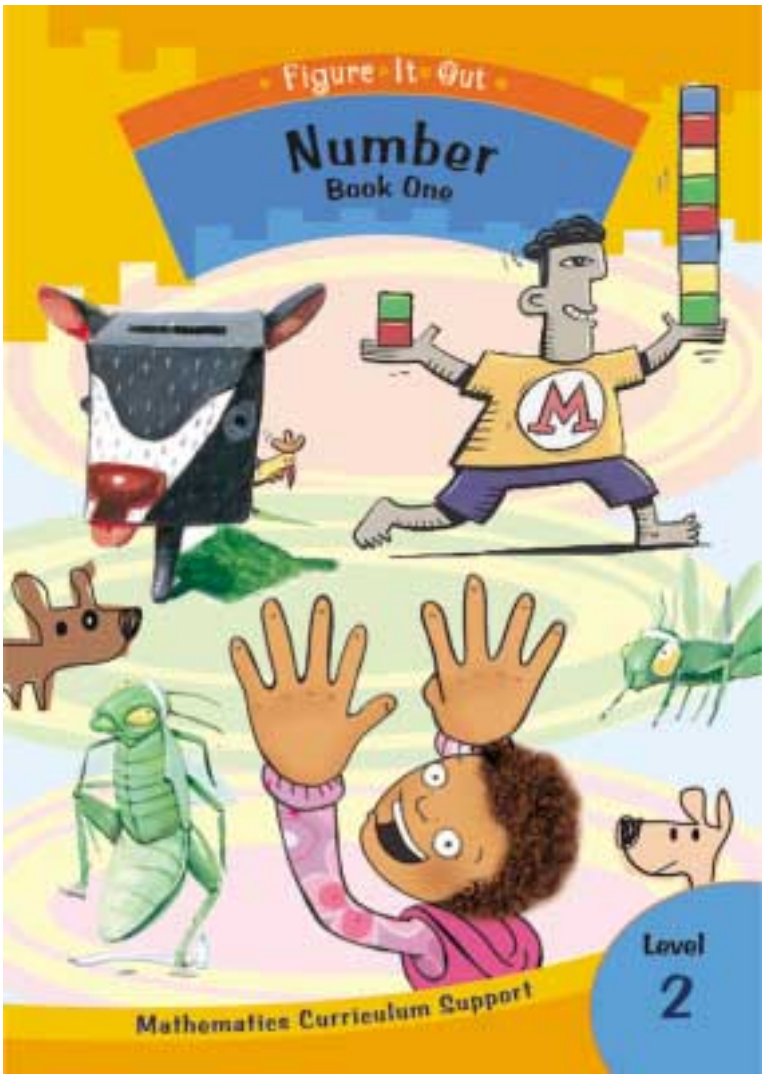
Answers and Teachers' Notes



MINISTRY OF EDUCATION
Te Tāhuhu o te Mātauranga

Contents

Introduction

The books for level 2 in the Figure It Out series are issued by the Ministry of Education to provide support material for use in New Zealand classrooms. The books have been developed to support teachers who have completed the Early Numeracy Project professional development. These books are most suitable for students in year 3. However, teachers should use their judgment as to whether to use the booklets with older or younger children who are also working at level 2.

Student books

The activities in the student books are set in meaningful contexts, including real-life and imaginary scenarios. The books have been written for New Zealand students, and the contexts reflect their ethnic and cultural diversity and the life experiences that are meaningful to students in year 3.

The activities can be used as the focus for teacher-led lessons, for students working in groups, or for independent activities. Also, the activities can be used to fill knowledge gaps (hotspots), to reinforce knowledge that has just been taught, to help students develop mental strategies, or to provide further opportunities for students moving between strategy stages of the Number Framework.

Answers and Teachers' Notes

The Answers section of the *Answers and Teachers' Notes* that accompany each of the student books includes full answers and explanatory notes. Students can use them for self-marking, or you can use them for teacher-directed marking. The teachers' notes for each activity, game, or investigation include relevant achievement objectives, comments on mathematical ideas, processes, and principles, and suggestions on teaching approaches. The *Answers and Teachers' Notes* are also available on Te Kete Ipurangi (TKI) at www.tki.org.nz/r/maths/curriculum/figure/index_e.php

Using Figure It Out in the classroom

Where applicable, each page starts with a list of equipment that the students will need in order to do the activities. Encourage the students to be responsible for collecting the equipment they need and returning it at the end of the session.

Many of the activities suggest different ways of recording the solution to the problem. Encourage your students to write down as much as they can about how they did investigations or found solutions, including drawing diagrams. Discussion and oral presentation of answers is encouraged in many activities, and you may wish to ask the students to do this even where the suggested instruction is to write down the answer.

> The ability to communicate findings and explanations, and the ability to work satisfactorily in team projects, have also been highlighted as important outcomes for education. Mathematics education provides many opportunities for students to develop communication skills and to participate in collaborative problem-solving situations.
>
> *Mathematics in the New Zealand Curriculum,* page 7

Students will have various ways of solving problems or presenting the process they have used and the solution. You should acknowledge successful ways of solving questions or problems, and where more effective or efficient processes can be used, encourage the students to consider other ways of solving a particular problem.

Figure It Out

Number

Answers

Page 1: The Mail Gets Through

Activity

1. 189, 241, 453, 735, 753
2. **a.** 241, 214, 142, 124, 421, 412
   b. 189, 198, 819, 891, 918, 981
   c. 735, 753, 375, 357, 537, 573
3. **a.** 14
   b. 14 twos
   11 threes
   4 fours, fives, and sixes
   3 sevens, eights, nines, and zeros

Page 2: Different Strokes!

Activity

1. **a.** 68 + 32 = **100**
   b. 68 + 33 = **101**
   c. 100 – 32 = **68**
   d. 100 – 69 = **31**
2. **a.** 51 beads — 100 – 49 = 51 or 100 – 51 = 49
   b. 25 beads — 100 – 25 = 75 or 100 – 75 = 25
   c. 19 beads — 100 – 19 = 81 or 100 – 81 = 19
   d. 97 beads — 100 – 3 = 97 or 100 – 97 = 3

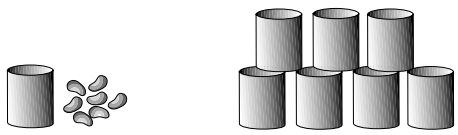
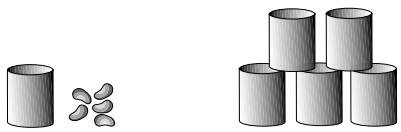
Page 3: Helping Hands

Activity

1. **a.** 4
   b. 6
   c. 8
   d. 3
   e. 4
2. **a.** 14
   b. 8
   c. 20
   d. 16
   e. 10
   f. 7
   g. 18

Page 4: Shaker Makers

Activity

1. 14
2. 40
3. **a.** 
   b. 
   c. 
   d. 

4. **a.** 7 tens

b. 5 tens

c. 3 tens

d. 2 tens

Page 5: How Old?

Activity

Word	Numeral	Tens	Ones
twelve	12	1	2
twenty	**20**	2	0
thirteen	**13**	**1**	**3**
thirty	**30**	**3**	**0**
fourteen	**14**	**1**	**4**
forty	**40**	**4**	**0**
fifteen	15	**1**	**5**
fifty	**50**	5	0
sixteen	**16**	**1**	**6**
sixty	**60**	**6**	**0**
seventeen	**17**	**1**	**7**
seventy	70	**7**	**0**
eighteen	**18**	**1**	**8**
eighty	**80**	**8**	**0**
nineteen	**19**	1	9
ninety	**90**	**9**	**0**

Page 6: Mighty Marty!

Activity

1. **a.** Yes.

b. 90 is 9 lots of 10. 10 is 1 lot of 10.
9 lots of 10 and 1 lot of 10 make 10 lots of 10, which are 100.
9 + 1 = 10, so 90 + 10 = 100.

2. **a.** 40 + 60 =**100**

b. 50 + 50 = **100**

c. 80 + 60 =**140**

d. 90 + 20 = **110**

Explanations will vary.

3. **a.** 100 + 500 = **600**

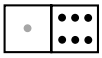
b. 800 + 200 = **1 000**

c. 5 000 + 4 000 = **9 000**

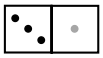
d. 2 000 + 7 000 = **9 000**

Page 7: Snakes in the Grass

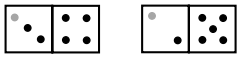
Activity

1. **a.** 

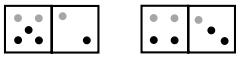
6 (4 + 1 + 2 + 3 + 5 + 2 + 1 + **6** = 24)

b. 

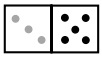
3 (2 + 5 + 4 + 1 + 3 + 4 + 1 + **3** = 23)

c. 

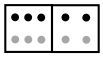
3, 4 or 2, 5 (1 + 6 + 2 + 4 + 2 + 3 + **7** = 25)

d. 

