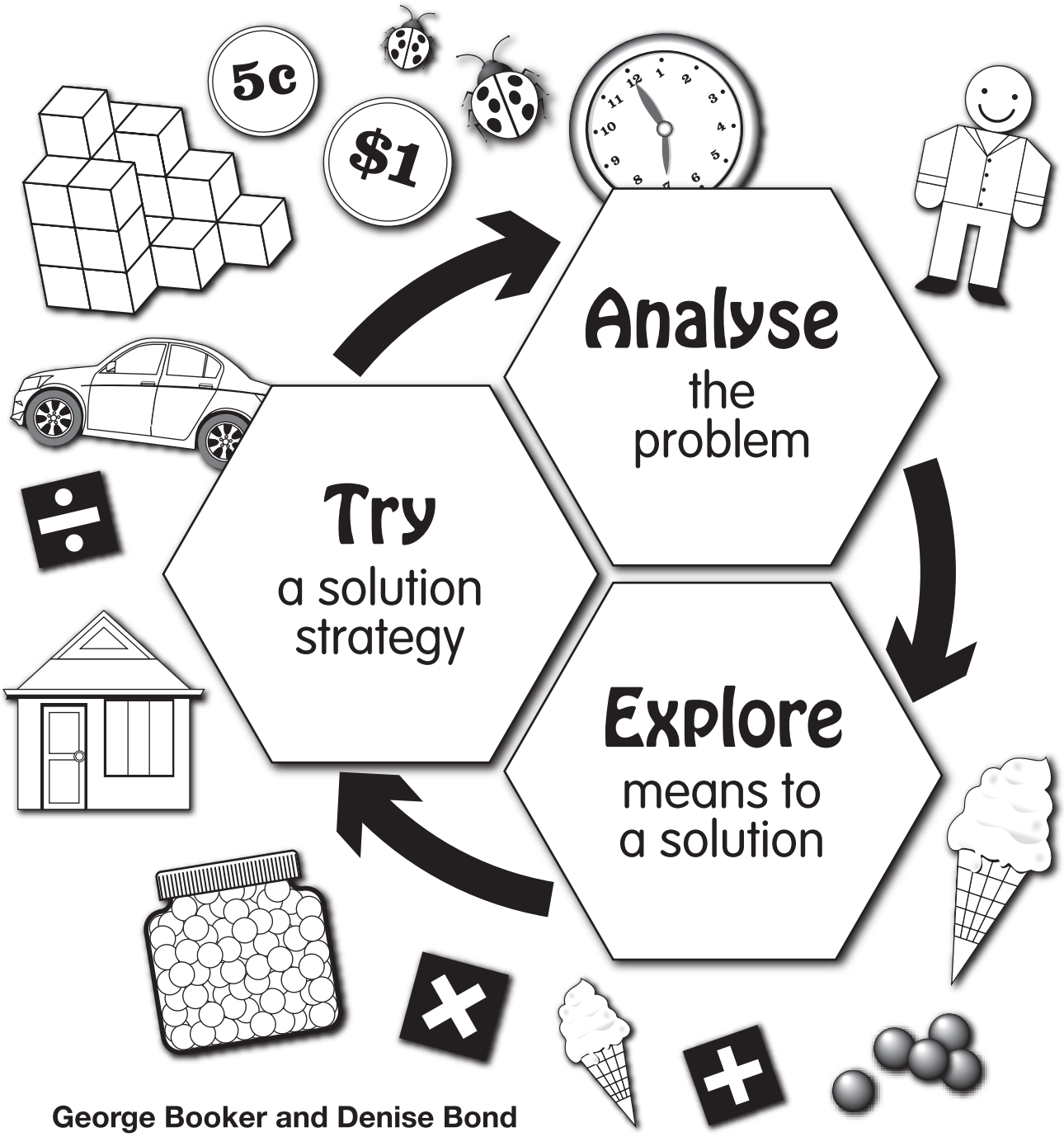
PRIMARY

BOOK B
(Ages 6–7)

