. Three plus seven equals ten
4. 3 + 7 = 10

- Illustrate with equipment if recall is slow or child is non-verbal

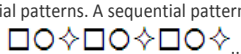
Equations and expressions

AO1: Communicate and explain counting, grouping, and equal-sharing strategies, using words, numbers, and pictures.
This means students will explain the number strategies they use to others using a combination of words, numbers and pictures. This implies that students will learn to write equations to express their findings, for example 5 + 9 = 14, to express their ideas using their own language in conjunction with mathematical language, e.g. add, subtract, times, fraction, and to develop diagrams to represent their strategies, for example set diagrams or number lines.

Patterns and relationships

AO1: Generalise that the next counting number gives the result of adding one object to a set and that counting the number of objects in a set tells how many.
This means students will understand the link between the cardinal and ordinal aspects of counting. The ordinal aspect refers to the fact that counting numbers have a conventional order. The last number in a count tells how many objects are in a set if all the objects are matched in one-to-one correspondence to the sequence of counting numbers. s. The next number in the counting sequence tells the result of adding an object while the number before in the sequence tells the count when an object is removed. The cardinal aspect involves knowing that when counting a set of items the last number describes all the items in the set, no matter their colour, size, arrangement or other attributes. This count can be trusted and built upon.

- **And start here!**
- Make counting groups in patterns, different formations and places for generalising – the count is always the same result – see over

AO2: Create and continue sequential patterns.
This means the students will explore sequential patterns. A sequential pattern is one in which further members of that pattern can be predicted from previous members. So  ..., and 1, 3, 5, 7, ... are sequential patterns. At Level One students should be able to reproduce a given pattern using objects, drawings or symbols and continue the pattern on with justification, e.g. It goes square, circle, star...They should also be able to invent their own patterns and communicate the "rule" for their pattern to others.

- **Start here!**
- Make patterns – see over

THE MATHEMATICS STANDARD

After one year at school, students will be achieving at early level 1 in the mathematics and statistics learning area of the New Zealand Curriculum.

Number and Algebra

In contexts that require them to solve problems or model situations, students will be able to:

- *apply counting-all strategies;*
- *continue sequential patterns and number patterns based on ones.*

Geometry and Measurement

In contexts that require them to solve problems or model situations, students will be able to:

- *compare the lengths, areas, volumes or capacities, and weights of objects directly;*
- *sort objects and shapes by a single feature and describe the feature, using everyday language;*
- *represent reflections and translations by creating patterns;*
- *describe personal locations and give directions, using everyday language.*

Statistics

In contexts that require them to solve problems or model situations, students will be able to:

- *investigate questions by using the statistical enquiry cycle (with support), gathering, displaying, and/or counting category data.*

The following problems and descriptions of student thinking exemplify what is required to meet this standard.

Number and Algebra

During this school year, Number should be the focus of 60–80 percent of mathematics teaching time.

Example 1

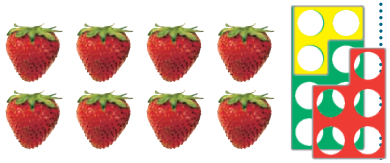
Imagine you have 4 teddies. *You get 5 more teddies.*

How many teddies do you have now?

The student gets the correct answer of 9 teddies by counting all of the objects: 1, 2, 3, 4, 5, 6, 7, 8, 9. They may do so by imaging the teddies, preferably, or by using substituted materials (e.g., fingers or counters). If they successfully use a more sophisticated strategy, such as counting on or doubling, they exceed the expectation.

Example 2

Imagine you have 8 strawberries.



You eat 3. How many strawberries do you have left?

The student gets the correct answer of 5 strawberries by counting all the objects (1, 2, 3, 4, 5, 6, 7, 8) and then counting back (7, 6, 5). They may do so by imaging the strawberries, preferably, or by using substituted materials (e.g., fingers or counters). If they successfully use a more sophisticated strategy, such as immediately counting back from 8 or using known facts, they exceed the expectation.