5, 2 or 4, 3 (3 + 6 + 3 + 2 + **7** = 21)

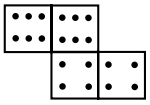
e. 

5 (3 + 3 + 1 + 6 + 2 + 4 + 3 + **5** = 22)

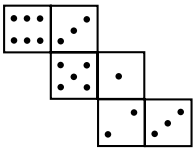
f. 

6, 4 (3 + 2 + 4 + 0 + 3 + 3 + **6** + **4** = 25)

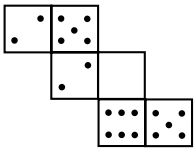
2. Answers will vary. Some examples are:



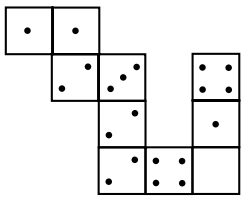
6 + 6 + 4 + 4 = 20



6 + 3 + 5 + 1 + 2 + 3 = 20



2 + 5 + 2 + 0 + 6 + 5 = 20

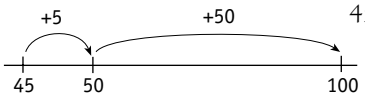


1 + 1 + 2 + 3 + 2 + 2 + 4 + 0 + 1 + 4 = 20

Pages 8–9: Hip Hup Hop

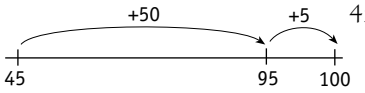
Activity

Methods will vary. They could include:

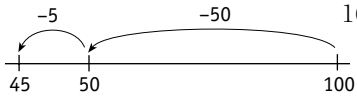
1. 

45 + 5 + 50 = 100

or

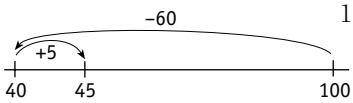


45 + 50 + 5 = 100

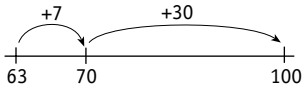
2. 

100 – 50 – 5 = 45

or

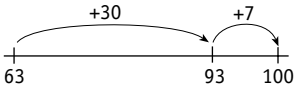


100 – 60 + 5 = 45

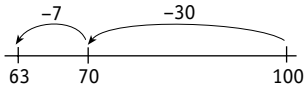
3. 

63 + 7 + 30 = 100

or

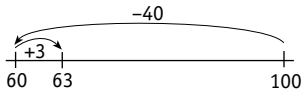


63 + 30 + 7 = 100

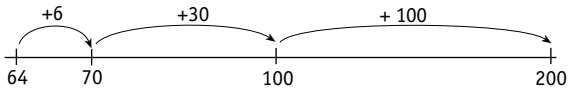
4. 

100 – 30 – 7 = 63

or

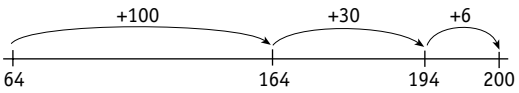


100 – 40 + 3 = 63

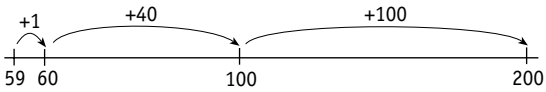
5. 

64 + 6 + 30 + 100 = 200

or

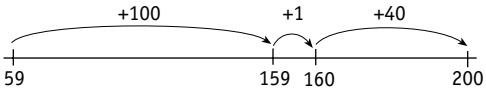


64 + 100 + 30 + 6 = 200

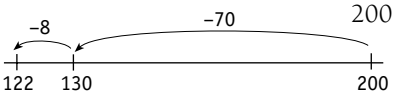
6. 

59 + 1 + 40 + 100 = 200

or

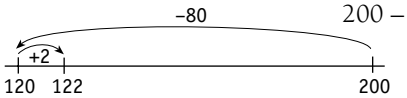


59 + 100 + 1 + 40 = 200

7. 

200 – 70 – 8 = 122

or



200 – 80 + 2 = 122

Page 10: Birthday Time

Activity

1. 1 + 9, 2 + 8, 3 + 7, 5 + 5

2. **a.** 11 candles

b. 15 candles

c. 18 candles

d. 17 candles

3. **a.** 36 candles

b. Practical activity, but a quick way is to regroup in pairs that make 10, for example, 2, 8; 3, 7; 4, 6 then add 5 and 1.

4. Answers will vary. Some examples are:

5, 5, 5, 5

4, 5, 5, 6

1, 3, 7, 9

2, 4, 6, 8

2, 3, 7, 8

Page 11: Weka Wobble

Activity

1. Answers will vary. Teacher to check

2. **a.** 91 more weka

b. 71 more weka

c. 45 more weka

d. 16 more weka

3. **a.** 20 more robins

b. 69 more robins

c. 118 more robins

d. 96 more robins

Page 12: Multiplying Madness

Activity

1. **a.** 6

b. 12

2. **a.** 12

b. 24

3. **a.** 12

   b. 24

   c. 21

4. **a.** 24

   b. 48

   c. 42

5. Practical activity

Page 13: The Pig Pen

Activity

1. **a.** 20 planks

   b. 15 planks

   c. 70 planks (20 x 2 = 40 and 15 x 2 = 30. 40 + 30 = 70)

2. **a.** 98 planks. Two ways of working this out are:
   - each long side: 4 x 7 = 28
     each short side: 3 x 7 = 21
     total planks needed: 28 + 28 + 21 + 21 = 98
   - A five-plank-high fence needs 70 planks.
     Extra planks needed for each long side:
     4 x 2 = 8
     extra planks needed for each short side:
     3 x 2 = 6
     total planks needed: 70 + 8 + 8 + 6 + 6 = 98

   b. Answers will vary.

Page 14: Hiding in the Swamp

Activity One

1. 12 eyes (2 x 6 = 12)

2. **a.** 16 eyes and legs

   b. 48 eyes and legs

3. **a.** 5 pūkeko

   b. 9 pūkeko

4. **a.** 6 pūkeko

   b. 9 pūkeko

5. **a.** 5 pūkeko

   b. 10 pūkeko

Activity Two

1. **a.** 4 insects

   b. 8 insects

2. **a.** 3 insects

   b. 4 insects

3. **a.** 2 insects

   b. 4 insects

Page 15: Pocket Money

Activity

1. $6 ($12 ÷ 2 = $6)

2. $4 (24 x $0.50 = $12 and $12 ÷ 3 = $4 or 24 ÷ 3 = 8 and 8 lots of 50 cents is $4)

3. $4 ($16 ÷ 4 = $4)

4. $20 ($6 + $6 + $4 + $4 = $20)

5. $17 (Earned: $6 + $4 + $4 = $14, half money in piggy bank: $6 ÷ 2 = $3, $14 + $3 = $17)

Page 16: What's My Number?

Activity

Answers will vary.

1. **a.** 32 (161 + 32 = 193)

   b. 45 (155 + 45 = 200)

   c. 154 (235 + 154 = 389)

   d. 316 (507 + 316 = 823)

   e. 43 (479 – 43 = 436)

   f. 415 (853 – 415 = 438)

2. Answers will vary.

Page 17: Flipping Fractions

Game

A game using equivalent fractions

Activity

1. 4 pieces

2. **a.** 3, $\frac{1}{4}$

   b. 6, $\frac{1}{2}$

c. 2, $\frac{1}{6}$

3. **a.** 4, $\frac{1}{6}$

b. 3, $\frac{1}{8}$

c. 2, $\frac{1}{12}$

Page 18: Emani's Haircutting

Activity

1. 12 talo

2. 8 talo

3. $\frac{1}{4}$ = 6 talo

4. Practical activity

Page 19: Dazzler Digs On

Activity

1. 7 x 3 = 21 bones or 3 + 3 + 3 + 3 + 3 + 3 + 3 = 21

2. **a.** 21 ÷ 3 = 7 bones or one-third of 21 is 7

b. 21 – 7 = 14 bones

3. **a.** 14 ÷ 2 = 7 bones or half of 14 is 7

b. 14 – 7 = 7 bones

4. **a.** 1 each (7 ÷ 4 = 1 with 3 remainder)

b. 3 bones

Page 20: Cooking Up a Storm

Activity

1. 48 muffins, biscuits, and tarts altogether

2. **a.** 3 muffins

b. 3 x $2 = $6

3. $10

Page 21: Puzzling Shapes

Activity

1. **a.** $\frac{1}{4}$ green and $\frac{3}{4}$ pink for each shape

b. Each shape is divided into four equal parts, and one of those parts is coloured green.

2. Lin and Tyron are right, and Ella is wrong.

3. **a.** square: $\frac{3}{4}$
pentagon: $\frac{3}{5}$
circle: $\frac{3}{3}$ or 1 (whole)

b. $\frac{3}{5}$, $\frac{3}{4}$, $\frac{3}{3}$

Pages 22–23: Frogs Frolic

Game

A game of addition and subtraction

Page 24: Soap Suds

Activity

1. Option B because they will get paid $28.
This is more than $25 for option A and $26 for option C.

2. **a.** Answers will vary. One possible solution is:

Monday	Leon
Tuesday	Alanna
Wednesday	Alanna
Thursday	Leon
Friday	both
Saturday	both
Sunday	both

This way, they both wash the dishes on 5 days and they both earn $14.