CURRICULUM LINKED

Problem-solving in mathematics



George Booker and Denise Bond

SAMPLE - NOT FOR SALE

CONTENTS

Foreword ..... iii – v
Contents vi
Introduction ..... vii – xix
Curriculum links xx
Teacher notes 2
Blocks 3
Grid fun 4
More blocks 5
Teacher notes 6
Block Street 7
Teacher notes 8
How many? 1 9
Swap cards 10
Magic square 11
Teacher notes 12
In the garden 13
How many? 2 14
How many? 3 15
Teacher notes 16
What's my number? 17
Teacher notes 18
Tangrams 1 19
Tangrams 2 20
Tangrams 3 21
Teacher notes 22
Missing numbers 23
More missing numbers 24
Make your own story 25
Teacher notes 26
Toy shop 27
Teacher notes 28
Egg cartons 1 29
Egg cartons 2 30
Spider webs 31
Teacher notes 32
Word problems 1 33
Word problems 2 34
Roland's roses/Angela's pots 35
Teacher notes 36
Sheets and pegs 37
Teacher notes 38
How long? 39
Pizza party 40
Class work 41
Teacher notes 42
Making shapes 43
Pattern block shapes 44
More shapes 45
Teacher notes 46
At the fruit shop 47
Koala corner 48
Bird aviary 49
Teacher notes 50
Alice's island 51
Solutions 52–56
Tangram resource page 57
10 mm x 10 mm grid resource page 58
15 mm x 15 mm grid resource page 59
Triangular grid resource page 60
Triangular isometric resource page 61
Square isometric resource page 62

SAMPLE - NOT FOR SALE

Problem-solving

To reason logically and to identify, create and describe patterns.

Materials

Blocks such as Unifix™ cubes or counters (for example, teddies or koalas) in four different colours

Focus

These pages explore making patterns, changing patterns and using patterns and numbers. Students analyse what makes a pattern and make predictions based on their experiences.

New Zealand Curriculum links

Geometry and Measurement
Shape
• Sort objects by different features

Discussion

Page 3

The first activity involves taking four blocks (of different colours) and lining them up in different groups of two. It is important to explain to students that there can be two groups with the same two colours but they have to be lined up in a different order. The possible arrangements are:

blue	red	red	blue	yellow	blue	green	blue
blue	yellow	red	yellow	yellow	red	green	red
blue	green	red	green	yellow	green	green	yellow

The same concept is extended in the next activity, where students now line up the blocks in groups of three. For example, a student might keep the same colour first and then change the next two colours or he/she might change the first colour and then swap the following two colours. Encourage students to explore different ways and arrangements. The possible arrangements are:

red	blue	green	red	yellow	blue	blue	red	green
red	blue	yellow	red	yellow	green	blue	red	yellow
red	green	yellow	blue	green	red	blue	yellow	green
red	green	blue	blue	green	yellow	blue	yellow	red
green	blue	red	green	yellow	red	yellow	blue	green
green	blue	yellow	green	yellow	blue	yellow	blue	red
green	red	blue	yellow	red	blue	yellow	green	red
green	red	yellow	yellow	red	green	yellow	green	blue

Page 4

This activity builds on the previous experience of lining up the blocks and interchanging the colours to make the pattern. The grid can be organised in a number of ways; however, each different way will always have the same diagonal with three blocks of the same colour. Two grids are provided to enable students to explore and try different possible arrangements.

Page 5

This activity builds on and extends the previous experience of the three-by-three grid by extending the grid to four-by-four with an additional colour. Again, the grid can be organised in a number of ways and this time it is possible for both diagonals to have four blocks of the same colour. Two grids are provided to enable students to explore and try different possible arrangements.

Possible difficulties

- Indiscriminately moving blocks around
- Unable to keep track of what has already been tried
- Content to find only one possibility
- Unable to consider both rows and columns

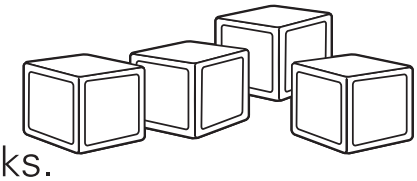
Extension

- Students can be encouraged to make and describe more complex patterns of their own.
- Extend the grid to five-by-five, using five different colours.

SAMPLE - NOT FOR SALE

BLOCKS

Take 4 blocks, each a different colour;
for example: red, blue, green and yellow.



1. Line up and draw different groups of 2 blocks.

2. How many different groups can you make? _____

3. Now, line up and draw different groups of 3 blocks.

4. How many can you make? _____

SAMPLE - NOT FOR SALE

GRID FUN

Make 3 groups of 3 blocks (9 blocks), with each group a different colour.