ILLUSTRATING THE STANDARD

Example 3

Here are 3 kete. There are 3 kūmara in each kete.

How many kūmara are there altogether?

The student gets the correct answer of 9 kūmara by counting all of the objects: 1, 2, 3, 4, 5, 6, 7, 8, 9. They may do so by imaging the kūmara, preferably, or by using substituted materials (e.g., fingers or counters). If they successfully use a more sophisticated strategy, such as skip-counting (3, 6, 9), they exceed the expectation.

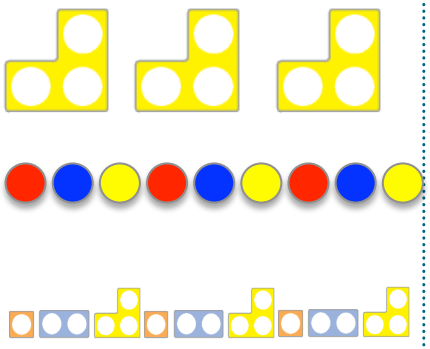
Example 4

Build up the pattern below one animal at a time in front of the student.

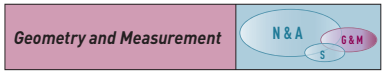
Copy this pattern with your animal cards.

Which animal comes next in the pattern? How do you know?

The student identifies which animal comes next (the pig) by attending to its relative position in the repeating sequence: cow, pig, sheep.



Geometry and Measurement



Example 5

Provide water in an ungraduated jug or bottle and 3 containers that are similar in capacity.

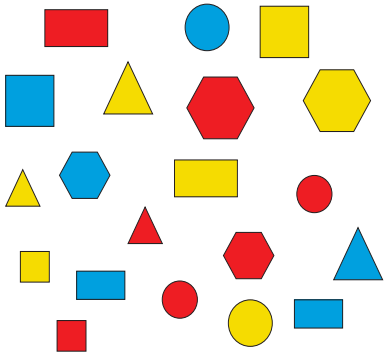
Here are 3 containers. Use water to find out which container holds the most.

The student pours water directly from one container to another to find out which holds the most.

Example 6

Provide the student with a set of attribute blocks.

Here is a set of blocks. Sort the blocks into families.



What is the same about the blocks in each family?

The student sorts the blocks by a feature of their choice and explains their sorting. The feature may be colour, size, shape, thickness, or some other characteristic, such as number of sides, symmetry, "pointiness", or "roundness".

AFTER ONE YEAR AT SCHOOL

ILLUSTRATING THE STANDARD

Example 7

Sit with the student at their desk in the classroom.

Imagine I am standing at the door. I need to get to where Rawiri sits. Tell me how to get to his seat.

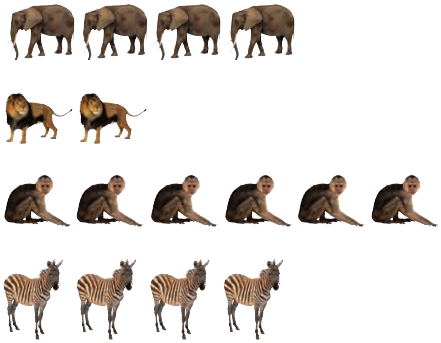
The student gives clear directions that lead you to Rawiri's seat. They may tell you to move backwards or forwards and to turn right or left. If the student specifies distances in steps or metres or uses half- or quarter-turns, they exceed the expectation.