Another possible solution is:

Monday	Alanna
Tuesday	Leon
Wednesday	Alanna
Thursday	Leon
Friday	Leon
Saturday	both
Sunday	Alanna

This way, they each work 4 days and they both earn $14.

b. Yes. If they work together for 3 days, it doesn't matter which 3 days they work together. If they work together for only 1 day, this day can only be Thursday or Saturday. The amounts on the rest of the days can be worked into combinations that equal the same amount, such as 1 + 5 + 6 and 2 + 3 + 7 or 1 + 3 + 7 and 2 + 4 + 5.

Possible answers can be shown in tables.
For example, for working together for 1 day:

M	T	W	Th	F	S	S
A	L	L	L/A	A	A	L
L	A	A	L/A	L	L	A
A	L	A	L	L	L/A	A
L	A	L	A	A	L/A	L

or for working together for 3 days:

M	T	W	Th	F	S	S
A	L	L	A	L/A	L/A	L/A
L/A	A	L	L	A	L/A	L/A
L/A	L/A	A	L	L	A	L/A
L/A	A	L	L/A	L	A	L/A

Figure It Out

Number

Teachers' Notes

Overview of Number: Book One

Title	Content	Page in students' book	Page in teachers' book
The Mail Gets Through	Reading and ordering three-digit numbers	1	12
Different Strokes!	Exploring compatible numbers to 100	2	13
Helping Hands	Revisiting doubles and halves	3	14
Shaker Makers	Investigating "teen" and "ty" numbers	4	14
How Old?	Investigating "teen" and "ty" numbers	5	15
Mighty Marty!	Using basic facts to add multiples of 10	6	16
Snakes in the Grass	Finding missing addends	7	16
Hip Hup Hop	Adding and subtracting on empty number lines	8–9	17
Birthday Time	Exploring compatible numbers	10	18
Weka Wobble	Using number lines to solve problems	11	19
Multiplying Madness	Exploring multiplication	12	20
The Pig Pen	Using a combination of operations	13	21
Hiding in the Swamp	Investigating multiplication and division	14	22
Pocket Money	Solving problems using combinations of operations	15	22
What's My Number?	Using mental strategies to solve problems	16	23
Flipping Fractions	Exploring fractions and division	17	24
Emani's Haircutting	Investigating fractions	18	24
Dazzler Digs On	Multiplying and dividing	19	25
Cooking Up a Storm	Solving problems with fractions and money	20	25
Puzzling Shapes	Investigating fractions and regions	21	26
Frogs Frolic	Adding and subtracting mentally	22–23	27
Soap Suds	Solving problems with money	24	28

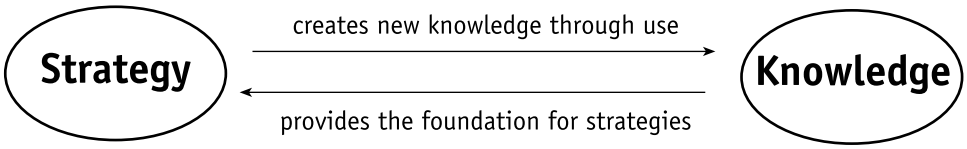
Introduction to Number

There is a remarkable commonality in the way many countries around the world are now teaching arithmetic. Changes in the approaches reflect the evolving demands of everyday life, a greater volume of classroom-based research about how students learn, and a desire to improve general levels of numeracy.

In the past, arithmetic teaching has focused on preparing students to be reliable human calculators. The prevalence of machines in society that calculate everything from supermarket bills to bank balances has meant that students now require a wider range of skills so that they can solve problems flexibly and creatively.

The Figure It Out series aims to reflect these trends in modern mathematics education. A range of books is provided at different levels to develop both number skills and number sense. The *Number* books are aimed at developing students' understanding of the number system and their ability to apply efficient methods of calculation.

The development of the Figure It Out series has occurred against the backdrop of a strong drive for improved standards of numeracy among primary-aged students. A key element of this drive has been the creation of the Number Framework as part of the Numeracy Strategy. The framework highlights this significant connection between students' ability to apply mental strategies to solving number problems and the knowledge they acquire.



Learning activities in the series are aimed at both the development of efficient and effective mental strategies and increasing the students' knowledge base.

Links to the Number Framework
There are strong links in the level 2 *Number* books to the stages of development in the Number Framework. The knowledge- and strategy-based activities in these books are all at the advanced counting to early additive part-whole stages of the Number Framework.

Information about the Number Framework and the Numeracy Project is available on the NZMaths website (www.nzmaths.co.nz/Numeracy/Index.htm). Teachers may wish to visit this website and refer to *The Number Framework* for details of these stages. The material masters mentioned in these notes can also be downloaded from this website. A planning guide will be available on the NZMaths website in 2003. The guide will make links to this booklet.

Terms
Teachers who are not familiar with the Numeracy Project may find the following explanations of terms useful.

The Number Framework – This is a framework showing the way students acquire concepts about number. It comprises eight stages of strategy and knowledge development.

Knowledge – These are the key items of knowledge that students need to learn. Knowledge is divided into five categories: number identification, number sequence and order, grouping and place value, basic facts, and written recording.

Strategies – Strategies are the mental processes that students use to estimate answers and solve operational problems with numbers. The strategies are identified in the eight stages of the Number Framework.

Counting strategies – Students using counting strategies will solve problems by counting. They may count in ones, or they may skip-count in other units such as fives or tens. They may count forwards or backwards.

Part-whole thinking or part-whole strategies – Part-whole thinking is thinking of numbers as abstract units that can be treated as wholes or can be partitioned and recombined. Part-whole strategies are mental strategies that use this thinking.

Partitioning – Partitioning is dividing a number into parts to make calculation easier. For example, 43 can be partitioned into 40 and 3, or 19 could be partitioned into 10 and 9 or thought of as 20 minus 1.

The advanced counting stage – Students who are at this stage understand that the end number in a counting sequence measures the whole set. They can relate the addition or subtraction of objects to the forward and backward number sequences by ones, tens, and so on. For example, instead of counting all objects to solve 6 + 5, the student recognises that "6" represents all six objects and counts on from there: "7 , 8 , 9, 10, 11." Students at this stage are also able to skip-count, for example, "10, 20, 30, 40, 50," to get $50 in $10 notes. This is the beginning of grouping to solve multiplication and division problems.

The early additive part-whole stage – At this stage, students have begun to recognise that numbers are abstract units that can be treated simultaneously as wholes or can be partitioned and recombined. This is called part-whole thinking.

A characteristic of this stage is the derivation of results from related known facts, such as finding addition answers by using doubles or "teen" numbers. For example, students at this stage might solve 7 + 8 by recalling that 7 + 7 = 14, so 7 + 8 = 15. They might solve 9 + 6 by knowing that 10 + 6 = 16, so 9 + 6 = 15. They might solve 43 + 35 as (40 + 30) + (3 + 5), which is 70 + 8 = 78.

Links to Beginning School Mathematics (BSM)

Many of the activities in the level 2 *Number* books can be supported by BSM activities that deal with similar concepts. BSM activities that link to the pages of the students' books have been identified in the teachers' notes for those pages.

Further BSM activities that link to the advanced counting and early additive part-whole stages of the Number Framework have been outlined in *Enriching the Number Framework with Beginning School Mathematics*, which is available from your Numeracy Project facilitator or can be downloaded from the NZMaths website (www.nzmaths.co.nz/Numeracy/project_material.htm).

Page 1: The Mail Gets Through

Achievement Objectives

- read any 3-digit whole number (Number, level 2)
- order any set of three or more whole numbers (up to 99) (Number, level 2)

Activity

This activity focuses on ordering numbers from 0 to 1 000. To do this activity, students need to be able to recognise the numbers in this range.

Model for the students by reading the numbers aloud in their full form, that is, "two hundred and forty-one". This makes the place value of the digits very clear. If you say "two forty-one" or "two four one", some or all of the digits are treated inappropriately as only representing the ones place value.

After the students have done question **1**, ask them how they know that they have ordered the numbers from smallest to biggest. The students are likely to explain that 189 is smallest because it has only one hundred, 241 has two hundreds, and so on. When comparing 735 and 753, the students will have to go beyond the hundreds and decide which has more tens.

You could ask the students what the letter box numbers have in common, that is, they are all odd numbers, and they all have three digits. This might lead to a discussion of how streets are laid out, with even numbers on one side of the street and odd numbers on the other.

You could extend the problem by asking the students to list three letter box numbers that would be between each pair of the ordered letter box numbers.

For question **2**, the students can use the digit cards to make the different three-digit combinations. To avoid repeating numbers, they should record each three-digit number as they make it.