1. Place the blocks on the grid, making sure that no row or column has the same colour in it more than once.

2. What do you notice about the diagonals? _____

_____

3. Try doing it a different way.

SAMPLE - NOT FOR SALE

978-1-925431-47-6 www.ricpublications.co.nz R.I.C. Publications®

MORE BLOCKS

Make 4 groups of 4 blocks (16 blocks), with each group a different colour.

1. Place the blocks on the grid, making sure that no row or column has the same colour in it more than once.

2. What pattern do you notice? _____

_____

3. Try doing it a different way.

SAMPLE - NOT FOR SALE

Problem-solving

To identify and use information in a problem.

Focus

These pages explore the reading and interpreting of information to solve problems involving numeration (no addition or subtraction is needed to solve them). Students analyse the problem to locate the required information, decide which information is not needed and then use comparison rather than addition or subtraction to obtain solutions.

New Zealand Curriculum links

Number and Algebra
Number strategies
• Use a range of counting and grouping strategies with whole numbers
Equations and expressions
• Communicate and explain counting, and grouping using words, pictures and numbers
Statistics
Statistical investigation
• Conduct investigations by gathering, counting, sorting and displaying data

Discussion

Page 9

Anne skipped 10 more times than Maree, who skipped 42 times. In the next problem, students need to read what happened on Saturday and the next day to infer that the next day was Sunday. The last problem is about jelly beans, with the additional information (about marshmallows) not required. Although Aaron has the largest number, these are marshmallows and not jelly beans. Jane has the largest number of jelly beans.

Page 10

In the first problem, Julie has no (or zero) swap cards, so technically, she has the smallest number of cards. This can lead to a discussion about whether the problem means the smallest actual number or should include only the people who actually have cards. The next problem introduces the idea of organising information in a table to help find a solution. The question does not specify how many cards John lost or how many Carla won. The information in the table will show that John has the least number of cards and Carla the most. As John loses some cards, he still has the least number, while Carla winning some means she still has the most.

Page 11

This page introduces the concept of magic squares. Simple three-by-three magic squares have been used to enable students to come to terms with the idea that each row, column and diagonal adds to the magic number.

Possible difficulties

Students are unable to interpret the information in the problems, including:

- thinking that Maree skipped 42 times and Anna skipped only 10 times
- not being able to work out that the next day is Sunday
- not realising that having no cards means 0 (zero)
- not seeing that having the least number of cards and then losing more will always mean you will have the least cards, while having the most cards and winning more will mean you always have the most.

Inadequate numeration understanding

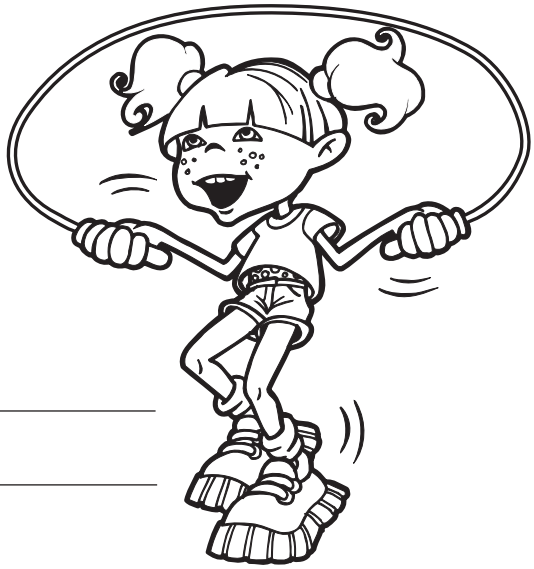
- Not understanding that zero, as a number, shows none of something.
- Counting or adding to find 10 more rather than using place value.
- Using comparison to determine least and greatest tens place value is not developed.

Extension

- Use a table to record information for the other problems and discuss how this helps in solving them.
- Investigate other magic squares.