Statistics

Example 8

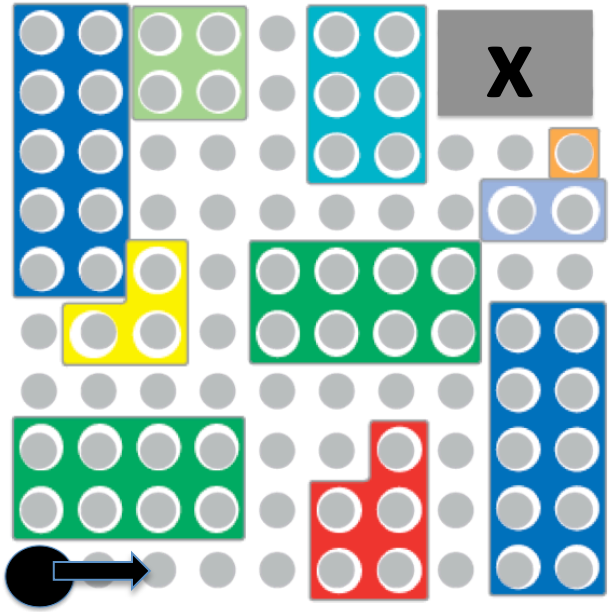
Provide the student with the animal cards shown below, randomly arranged.

Arrange the cards so that someone else can see how many of each animal there are at the zoo. How many zebras are there? Which animal is there most of?

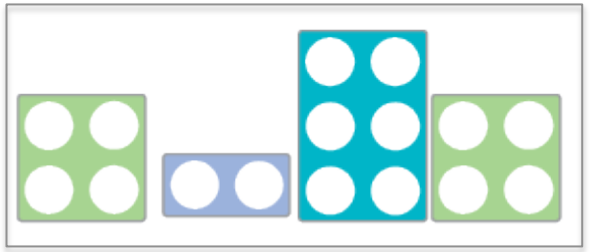


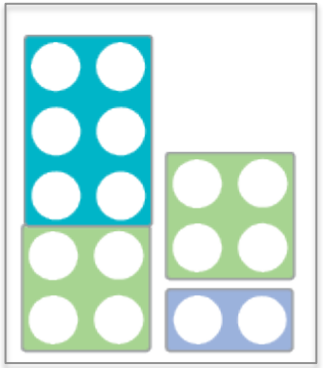
The student sorts the animals into categories and displays the number of animals in each category, using a set grouping or pictograph as above. They correctly answer that there are 4 zebras and more monkeys than any other animal.

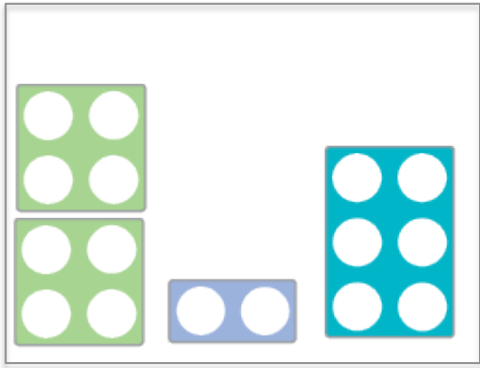
Can find their way from the door to the desk marked 'x'



Can see:
How many more,
How many less,
Total,
Sort into groups







THE MATHEMATICS STANDARD

After two years at school, students will be achieving at level 1 in the mathematics and statistics learning area of the New Zealand Curriculum.

Number and Algebra

In contexts that require them to solve problems or model situations, students will be able to:

- *apply counting-on, counting-back, skip-counting, and simple grouping strategies to combine or partition whole numbers;*
- *use equal sharing and symmetry to find fractions of sets, shapes, and quantities;*
- *create and continue sequential patterns by identifying the unit of repeat;*
- *continue number patterns based on ones, twos, fives, and tens.*

Geometry and Measurement

In contexts that require them to solve problems or model situations, students will be able to:

- *compare the lengths, areas, volumes or capacities, and weights of objects and the durations of events, using self-chosen units of measurement;*
- *sort objects and shapes by different features and describe the features, using mathematical language;*
- *represent reflections and translations by creating and describing patterns;*
- *describe personal locations and give directions, using steps and half- or quarter-turns.*

Statistics

In contexts that require them to solve problems or model situations, students will be able to:

- *investigate questions by using the statistical enquiry cycle (with support), gathering, displaying, and/or identifying similarities and differences in category data;*
- *describe the likelihoods of outcomes for a simple situation involving chance, using everyday language.*

The following problems and descriptions of student thinking exemplify what is required to meet this standard.