When the students have completed this question, you could ask them, "How do you know you've made all the three-digit numbers you can using those three digits?" Some students may have taken a methodical approach to solving these questions, following the model given, that is, each of the three digits appears twice in the hundreds place, with the two other digits used interchangeably in the tens and ones places.

You can easily extend these problems by introducing a fourth digit to make four-digit numbers. Students who have found these questions easy may like to go on to do On the Cards in *Number*, Figure It Out, Levels 2–3, page 7.

Ask the students to estimate the answers to question **3** before actually working them out. To solve the problems here, the students could list the numbers from 1 to 36 and count the number of times each digit occurs. Alternatively, they could refer to a hundreds board. In both cases, they could use tally marks next to a list of the digits 0 to 9.

To extend the students' recording into an organised table, you could model making a table, with the digits 0 to 9 along the top and four rows, as shown below. Under each digit, the students need to write the number of times that digit is used in the range of numbers that is given in the cell at the left of each row.

	0	1	2	3	4	5	6	7	8	9
1–9		1	1	1	1	1	1	1	1	1
10–19	1	11	1	1	1	1	1	1	1	1
20–29	1	1	11	1	1	1	1	1	1	1
30–36	1	1	1	8	1	1	1	0	0	0
Total	3	14	14	11	4	4	4	3	3	3

BSM activities relevant to this page are:

12-3-3 Daily run 12-3-4 Move to it

12-3-81 Survivor 12-3-82 Write it down

Page 2: Different Strokes!

Achievement Objectives

- mentally perform calculations involving addition and subtraction (Number, level 2)
- write and solve story problems which involve whole numbers, using addition, subtraction, multiplication, or division (Number, level 2)

Activity

This activity explores groupings within 100. The 100-bead frame, or Slavonic abacus, provides a concrete model of 100. Beads are arranged in 10 rows of 10 beads, with different-coloured groups of fives in each row. Different colours are used for the second 50 beads, which makes it easy to recognise groupings of 25 and 50.

Students who are exploring groupings within 100 should already be familiar with the groupings within 5, 10, and 20.

Although the emphasis is on groupings within 100, the students also need to use the groupings to derive answers that will be just above or below 100, for example:

$32 + 68 = 100$
so $68 + 33 = (68 + 32) + 1$
$= 101$

Examples of the questions that the students could ask each other are:

$100 - 49 = \square$
$81 + \square = 100$

These problems extend the concept of reversibility. Reversibility refers to the way in which subtraction reverses the effects of addition, for example, $7 - 5 = 2$ is the reverse of $2 + 5 = 7$. Addition and subtraction problems have been deliberately presented together in this activity to help highlight their relationship.

To develop this work further, the students could modify this activity to work out how many more beads they need to make 50, starting with fewer than 50 beads.

BSM activities relevant to this page are:
12-1-1 Looking at a hundred
12-1-2 Looking at patterns to one hundred
12-1-82 Make it a hundred

Page 3: Helping Hands

Achievement Objectives

- recall the basic addition and subtraction facts (Number, level 2)
- mentally perform calculations involving addition and subtraction (Number, level 2)

Activity

Doubles such as 5 + 5 and 3 + 3 are some of the basic facts that students find easiest to commit to memory. Presenting doubles and halves alongside one another will help the students to understand that halving is the inverse of doubling. A secure knowledge of doubles gives students a good foundation for learning the multiplication basic facts.

The example given at question **2** uses double 5 and double 1 for one way of thinking about double 6. This understanding is most easily developed using finger patterns; students working at level 2 should have had learning experiences that allow them to automatically make the pattern for 6 without having to count on their fingers. They should know that 6 can be made up of 5 and one more.

Students at this level will be developing recall of their doubles and halves to 20, so some may not need to use this five-based strategy.

You could make explicit for the students the connection between doubles and skip-counting in twos as well as using this opportunity to explain that an even number can be halved with no (whole number) remainders.

As an extension, you could ask the students:

"Could you play this game by yourself using a mirror? How?"

"What would happen to the answers to the doubles problems in question **2** if you and your classmate used a mirror?" (They would, of course, double again.)

BSM activities relevant to this page are:

10-1-6 Seeing double
10-1-47 Double trouble
10-1-48 Double happy
10-1-83 Double the pattern
12-1-86 Double the number

Page 4: Shaker Makers

Achievement Objective

- explain the meaning of the digits in 2- or 3-digit whole numbers (Number, level 2)

Activity

The activity on this page helps students to understand the difference between "teen" and "ty" numbers.

The words and numerals are connected to concrete materials – in this case, groups of 10 beans and single beans. When 10 beans have been counted, place them in an opaque film canister with the lid on. This will encourage the students to move from relying on concrete materials to working with a mental image of the beans and to counting in tens as they count each canister.

It may also be helpful to exaggerate the "teen" syllable when counting these numbers with the whole class or with a group.

As an extension, the students could count in te reo Māori. Counting in Māori will consolidate the students' understanding of the difference between "teen" and "ty" numbers. The students need to understand the difference between "teen" and "ty" numbers before they can move on to part-whole thinking.

Tekau means 10, and mā means "and" or +.

Numeral	Māori
0	kore
1	tahi
2	rua
3	toru
4	whā
5	rima
6	ono
7	whitu
8	waru
9	iwa
10	tekau
11	tekau mā tahi 10 and 1 10 + 1
12	tekau mā rua 10 and 2
13	tekau mā toru
20	rua tekau 2 tens
21	rua tekau mā tahi 2 tens and 1 20 + 1
40	whā tekau
99	iwa tekau mā iwa

Further activities with the Māori counting system are offered in Now and Then, *Number*, Figure It Out, Levels 2–3, page 4 of the students' book.

Page 5: How Old?

Achievement Objective

- explain the meaning of the digits in 2- or 3-digit whole numbers (Number, level 2)

Activity

This activity uses the knowledge that the students have developed in Shaker Makers on the previous page by asking them to distinguish between "teen" and "ty" numbers.

The students need to have had various learning experiences where written numbers are presented alongside a concrete model of that number, as shown in Shaker Makers. Beans or counters can be grouped in tens in opaque film canisters; ice-block sticks can be bundled into tens; multilink cubes can be joined into stacks of 10. With all of these materials, the students create the unit of 10 by grouping 10 ones and can also easily break the 10 into ones again.

The hundreds board can be a useful reference point for the students to check how a number looks. However, students who are still confused about "teen" and "ty" numbers should do more activities that involve making numbers with concrete materials (such as those in Shaker Makers) before moving on to the more abstract work on this page.

BSM activities relevant to this page are:

9-1-9 Our system
9-1-10 Houses for Decimals
9-1-47 Three cups full
9-1-48 Place-value snap

Page 6: Mighty Marty!

Achievement Objectives

- recall the basic addition and subtraction facts (Number, level 2)
- mentally perform calculations involving addition and subtraction (Number, level 2)

Activity

In this activity, the students use their basic facts knowledge to solve problems involving basic facts multiplied by 10, 100, or 1 000. The students will feel empowered when they realise that their knowledge of addition basic facts can help them to solve problems with much larger numbers.

You may want to demonstrate Marty's working, using materials such as ice-block sticks bundled in tens, multilink cubes joined in stacks of 10, or film canisters containing 10 beans.

Encourage the students to explain their strategies, both verbally and in written form. For example, for question **1**:

> "I know … because 9 + 1 = 10 and 90 is 9 lots of 10, and 10 is 1 lot of 10,
> so … 9 lots of 10 and 1 lot of 10 make 10 lots of 10, which are 100.
> 9 + 1 = 10, and 90 + 10 = 100.
>
> That means if I have 9 and I want 90, it's 10 lots bigger or 10 times bigger.
> So 90 is a multiple of 10."

As an extension, you could present the students with problems where they can use their knowledge of groupings within 20. For example, if they know that 12 + 5 = 17, can they use that knowledge to solve 120 + 50? Or, if 11 + 9 = 20, can they work out 110 + 90?

The problems in this activity are set in a number context. As a follow-up activity, the students could write their own story problems for some of the number sentences used in questions **2** and **3**.

Page 7: Snakes in the Grass

Achievement Objectives

- mentally perform calculations involving addition and subtraction (Number, level 2)
- write and solve story problems which involve whole numbers, using addition, subtraction, multiplication, or division (Number, level 2)

Activity

The problems in this activity are missing-addend type problems, where the students work out what number of dots are on the hidden dominoes.

There are four parts to each snake problem:

- finding the total number of dots on the exposed dominoes;
- working out the difference between that number and the given total;
- working out what pairs of numbers make up the difference number, for example, 6 could be represented by the domino combinations 5 and 1, 4 and 2, or double 3;
- deciding which combination(s) matches the dot patterns on the partially exposed domino.

At this level, the students should recognise the dot patterns on the dominoes (which are the same as the patterns on dice) without needing to count each dot. When the students are finding the total number of dots, encourage them to use strategies to help them add more quickly. They could look for pairs or groups of numbers that make 10, and using their doubles knowledge may be helpful with some of the problems. For example, in the 21-dot snake shown in the example, the students might see that 3 + 2 + 5 = 10, 6 + 4 = 10, and one more makes 21.