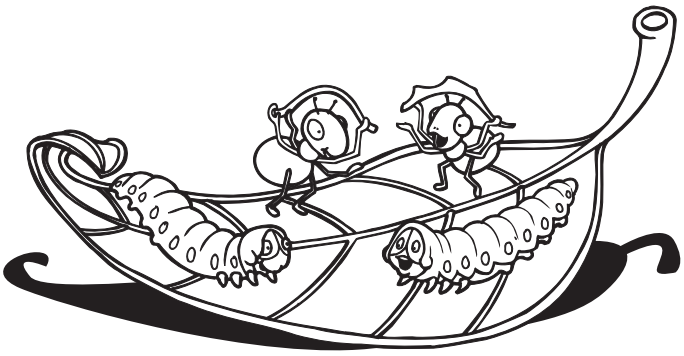
SAMPLE - NOT FOR SALE

HOW MANY? 1



Maree and Anne were skipping.
Maree skipped 42 times.
Anne skipped 10 more times.

1. Who skipped the most? _____
2. How many times did Maree skip? _____



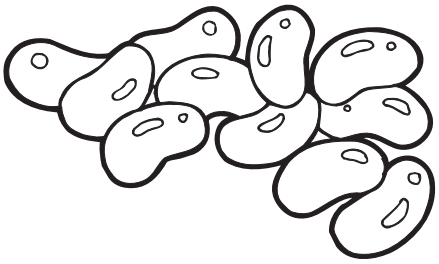
On Saturday, Lee counted 46 ants and 23 caterpillars. The next day she counted 58 ants and 25 caterpillars.

3. How many ants did Lee count on Sunday?

_____

4. On which day did she count the most caterpillars?

_____



Jane had 32 jelly beans.
Aaron had 48 marshmallows.
Scott had 29 jelly beans.

5. Who had the most jelly beans? _____

SAMPLE - NOT FOR SALE

SWAP CARDS

Kerry has 42 swap cards.
Julie has no swap cards.
Valda has 35 swap cards.

1. Who has the smallest number of cards? _____

Mark has 53 swap cards.
John has 10 less than Mark.
Carla has 72 swap cards.

2. Use the table to record how many cards each person has.

Mark	John	Carla

The next day, John lost some cards and Carla won some cards.

3. Who has the most cards? _____

4. Who has the least cards? _____

SAMPLE - NOT FOR SALE

978-1-925431-47-6 www.ricpublications.co.nz R.I.C. Publications®

MAGIC SQUARE

In a magic square, every row, column and diagonal adds to the same number.

2	7	6
9	5	1
4	3	8

In this magic square all the rows, columns and diagonals add to **15**. Its magic number is **15**.

Look at the magic squares below. Remember, each row, column and diagonal must to add to the same number.

1. Figure out what the magic number of each square is.
2. Fill in the missing numbers in each square.

6		8
7	5	3
	9	

	1	6
3		7
		2

(a) Magic number: _____ (b) Magic number: _____

SAMPLE - NOT FOR SALE

Problem-solving

To interpret and organise information in a series of interrelated problem statements.

Focus

These pages explore ways to arrange given numbers into problem situations so that the resulting stories make sense. Students need to read the stories carefully to work out which number goes where. The numbers are not listed in the order in which they are used in the story. To extend this concept, some questions require students to think of their own numbers to fit problem situations.

New Zealand Curriculum links

Number and Algebra
Number strategies
• Use a range of counting and grouping strategies with whole numbers
Equations and expressions
• Communicate and explain counting, and grouping using words, pictures and numbers

Discussion

Page 23

The first two problems require students to read and interpret the given situations and then place the numbers that are provided in the sentences so that the resulting story makes sense. Students need to make decisions about who is the oldest person and who is the youngest and use their understanding of 'group words' to make sense of the situations. The last problem uses the same story structure, but students are required to provide numbers of their own that will make appropriate stories.

Page 24

The problems on this page extend from the thinking used for page 23. The first situation must be read and interpreted so that the students use the numbers provided to produce a story that makes sense. The second problem uses the same story structure but asks students to think of their own numbers. The last problem extends this to a different situation, one in which students have to choose numbers without a set of 'rules' to follow. There is considerable leeway as to what numbers would make sense, but an understanding of the context is also needed; for example, to have 100 students in the class would not be likely, while 35 might be more reasonable.

Page 25

Here the idea of students choosing their own numbers to pose problems is extended to a more complex situation and is linked to the earlier notion of using a table to organise and analyse information. The various stories students write should be discussed and contrasted. The leading concept that should be understood by students is that a range of numbers can be used in each sentence (there is no one right answer).