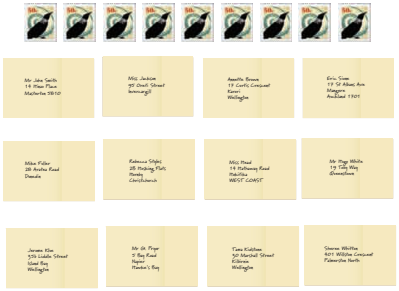
Number and Algebra

During this school year, Number should be the focus of 60–80 percent of mathematics teaching time.

Example 1

Imagine you have 9 stamps and 12 letters.

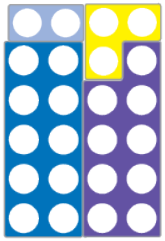
Each letter needs a stamp.



How many more stamps would you need to post all the letters?

The student gets the correct answer of 3 stamps by counting on 10, 11, 12 and tracking the count of 3. Alternatively, they may count back 11, 10, 9, tracking the count of 3.

If the student successfully uses a part–whole strategy, they exceed the expectation (e.g., "9 stamps and 1 more is 10, and that leaves 2 more stamps, which is 12", or "12 is 4 threes, and 9 is only 3 threes, so I need 3 more stamps").



ILLUSTRATING THE STANDARD

Example 2

Imagine there are 49 birds sitting in the tree.

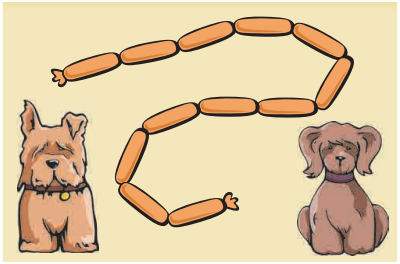
Another 4 birds come along.

How many birds are in the tree now?

The student gets the correct answer of 53 birds by counting on 50, 51, 52, 53 and tracking the count of 4. They may track the count by imaging or using substitute materials, including fingers.

If the student successfully uses a part–whole strategy (e.g., "49 and 1 is 50; that leaves 3 more birds, so there are 53 birds in the tree"), they exceed the expectation.

Example 3



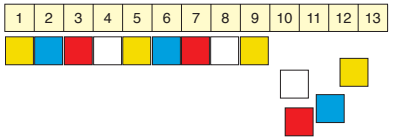
Here is a string of 12 sausages to feed 2 hungry dogs.

Each dog should get the same number of sausages. How many will each dog get?

The student uses equal sharing to distribute the sausages between the dogs. This might involve skip-counting ("2 sausages makes 1 each, 4 sausages makes 2 each ... 12 sausages makes 6 each") while tracking the count mentally or with fingers, or it might involve halving, that is, dividing 12 into 6 and 6. (Note that 6 and 6 is a symmetrical partitioning of 12.)

Example 4

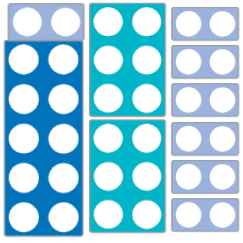
Show the student a number strip with coloured cubes lined up along it, as in the diagram below. Provide extra coloured cubes.



What colour cube goes on the number 13 in this pattern?

The student identifies the unit of repeat (yellow, blue, red, white) and continues the pattern one cube at a time until they identify a yellow cube on 13.

If the student notices that multiples of 4 have a white cube and therefore 13 has a yellow cube, they exceed the expectation.



NZ Curriculum Level 2 -Years 3,4,(5)Number and Algebra

Number strategies

AO1: Use simple additive strategies with whole numbers and fractions.
This means students will learn to treat whole numbers as units of ones that can be split and recombined to make calculations easier. Additive strategies are about a type of thinking not the operation of addition. So additive strategies can be applied to addition, e.g. 47 + 38 is 50 + 40 – 5, subtraction, e.g. 74 – 8 = ☐ as 74 – 4 – 4 = ☐, multiplication, e.g. 4 x 6 = ☐ as 4 + 4 + 4 + 4 + 4 = ☐, which is 8 + 8 = ☐, division, e.g. 18 ÷ 3 = ☐, as 5 + 5 + 5 = 15 so 6 + 6 + 6 = 18. Additive strategies may also be applied to finding fractions of sets particularly halves, thirds, quarters, fifths, eighths and tenths. Level Two corresponds to students being proficient at the Early Additive stage of the number framework.