After the students have done question **2**, you could further challenge them by asking them to make exactly 20 using the smallest or greatest number of dominoes possible, or you could pose problems such as "How many different ways can you make 20 with three dominoes? What about five dominoes?" As well as this, the total could be changed to another number, say, 22. If the students already have several domino snakes whose totals are 20, can they think of a way to quickly increase their totals to 22? (They could change one domino for a domino with two more dots.)

As an extension, the students could make up number snake problems for their classmates to solve.

Pages 8–9: Hip Hup Hop

Achievement Objectives

- mentally perform calculations involving addition and subtraction (Number, level 2)
- write and solve story problems which involve whole numbers, using addition, subtraction, multiplication, or division (Number, level 2)

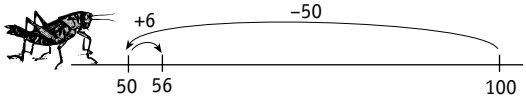
Activity

The examples given on page **8** encourage the students to partition numbers (that is, to break them into tens and ones) in order to add and subtract efficiently. They also reinforce the relationship of addition and subtraction as inverse operations.

The strategies used in Different Strokes! (page **2** of the students' book) are extended here, that is, the students are working up and down through multiples of 10 to solve addition and subtraction problems.

The students record each step of their thinking on an empty number line. Using the empty number line encourages the students to develop their knowledge of number relationships, estimating distances between numbers and situating numbers before/after/between other numbers. For students who no longer need the support of a more structured model (such as a conventional number line), the empty number line is a concise way of presenting their mental strategies.

The last strategy presented on page **8** may raise the issue of what order should be used with the two operations.



The number sentence for this is 100 – 50 + 6 = 56.

The students could explore what happens when 50 and 6 are added before doing the subtraction (that is, 50 + 6 = 56, so the equation becomes 100 – 56 = 44). When addition and subtraction are both included in an equation, the convention is to tackle them in the order in which they occur, that is, 100 – 50 = 50, then 50 + 6 = 56. This convention helps to avoid confusion over the order of operations.

BSM activities relevant to this page are:

12-1-5 Frog jumps
12-1-44 How many at a time?
12-1-45 Spin and jump
12-1-84 How did I count?

Page 10: Birthday Time

Achievement Objectives

- mentally perform calculations involving addition and subtraction (Number, level 2)
- recall the basic addition and subtraction facts (Number, level 2)
- write and solve story problems which involve whole numbers, using addition, subtraction, multiplication, or division (Number, level 2)

Activity

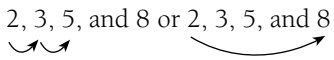
Adding three or more single-digit numbers by looking for numbers that make 10 is the focus of this activity. If the students simply added the numbers in the order in which they were presented, they would do something like this:

4 and 5 is 9, and 6 more is 15, and 7 more is 22, and 8 makes 30.

Scanning the list of numbers for two or sometimes three numbers that add to 10 is a strategy that might help the students to solve problems like these more efficiently. This also reinforces their knowledge of groupings within 10, which they should know at this level.

Question **1** serves to remind the students of the combinations of numbers that make 10. Encourage the students to move beyond basic facts here by asking "How many combinations of three numbers can you think of that make 10?"

In questions **2** and **3**, the students should be applying this knowledge of groupings within 10 to make the addition easier. In question **2c**, there are two ways of grouping the numbers to make 10, that is:



Demonstrate how the students could arrange the digit cards into groups of numbers that make 10.

The answers given to question **4** all use single-digit numbers. The students may well find solutions that include a two-digit number, for example, 10, 5, 3, and 2 or 12, 4, 3, and 1.

This question could be extended by increasing the number of candles, for example, to 30, and instructing the students to use at least one two-digit number in their solutions.

This activity uses the associative property of addition, that is, the order in which the numbers are added does not alter the sum. Ensure that the students understand that this property applies regardless of whether two, three, four, or more numbers are being added. You could model adding four numbers using concrete materials, for example, counters, beans, or cubes, to demonstrate this.

It's important that you help the students to build up a range of mental strategies and that they do not become totally reliant on any one strategy to tackle all problems. For instance, although using doubles and near doubles is a useful addition strategy, it is not so useful with a question like 1 + 3 + 7. The students need to be able to select, from a range of strategies, the best strategy for a particular problem.

Page 11: Weka Wobble

Achievement Objectives

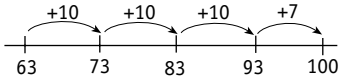
- mentally perform calculations involving addition and subtraction (Number, level 2)
- write and solve story problems which involve whole numbers, using addition, subtraction, multiplication, or division (Number, level 2)

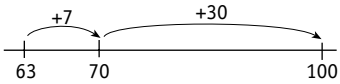
Activity

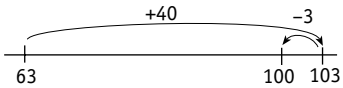
In this activity, the students record their addition and subtraction methods on a number line. This gives them a visual record of their mental strategies. Using a number line marked in decades (10, 20, 30, …) gives the students some structure for their recording. Later, as they develop a wider range of strategies and greater confidence about number relationships, an empty number line may be more suitable. The students should also be able to discuss and explain their recording.

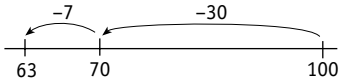
The students often solve problems that ask "How many more?" by using a missing-addend approach, that is, 63 + □ = 100. Some students, though, will think of these as subtraction problems, that is, 100 – 63 = □. Their strategy might be "I'll start from 100 and go back to 60 … that's 40. Then I'll go up 3 to 63. 40 take away 3 is 37."

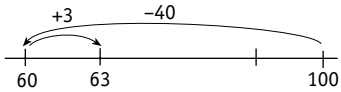
There are a number of other methods that the students might use when working on an empty number line. These include:











BSM activities relevant to this page are:

12-1-5 Frog jumps
12-1-44 How many at a time?
12-1-45 Spin and jump
12-1-84 How did I count?

Page 12: Multiplying Madness

Achievement Objectives

- demonstrate the ability to use the multiplication facts (Number, level 2)
- write and solve story problems which involve whole numbers, using addition, subtraction, multiplication, or division (Number, level 2)

Activity

These problems involve some basic multiplication facts from the 3 and 4 times tables. The students could solve part **a** of each question by using counting strategies with the illustrations, but they will need to use a range of strategies to answer the later parts of the questions. As the students begin to develop an understanding of multiplication, they will use their basic addition facts. Doubles are particularly useful here. For example, to find out how many corners there are on four triangles, the students might use double 3 to find the corners on two triangles and then double again (for four triangles), giving 12 corners altogether.

Other prior knowledge that the students will bring to multiplication is skip-counting in twos, fives, and tens. Make the connection between skip-counting and the multiplication tables explicit for the students. Highlighting multiples on a hundreds board – or even on a thousands chart to **really** emphasise the patterns – is one way to help the students make this link.

For question **3b** (How many corners are on eight triangles?), the students might use a combination of doubles and/or repeated addition:

$$\underbrace{3+3}+\underbrace{3+3}+\underbrace{3+3}+\underbrace{3+3} = 24$$
$$6 + 6 + 6 + 6 = 24$$

So eight lots of 3 makes 24, or 8 x 3 = 24. An even more efficient strategy would be to double the answer to **3a**.

To solve question **3c**, the students' strategies might include:
- repeated addition
- doubles
- eight lots of 3 (which they have just solved in **3b**) minus 3.

The students can use similar strategies for question **4c**.

The special characteristic of these types of addition problem is that each addend is the same; the groups are all equal. The students will initially record the repeated addition equation and will later move to using the mathematical shorthand for multiplication problems.

The table below shows various terms and symbols that are often used in multiplication. As you introduce the various terms to the students, you could add them to a class chart. The students could illustrate the chart with pictures showing eight groups of 2 (in contexts that have meaning for them).

	lots of		makes	
8	groups of	2	equals	16
	times		is	
	x		=	

BSM activities relevant to this page are:

11-3-12 Pooling our material
11-3-13 Making up the teams
11-3-54 Fill the bags
11-3-55 Who has the longest track?
11-3-85 Tick-tock heart

Page 13: The Pig Pen

Achievement Objectives

- demonstrate the ability to use the multiplication facts (Number, level 2)
- write and solve story problems which involve whole numbers, using addition, subtraction, multiplication, or division (Number, level 2)
- write and solve story problems which require a choice of any combination of the four arithmetic operations (Number, level 2)

Activity

These problems involve combining equal groups to find a total. There is a variety of strategies that the students can use to solve the problems.

For question **1**, the students' strategies for finding the planks for the long side might include:
- using repeated addition: 5 + 5 + 5 + 5 = 20
- skip-counting in fives: 5, 10, 15, 20
- using doubles: double 5 is 10, and double 10 is 20
- recalling known facts: 4 times 5 is 20

The students can use similar strategies to calculate the planks for the short sides of the fence in question **1b**.