Possible difficulties

- Placing the numbers in a story in the order in which they are listed rather than considering if they make sense
- Not taking into account the context of the story when selecting numbers
- Students having difficulty when trying to think of their own numbers for a story to make sense

Extension

- Students should be encouraged to write further stories of their own and swap them with others in the class to solve.
- Students could write stories with and without numbers.

SAMPLE - NOT FOR SALE

978-1-925431-47-6 www.ricpublications.co.nz R.I.C. Publications®

MISSING NUMBERS

Some numbers have been left out of the story. Put in the numbers so that the story makes sense.

6	11	9

1. Patty is the oldest child in her family.

   She is _____ years old.

   Helen is younger than Rina. Helen is _____ years old.

   Rina is _____ years old.

Some numbers have been left out of the story. Put in the numbers so that the story makes sense.

5	2	10

2. Roger bought a packet of socks.

   The packet has _____ pairs of socks.

   Altogether, Roger has _____ socks.

   He shopped for _____ hours.

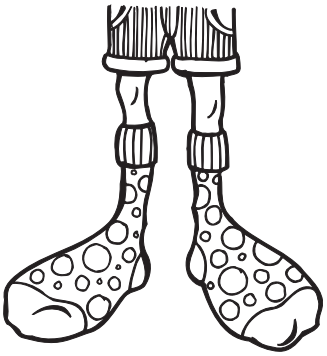
Use your own numbers in the story so that it makes sense.

3. Roger bought a packet of socks.

   The packet has _____ pairs of socks.

   Altogether, Roger has _____ socks.

   He shopped for _____ hours.



SAMPLE - NOT FOR SALE

MORE MISSING NUMBERS

Some numbers have been left out of the story. Put in the numbers given so that the story makes sense.

7	12	3

1. Mandy's school is _____ kilometres from her house.

   Her class has lunch at _____ o'clock.

   She is _____ years old.

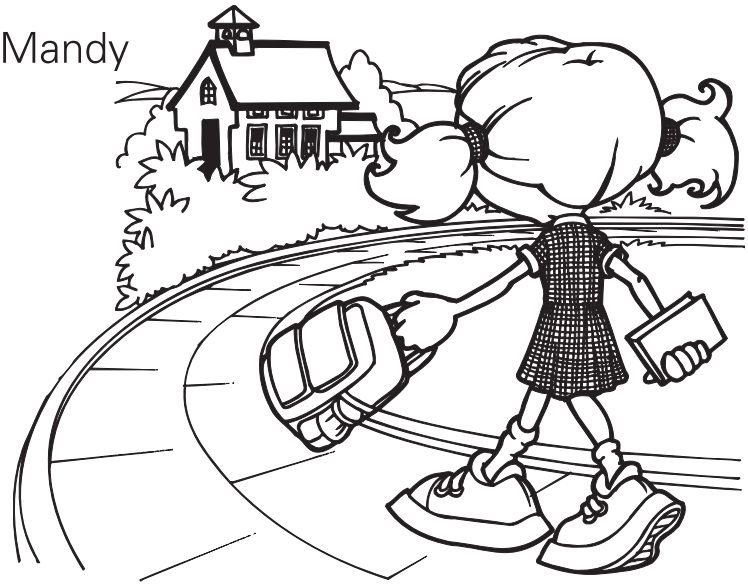
Now use your own numbers so that the story makes sense.

2. Mandy's school is _____ kilometres from her house.

   Her class has lunch at _____ o'clock.

   She is _____ years old.

   What is the youngest age Mandy could be? _____



Choose your own numbers so that this story makes sense.

3. Haani's mother works _____ kilometres from their house.

   She works as a teacher and has _____ students in her class.

   Her students go home at _____ o'clock.

SAMPLE - NOT FOR SALE

978-1-925431-47-6 www.ricpublications.co.nz R.I.C. Publications®

MAKE YOUR OWN STORY

Make up your own numbers to use in the story. Draw a picture of your story when you have finished.

1. Linda and Lisa are sisters.

   Linda is _____ years old.

   She is in Year _____ at school.

   Lisa is her older sister. Lisa is _____ years old.

   Lisa is in Year _____ at school.

   Linda and Lisa have a brother, Lenny.

   Lenny is younger than Lisa but older than Linda.

   Lenny is _____ years old.

2. Record how old each person is in the table below.

Linda	Lisa	Lenny

3. Draw a picture of your story.

SAMPLE - NOT FOR SALE