Number knowledge

AO1: Know forward and backward counting sequences with whole numbers to at least 1000.
This means students will know the forward number word sequence to 1000 is the counting pattern of words and symbols, 0, 1, 2, 3, 4,...1000 while the backward sequence is the pattern 1000, 999, 998, 997, ... At level Two students should know these sequences in multiples of one, ten, e.g. 358, 348, 338,..., and one hundred, e.g. 247, 347, 447,... An important part of knowing these sequences is being able to name the number before and after a given number since this relates to taking an item off or putting an item onto an existing set, e.g. If a set contains 800 items, 799 items are left if one is removed. This also applies to the sequence in tens and hundreds, e.g. ten removed from a set of 503 results in 493 objects left..

AO2: Know the basic addition and subtraction facts.
This means students will know the basic addition facts from 0 + 0 = 0 to 9 + 9 = 18. So 4 + 1 = 5, 8 + 6 = 14, and 9 + 3 = 12 are all basic addition facts. The basic subtraction facts are the subtraction equivalent of the addition facts, so 5 – 1 = 4, 5 – 4 = 1, 12 -3 = 9 and 12 – 9 = 3 are all examples. It is important that students understand the commutative property of addition, e.g. 4 + 7 = 7 + 4, and the inverse nature of addition and subtraction, e.g. 6 + 7 = 13 so 13 – 7 = 6, as a foundation for more difficult problems, as well as a way to connect basic facts. Students also need to encounter the unknown in different positions within their basic facts, e.g. 4 + ☐ = 12 and ☐ – 5 = 8.

AO3: Know how many ones, tens, and hundreds are in whole numbers to at least 1000.
This means students will develop an additive view of whole number place value by knowing the significance of the position of digits in a whole number, e.g. In 456 the 5 means five tens. However, many strategies for computation require a nested view of place value. This means that nested in the hundreds are tens in the same way that nested in the hundreds and tens are ones, e.g. 456 has 45 tens and 456 ones. An understanding of nested place value is best demonstrated by calculations where tens must be constructed from ones, hundreds constructed from tens, tens created from breaking hundreds and ones created from breaking tens. For example, calculations like 456 + 70 = ☐ or 456 - ☐ = 396, show whether students can apply place value in this way.

AO4 Know simple fractions in everyday use.
This means students will understand the meaning of the digits in a fraction, how the fraction can be written in numerals and words, or said, and the relative order and size of fractions with common denominators (bottom numbers). Fundamental concepts are that fractions are iterations (repeats) of a unit fraction, e.g. 3/4 = 1/4 + 1/4 + 1/4 and 4/3 = 1/3 + 1/3 + 1/3 + 1/3 . This means the numerator (top number) is a count and the denominator tells the size of the parts, e.g. In 4/3 there are four parts. The parts are thirds created by splitting one into three equal parts. This means that fractions can be greater than one, e.g. 4/3 = 1 1/3, and that fractions have a counting order if the denominators are the same, e.g. 1/3, 2/3, 3/3, 4/3,... Note that whole numbers can be written as fractions, e.g. = 1. Fractions in everyday usage include halves, thirds, quarters (fourths), fifths, eighths, and tenths..

Equations and expressions

AO1: Communicate and interpret simple additive strategies, using words, diagrams (pictures), and symbols.
This means students will be able to use words, symbols and diagrams to explain their number strategies to others. Recording also allows students to think through solutions to problems and allows them to reduce their working memory load by storing information in written form. This is particularly important for the solving of complex, multi-step problems. Students should be able to write the numerals for whole numbers, to 1000, and simple fractions. They should also be able to write addition, subtraction, multiplication and division equations with understanding of the meaning of these operations and of the equals sign as meaning “equal to”. Similarly they should know which operation to perform on a calculator if the numbers are beyond their mental range. Students should also be familiar with using empty number lines to record addition and subtraction strategies and of drawing arrays to record simple multiplication and division strategies. Formal written algorithms for multi-digit addition and subtraction should not be taught at Level Two until students have the place value knowledge required to understand them.