There is also an opportunity here to reinforce what the students already know about rectangles: both the long sides are the same length, and both the short sides are the same length. So when the students have worked out that 20 planks are needed for one long side, they do not need to work out the answer for the other long side.

For question **1c**, the students could use any of these strategies:
- 20 and 20 is 40, and 15 more is 55, and 15 more makes 70 planks altogether.
- Double 20 and double 15 is the same as 40 and 30, which is 70 planks.
- 20 plus 15 is 35. That's for half the fence, so I double it to get 70 planks for the whole fence.

In question **1**, the students have worked out how many planks Jamal will need when each section of the fence is five planks high. The illustration supports this. So when the students are asked to calculate the total number of planks if the fence is seven planks high in question **2**, the visual information encourages them to use a strategy of adding two planks all the way around.

The many strategies that the students could use to find out how many planks Jamal needs for the higher fence include:
- using the answers for question **1**: there are four sections in each long side and two more planks in each section, so that's eight more planks on each long side. There are three sections in each short side, so that's 3 x 2 = 6 more planks on each short side. Altogether, that's 8 + 8 + 6 + 6 = 28 more planks to add to 70.
- using five-based strategies: there are 14 sections in the fence: 14 fives are 70. There are 14 more twos … that's 28. 70 and 28 is 98.
- working with multiples of 10: 10 sections would take 10 x 7 = 70 planks. Four more sections would be 4 x 7 = 28. 70 + 28 = 98.

After the students have finished question **2** and discussed how they worked out the answer, you could have a class discussion about the most efficient strategies for these problems and what makes one strategy more efficient than another.

A BSM activity relevant to this page is:
12-3-13 Lots of groups the same

Page 14: Hiding in the Swamp

Achievement Objectives

- demonstrate the ability to use the multiplication facts (Number, level 2)
- write and solve story problems which involve whole numbers, using addition, subtraction, multiplication, or division (Number, level 2)
- write and solve story problems which require a choice of any combination of the four arithmetic operations (Number, level 2)

The activities on this page involve finding the total of groups of the same number of objects and sharing objects evenly, that is, multiplication and division. Encourage the students to use their knowledge of multiplication to solve related division problems.

Activity One

The students can use the strategies they practised with Multiplying Madness and The Pig Pen (pages **12** and **13** respectively of the student's book), that is, repeated addition, doubles, and skip-counting, to answer questions **1** and **2**.

They could use the grouping or repeated subtraction approach to division to answer questions **3**, **4**, and **5**, for example, 10 shared into twos might be thought of as:

"10 – 2 = 8, 8 – 2 = 6, 6 – 2 = 4, and 4 is two lots of 2,
so that's five lots of 2 altogether: five pūkeko are at the swamp."

The students might also use a repeated addition strategy to see how many groups of 2 there are in 10.

To solve question **5**, the students might take 2 from the starting numbers to account for the two one-eyed pūkeko, then work out how many lots of two eyes there are in what remains. Using the cubes or counters will help the students to solve these problems.

An extension exercise could be to look at the number of eyes and beaks.

Activity Two

These problems involve the sharing aspect of division, that is, eight insects shared by two pūkeko. To solve these problems, the students can act out the questions using multilink cubes or counters. For the example discussed here, they would give one "insect" to each "pūkeko", then a second insect to each, then a third, and so on.

Page 15: Pocket Money

Achievement Objectives

- write and solve story problems which involve halves, quarters, thirds, and fifths (Number, level 2)
- write and solve story problems which require a choice of any combination of the four arithmetic operations (Number, level 2)

Activity

These problems can be solved in a variety of ways, and the students might use a mixture of the four arithmetic operations to find the solutions.

The students who recognise the connection between sharing equally between two and halving might use their recall of doubles and halves to answer question **1**. To help highlight the different ways of talking about halving, the students could brainstorm the various expressions for half, that is, halving, divide by 2, share equally between two, ÷ 2, find $\frac{1}{2}$ of.

Acting out the problems using toy money will provide the support that some students need. They could use a calculator as well as their mental strategies and compare their solutions with the answer on the calculator. They need to be able to explain how they got their answers, however. To use the calculator efficiently, the students need to be familiar with the "divide by" sign. If they use the calculator for question **2**, the students will probably key in 24 x 50 = and arrive at a solution of 1 200. Ask them "1 200 what?" You may need to remind them that the context is cents. If they do not have the place value understanding to interpret 1 200 cents as $12, using the toy money will help them.

As an extension, you could say to the students "The window cost $30 to fix. How much did Jani's mum pay?"

BSM activities relevant to this page are:
11-2-55 Saving up for a pet 11-2-56 Fred's fast-food machine

Page 16: What's My Number?

Achievement Objectives

- read any 3-digit whole number (Number, level 2)
- mentally perform calculations involving addition and subtraction (Number, level 2)
- write and solve story problems which involve whole numbers, using addition, subtraction, multiplication, or division (Number, level 2)

Activity

A sound knowledge of number relationships can help the students to develop strategies for problem solving. In the case of the thousands chart, the students need to understand that numbers are related by ones when they move horizontally and by tens when they move vertically. For some students, a mental image of numbers as they are arranged on a thousands chart will be helpful for solving addition and subtraction problems.

Before tackling the missing-addend problems presented in this activity, the students should have had experience of using the thousands chart to solve addition and subtraction problems where the result is unknown. For example, to solve 64 + 23, they might begin at 64, add 10 (74), add another 10 (84), then add 1 (85), add another 1 (86), and add another 1 (87). The missing addend – or change unknown – type of problem using the thousands chart means that the students need to keep track of how much they have added or subtracted. They also need to keep an eye on their destination number and take the "jumps" needed to arrive exactly on that number.

When the students are able to confidently solve the sorts of problems presented here with the thousands chart, which has every number represented, the same problems can be posed using a thousands book, which has only a selection of numbers on each page. The empty squares in the thousands book force the students to visualise which numbers belong in which squares, removing some of the support offered by the thousands chart. A material master for a thousands book can be downloaded from the NZMaths website. (Go to www.nzmaths.co.nz/numeracy/project_material.htm. The thousands book is material master 4-7.)

Page 17: Flipping Fractions

Achievement Objectives

- write and solve story problems which involve halves, quarters, thirds, and fifths (Number, level 2)
- write and solve story problems which involve whole numbers, using addition, subtraction, multiplication, or division (Number, level 2)

Game

The students will need to be familiar with the different names for fractions before they play this memory game. They should read their cards aloud as they turn them up. They also need to make sure the other player has a chance to see the cards they have turned up in order to check what they have said.

Activity

The focus here is on dividing a region into fractions. The students use the copymaster to shade areas of the 12-piece slice to help them solve these problems. Alternatively, they could use 12 pieces of paper and arrange them the same way as in the illustration. The students could use a model of the slice to act out the problems.

The students' answers to question **2** may vary from those given in the answers section. If the slice were shared equally among four people, then each person would get three out of 12 pieces of the slice or $^{3}/_{12}$. Students working at this level will not be ready for an in-depth exploration of equivalent fractions, but it would be appropriate to show them, using the slices copymaster, that $^{3}/_{12}$ and $^{1}/_{4}$ are, in fact, the same.

You could use the fraction cards from the Fractions Memory game to talk about the answers to questions **1** and **2**.

If the students need a visual model to help them solve question **3**, they will need to decide how the 12-piece slice can be modified to make 24 pieces. The easiest way is to draw a line horizontally through each row (or vertically through each column).

BSM activities relevant to this page are:
12-3-51 Two of a kind
12-3-83 Have you got this part?

Page 18: Emani's Haircutting

Achievement Objectives

- write and solve story problems which involve halves, quarters, thirds, and fifths (Number, level 2)
- write and solve story problems which involve whole numbers, using addition, subtraction,multiplication, or division (Number, level 2)

Note: Talo is the Niuean word for the vegetable that is also called taro. If you would like to find out more about Niuean haircutting ceremonies, read "First Haircut", *School Journal*, Part 4 Number 3, 1998.

Activity

Finding fractions of a set is the focus of this activity, and it builds on the work done in **Activity Two** of Hiding in the Swamp on page **14** of the students' book.

The students might use their knowledge of doubles at the beginning of the activity. Some might need counters or cubes to act out the sharing of the talo. To find a third of the talo (or one of three equal parts), the students have to divide the talo between three people, using a sharing approach. Make this connection with division explicit for the students.

Question **4** challenges the students to make up their own fraction problems. They are likely to need some direction about which numbers would be good to use, for example, 12, 24, and 36 will all yield whole number answers for $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$.

Page 19: Dazzler Digs On

Achievement Objectives

- write and solve story problems which involve halves, quarters, thirds, and fifths (Number, level 2)
- demonstrate the ability to use the multiplication facts (Number, level 2)
- mentally perform calculations involving addition and subtraction (Number, level 2)
- write and solve story problems which involve whole numbers, using addition, subtraction, multiplication, or division (Number, level 2)

Activity

Like Emani's Haircutting on page **18** of the students' book, this activity involves finding fractions of a set. The difference is that the total number of the set decreases from question to question as fractions of the set are subtracted.