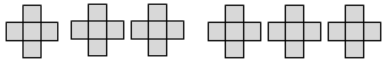
Patterns and relationships

AO1: Generalise that whole numbers can be partitioned in many ways.

Students at level two should understand that numbers are counts that can be split in ways that make the operations of addition, subtraction, multiplication and division easier. From Level One students understand that counting a set tells how many objects are in the set. An advance on this thinking is to realise that the count of a set can be partitioned and that the count of each subset tells how many objects are in that subset. Also required is understanding that partitions of a count can be recombined. For example, a count of ten can be partitioned into 1 and 9, 2 and 8, 3 and 7, etc. This objective also involves critical choice of partitioning. For example, 8 + 6 = ☐ can be solved by partitioning 6 into 1 and 5, 2 and 4, 3 and 3. Of these partitions 2 and 4 is the best strategic choice since it recombines into a “ten and...” fact, i.e. 8 + 6 = 8 + 2 + 4 = 10 + 4. At Level Two, students are expected to understand the strategic importance of using place value as a way to partition numbers. Students should apply their partitioning generalisation to many problem types including combining (e.g. 27 + 9 = ☐) , separating (e.g. 105 - 19 = ☐), comparing (e.g. 45 + ☐ = 106), duplicating (e.g. 8 x 5 = ☐) and sharing (e.g. 20 ÷ 4 = ☐).

AO2: Find rules for the next member in a sequential pattern.

This means students will explore sequential patterns, both can be either spatial, e.g. ☐○✧☐○✧☐○✧,.. or numeric, e.g. 1, 3, 5, 7, ... A pattern has consistency so further ter ms of it can be anticipated from those already known. In spatial patterns students should be able to identify the repeating element, e.g. ☐○✧ in that above, and use this to predict the shape in a given ordinal position, e.g. the next shape is ☐, the eleventh shape will be ○. For simple number patterns students should identify the consistent “gap” between the terms, e.g. 1, 3, 5, 7,... two is added each time, and use this additive difference to find further terms. Students should also develop their concept of relations between variables using spatial patterns that can be represented using numeric tables of values, e.g. For this pattern, how many squares make 7 crosses?



BB – an introduction to level 2

- Pattern extension
- Number and the Number System17 - 21
- Calculating 12 – 18

With further extension from NPC 2 and 3

THE MATHEMATICS STANDARD

After three years at school, students will be achieving at early level 2 in the mathematics and statistics learning area of the New Zealand Curriculum.

Number and Algebra

In contexts that require them to solve problems or model situations, students will be able to:

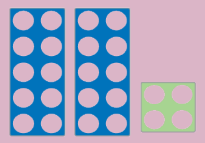
- *apply basic addition facts and knowledge of place value and symmetry to:*
  - *combine or partition whole numbers*
  - *find fractions of sets, shapes, and quantities;*
- *create and continue sequential patterns with one or two variables by identifying the unit of repeat;*
- *continue spatial patterns and number patterns based on simple addition or subtraction.*

Geometry and Measurement

In contexts that require them to solve problems or model situations, students will be able to:

- *measure the lengths, areas, volumes or capacities, and weights of objects and the duration of events, using linear whole-number scales and applying basic addition facts to standard units;*
- *sort objects and two- and three-dimensional shapes by their features, identifying categories within categories;*
- *represent reflections, translations, and rotations by creating and describing patterns;*
- *describe personal locations and give directions, using whole-number measures and half- or quarter-turns.*

NNS 17



2 4

Statistics

In contexts that require them to solve problems or model situations, students will be able to:

- *investigate questions by using the statistical enquiry cycle (with support):*
  - *gather and display category and simple whole-number data*
  - *interpret displays in context;*
- *compare and explain the likelihoods of outcomes for a simple situation involving chance.*

The following problems and descriptions of student thinking exemplify what is required to meet this standard.

Number and Algebra

During this school year, Number should be the focus of 60–80 percent of mathematics teaching time.

Example 1

You have 18 turtles, and you buy another 8 turtles from the pet shop.

How many turtles do you have now?

The student could use "making tens" (e.g., "18 + 2 = 20; that leaves 6 remaining from the 8; 20 + 6 = 26") or apply their knowledge of doubles and place value (e.g., "18 = 10 + 8; first add the 8, then the 10; 8 + 8 = 16, 16 + 10 = 26").

If the student responds very quickly because they know the fact 18 + 8 = 26, this also meets the expectation. If the student counts on, they do not meet the expectation.

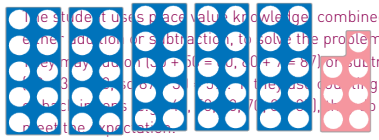
ILLUSTRATING THE STANDARD

Example 2

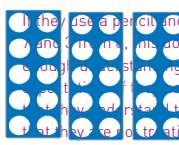
87 people are at the pōwhiri (welcome). 30 of the people are tangata whenua (locals). The rest of the people are manuhiri (visitors).

How many manuhiri are there?

The student uses place value knowledge combined with [illegible] to solve the problem. [illegible] for subtraction [illegible] up [illegible] not [illegible].



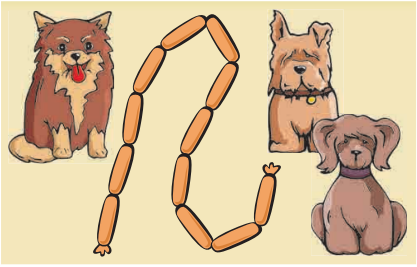
If the student uses a pencil and paper method to subtract 0 from [illegible] this doesn't necessarily demonstrate [illegible] of place value to meet the [illegible] this method, they must show [illegible] place value of the digits and [illegible] are not treating them all as ones.



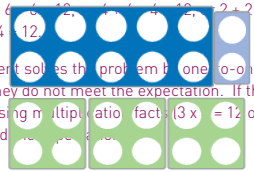
Example 3

Here is a string of 12 sausages to feed 3 hungry dogs.

Each dog should get the same number of sausages. How many will each dog get?



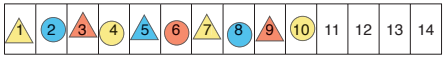
The student applies basic addition facts to share out the sausages equally between the dogs. Their thinking could be based on doubles or equal dealing – for example, 5 + 5 + 2 = 12, so 4 + 4 + 4 = 12 (redistributing 1 from each 5), or [illegible] 2 + 2 + 6, so 4 + 4 + 4 [illegible] 12.



If the student solves the problem by one-to-one equal sharing, they do not meet the expectation. If they solve the problem using multiplication facts (3 x [illegible] = 12 or 12 ÷ 3 = 4), they exceed [illegible].

Example 4

Show the student the illustration below.



What shape goes on the number 14 in this pattern? What colour will it be?

The student identifies the two variables (shape and colour) in the pattern. They might look at the variables separately and identify the unit of repeat for each ("Yellow, blue, red" and "Triangle, circle"). Or they might look at the variables together to identify the complete unit of repeat ("Yellow triangle, blue circle, red triangle, yellow circle, blue triangle, red circle").

They continue the pattern until they identify that the shape on number 14 is a blue circle. If the student recognises that multiples of 2 in the pattern are circles and multiples of 3 are red and uses this information to solve the problem, they exceed the expectation.

THE MATHEMATICS STANDARD

By the end of year 4, students will be achieving at level 2 in the mathematics and statistics learning area of the New Zealand Curriculum.