The students can use the cubes to model the problems. Encourage them to do as much as they can by using their mental strategies supported by their recording. You may need to model the number stories for the students.

Page 20: Cooking Up a Storm

Achievement Objectives

- write and solve story problems which require a choice of any combination of the four arithmetic operations (Number, level 2)
- write and solve story problems which involve halves, quarters, thirds, and fifths (Number, level 2)
- demonstrate the ability to use the multiplication facts (Number, level 2)

Activity

Encourage the students to use strategies *other than* counting from one to answer question **1**. You could ask, "What's the quickest way to work this out?" The students might use repeated addition to find the number of biscuits. This could be modelled with multilink cubes as either:

4 + 4 + 4 + 4 + 4 + 4

(which can be thought of as 4 and 4 is 8, and 4 is 12, and 4 is 16, and 4 is 20, and 4 is 24 biscuits altogether or as skip-counting by 4)

or:

6 + 6 + 6 + 6

(which can be thought of as 6 and 6 is 12, 12 and 6 makes 18, 18 and 6 more makes 24 biscuits altogether).

The students might also use their doubles to add the groups:

Double 4 is 8, 8 doubled is 16, plus another double 4 is 24,

or:

Double 6 is 12, and double 12 is 24.

Yet another possibility is that the students will see how many muffins or biscuits are on one half of a tray and double this number to find the total.

There is an opportunity here to link repeated addition to the conventional notation for multiplication. Explain to the students that when they are adding lots of groups of the same number, there is a quicker way to record this and to talk about it. In the case of 4 + 4 + 4 + 4 + 4 + 4, there are six lots of 4, and six times 4 is recorded as 6 x 4.

Question **2** is about halving and doubling and will build on the students' existing knowledge of halving and doubling numbers to 20. First, the students need to find half of 12 (the total number of muffins). To work out how many muffins they each have, they must halve 6. Finally, to find the cost to each child, they can either count in twos or double 3 to reach a cost of $6 each. The students who have recall of their doubles should be able to do this mentally. For those who are unsure, use the multilink cubes to represent muffins. You could set the toy money out in lots of $2 next to each muffin to help them work out the cost.

In order to find one-third of the biscuits in question **3**, the students could use the multilink cubes and share the total of 24 biscuits into three equal groups. The answer of eight biscuits needs to be added to 12 tarts, giving 20 items altogether (which cost $1 each). The students could then work out the total cost before halving this figure to solve the problem.

The students might begin to find the cost in question **3** by using a similar approach to that in question **2**. This would mean putting $1 next to each imaginary biscuit or tart. You should encourage the students to predict the cost by asking them "If one tart (or biscuit) costs $1 and two tarts (or biscuits) cost $2, how much will three tarts (or biscuits) cost? What about 20?" This can be connected to the one times table, which leaves the other number unchanged. The number 1 is known as the identity element for multiplication (and division) because when any number is multiplied by 1, it does not change.

Multiplication and/or division are explored in a number of other activities in the student book: Multiplying Madness, page **12**; Hiding in the Swamp, page **14**; Flipping Fractions, page **17**; Emani's Haircutting, page **18**; and Dazzler Digs On, page **19**.

You could extend this activity by asking questions such as:
"At the end of the day, Baker Bob reduces the cost of the biscuits to 50 cents each. Jack buys the remaining half of the biscuits. How much does he pay?"

Page 21: Puzzling Shapes

Achievement Objective

- write and solve story problems which involve halves, quarters, thirds, and fifths (Number, level 2)

Activity

In this activity, the students are dealing with fractions of regions (questions **1** and **3**) and fractions of sets (question **2**). When doing question **1**, the students need to see that the same fraction (one-quarter) can be different sizes and shapes. This shows why it is important to always relate a fraction to the whole, for example, "one-quarter" can have many meanings, so it's important to specify the context, for example, "one-quarter of the cake", "one-quarter of 16", and "one-quarter of the square".

Your students may find it helpful to use counters (one colour for raspberry and a different colour for chocolate) to solve question **2**.

The copymaster of the Fraction Memory cards at the back of this book has a set of cards with different expressions for fractions. You could also use these cards for this activity, with the addition of the cards below.

1 divided into 2 equal parts	1 divided into 3 equal parts	1 divided into 4 equal parts	1 divided into 6 equal parts

The words "share equally between two" relate to dividing a set of objects in half, whereas "1 divided into two equal parts" relates to an area model of one-half.

It's important that the students develop confidence in using the varied language of fractions, along with an understanding that there are several ways to talk about the same fraction. Use the students' ideas as a starting point. Present them with the symbolic recording for one-quarter ($^1/_4$) and invite them to talk about what they think the 4 means. "What about the 1?" This does, of course, need to be introduced alongside a concrete model of one-quarter.

In question **3**, the students are asked to label the fractions they have coloured on each of the shapes. If they can express the shaded area of the square as "three out of four equal parts", then recording $^3/_4$ is likely to be straightforward. The students may need prompting with questions such as "How many equal parts has the square been cut into?" "What's the name for that fraction?" "How many quarters have you coloured in?"

The students are then asked to put these fractions in order. Although ordering fractions with different denominators might seem advanced for students at level 2, they are asked to do this with the visual support of the fractions they have themselves created. Because all the numerators are 3, you could use this question to explore the relationship between the size of a fraction and the denominator, that is, that the greater the denominator, the smaller the fraction (where the numerator is constant). Although you may not expect the students to use the terms numerator and denominator, it is appropriate for you to introduce these words while working with fractions.

BSM activities relevant to this page are:
11-2-18 Make a whole
11-2-59 Spin a whole

Pages 22–23: Frogs Frolic

Achievement Objectives

- make sensible estimates and check the reasonableness of answers (Number, level 2)
- mentally perform calculations involving addition and subtraction (Number, level 2)

Game

This game gives the students practice using mental strategies for addition and subtraction. The aim of the game is to be the first to reach 50. Make sure that the students are aware that some lily pads and stones are hazards and some are bonuses. The students must then decide whether adding or subtracting the number they have rolled will be of the greatest benefit to them. They should both add and subtract to see which direction would take them to a more favourable lily pad or stone.

Encourage the students to add and subtract the number they throw to and from the number they are on and then move straight to the new number rather than counting on or back along the numbered places. The students do not need to throw the exact number to get to 50.

Page 24: Soap Suds

Achievement Objectives

- write and solve comparison problems (Number, level 2)
- write and solve story problems which require a choice of any combination of the four arithmetic operations (Number, level 2)
- devise and use problem-solving strategies to explore situations mathematically (Mathematical Processes, problem solving, level 2)

Activity

In this activity, the students need to use their addition, subtraction, multiplication, and division strategies to work out how much money Alanna and Leon would each earn in the three different scenarios. The students can use the toy money to support their thinking and to explain their strategies to others.

The students can use mental strategies for addition and multiplication to find the total value of options A, B, and C. They can then use either their halving strategy or their knowledge of division facts to calculate how much Alanna and Leon could each be paid. In each of the three situations, the students may understand that it's not necessary to find half of the total amount to decide which option would pay the most: the biggest total amount would also give the biggest half.

Question **2** has a strong problem-solving element. In order to explore the various possible combinations, the students could copy the list shown in option B. They could then use a trial and improvement approach:

Monday	$1	Alanna
Tuesday	$2	Leon
Wednesday	$3	Alanna
Thursday	$4	Leon
Friday	$5	Alanna
Saturday	$6	Leon
Sunday	$7	Alanna & Leon

This example would result in Alanna being paid $12.50 and Leon being paid $15.50 so does not solve the problem.

Assuming that Alanna and Leon share the work (as well as the money) equally, then they could either:

- work 2 days each on their own and 3 days together, or
- work 3 days each on their own and 1 day together.

(They could not earn the same amount if they worked for 1 day alone and 6 days together because no two single days are paid the same amount.) Next, it's a matter of looking for combinations of two (or three) numbers that equal the same, such as 1 + 4 and 2 + 3 (or 1 + 5 + 6 and 2 + 3 + 7). The students can use the toy money to explore the possible combinations.

BSM activities relevant to this page are:

12-3-60 Birthday spending	12-3-89 Running totals
12-3-90 Small money	12-3-91 Pay as you travel

Copymaster: How Old?