Number and Algebra

In contexts that require them to solve problems or model situations, students will be able to:

- *apply basic addition and subtraction facts, simple multiplication facts, and knowledge of place value and symmetry to:*
  - *combine or partition whole numbers*
  - *find fractions of sets, shapes, and quantities;*
- *create, continue, and give the rule for sequential patterns with two variables;*
- *create and continue spatial patterns and number patterns based on repeated addition or subtraction.*

Geometry and Measurement

In contexts that require them to solve problems or model situations, students will be able to:

- *measure the lengths, areas, volumes or capacities, weights, and temperatures of objects and the duration of events, reading scales to the nearest whole number and applying addition, subtraction, and simple multiplication to standard units;*
- *sort objects and two- and three-dimensional shapes by two features simultaneously;*
- *represent and describe the symmetries of a shape;*
- *create nets for cubes;*
- *describe personal locations and give directions, using simple maps.*

Calculating 12
NPC3 CAL 4

Statistics

In contexts that require them to solve problems or model situations, students will be able to:

- *investigate questions by using the statistical enquiry cycle independently:*
  - *gather and display category and simple whole-number data*
  - *interpret displays in context;*
- *compare and explain the likelihoods of outcomes for a simple situation involving chance, acknowledging uncertainty.*

The following problems and descriptions of student thinking exemplify what is required to meet this standard.

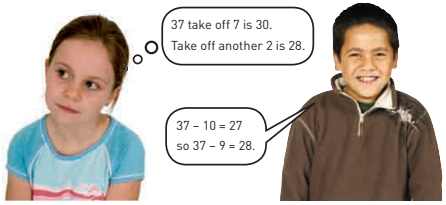
Number and Algebra

During this school year, Number should be the focus of 60–80 percent of mathematics teaching time.

Example 1

Imagine you have 37 lollies and you eat 9 of them.

How many lollies would you have left?



The student gets to the answer 28 by mentally partitioning numbers (e.g., 9 = 7 + 2 in the first calculation) and by using tidy numbers (e.g., 10 in the second calculation).

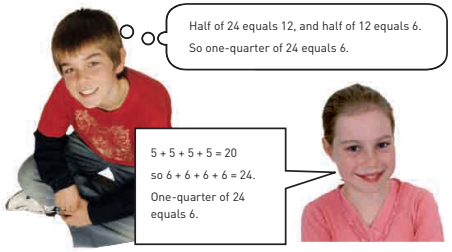
Source: NumPA, Numeracy Development Projects, Book 2: *The Diagnostic Interview*, page 8.

ILLUSTRATING THE STANDARD

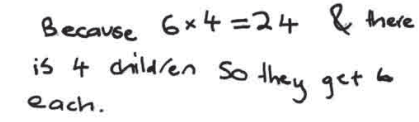
Example 2

If there are 24 marbles in the bag, how many should each student get?

The student applies their knowledge of symmetry or number facts to partition the set of 24 – for example, by using repeated halving or by using trial and improvement with addition facts.

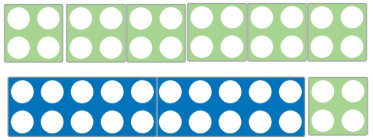


If the student knows or derives the fact 4 x 6 = 24, they exceed the expectation.



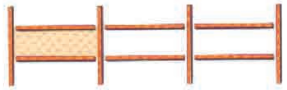
Calculating 17

Thinking, Levels 2–3, page 4.



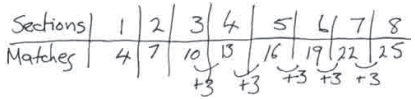
Example 3

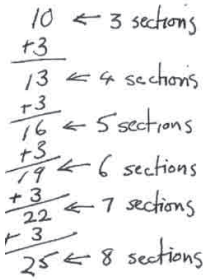
Here is a 3-section matchstick fence.



How many matchsticks would it take to make an 8-section fence?

The student continues the number pattern by using repeated addition, possibly in conjunction with written recording.





If the student draws an 8-section fence and then counts the matchsticks, they do not meet the expectation.

Using a multiplicative strategy (e.g., (7 x 3) + 4 = 25 or (8 x 3) + 1 = 25) exceeds the expectation.

Source: adapted from Figure It Out, *Algebra*, Level 3, page 2.