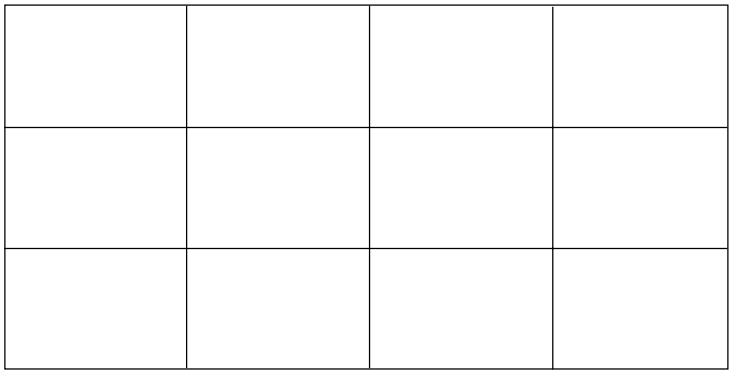
Word	Numeral	Tens	Ones
twelve	12	1	2
twenty		2	0
thirteen			
thirty			
fourteen			
forty			
	15		
		5	0
sixteen			
sixty			
seventeen			
	70		
eighteen			
eighty			
		1	9
ninety			

Word	Numeral	Tens	Ones
twelve	12	1	2
twenty		2	0
thirteen			
thirty			
fourteen			
forty			
	15		
		5	0
sixteen			
sixty			
seventeen			
	70		
eighteen			
eighty			
		1	9
ninety			

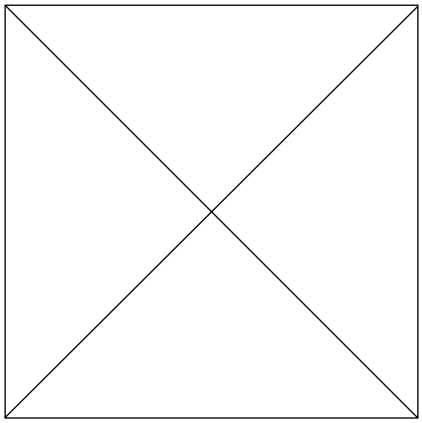
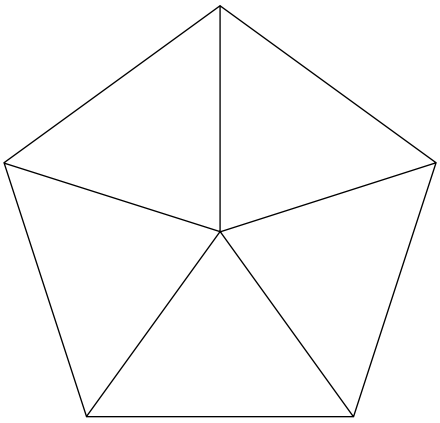
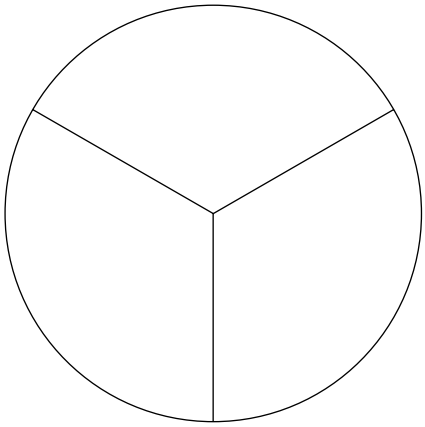
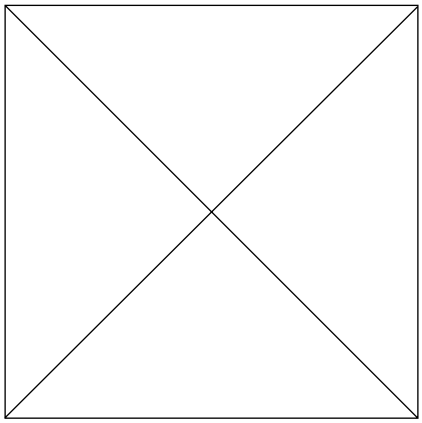
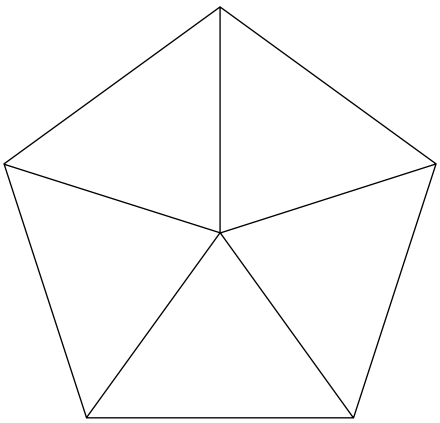
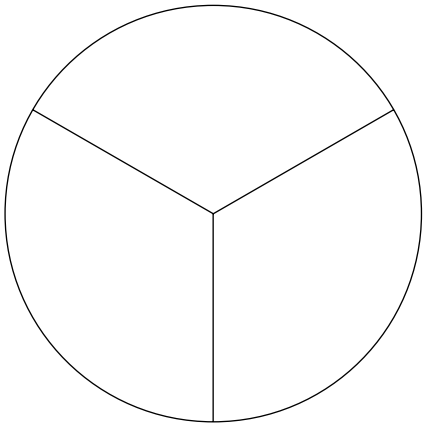
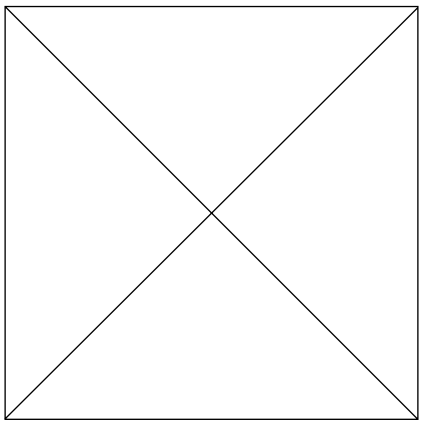
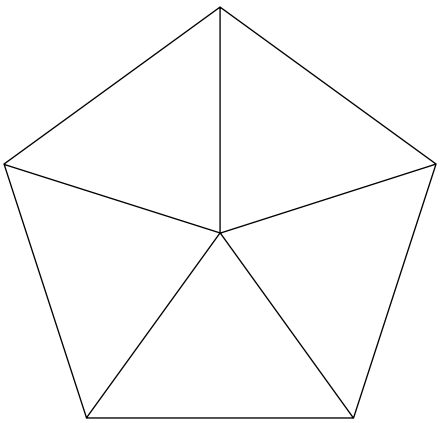
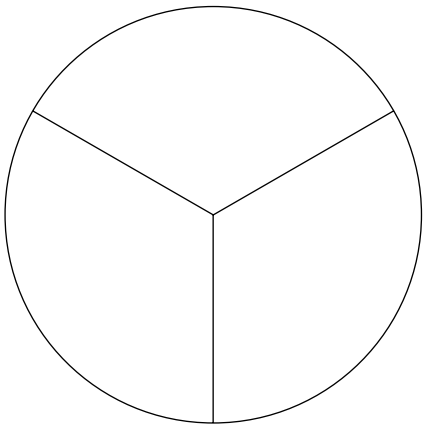
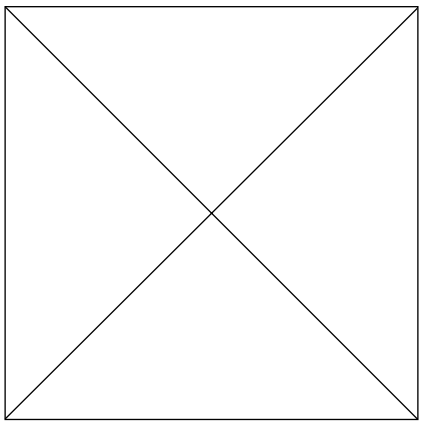
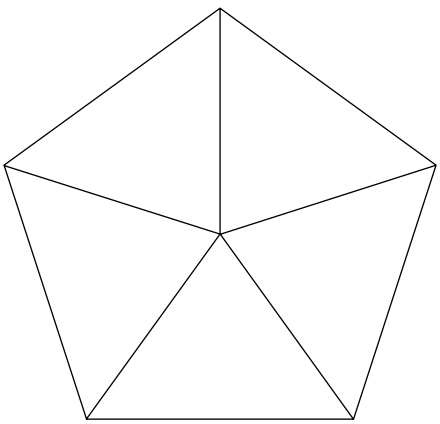
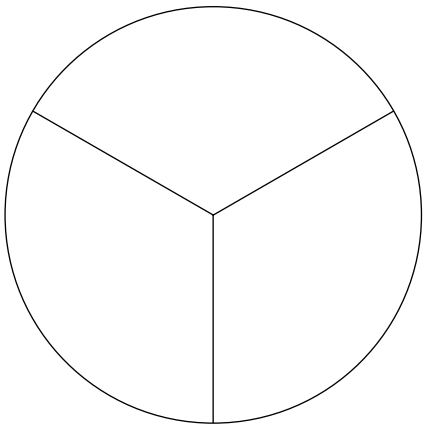
Copymaster: Fraction Memory cards

Share equally between two	Divide by two	$\frac{1}{2}$	One-half
Share equally between three	Divide by three	$\frac{1}{3}$	One-third
Share equally between four	Divide by four	$\frac{1}{4}$	One-quarter
Share equally between five	Divide by five	$\frac{1}{5}$	One-fifth
Share equally between six	Divide by six	$\frac{1}{6}$	One-sixth

Copymaster: Chocolate Slice



Copymaster: Shapes

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