Answers and Teachers' Notes

MINISTRY OF EDUCATION
Te Tāhuhu o te Mātauranga

Contents

Introduction

The Figure It Out series is designed to support *Mathematics in the New Zealand Curriculum*. The booklets have been developed and trialled by classroom teachers and mathematics educators. The series builds on the strengths of a previous series of mathematics booklets published by the Ministry of Education, the School Mathematics supplementary booklets.

Figure It Out is intended to supplement existing school mathematics programmes and can be used in various ways. It provides activities and investigations that students can work on independently or co-operatively in pairs or groups. Teachers can select particular activities that provide extension to work done in the regular classroom programme. Alternatively, teachers may wish to use all or most of the activities in combination with other activities to create a classroom programme. The booklets can be used for homework activities, and the relevant section in the teachers' notes could be copied for parents. These notes may also provide useful information that could be given as hints to students. The teachers' notes are also available on Te Kete Ipurangi (TKI) at www.tki.org.nz/community

There are now nine booklets for levels 2–3: one booklet for each content strand, one on problem solving, one on basic facts, and two theme booklets. Each booklet has its own *Answers and Teachers' Notes*. The notes include relevant achievement objectives, suggested teaching approaches, and suggested ways to extend the activities. The booklets in this set (levels 2–3) are suitable for most students in year 4. However, teachers can decide whether to use the booklets with older or younger students who are also working at levels 2–3.

The booklets have been written in such a way that students should be able to work on the material independently, either alone or in groups. Where applicable, each page starts with a list of equipment that students will need to do the activities. Students should be encouraged 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 a problem. Teachers could encourage students to write down as much as they can about how they did investigations or found solutions, including drawing diagrams. Where possible, suggestions have been made to encourage discussion and oral presentation of answers, and teachers may wish to ask their 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. Successful ways of solving problems should be acknowledged, and where more effective or efficient processes can be used, students can be encouraged to consider other ways of solving the problem.

Figure It Out

Gala

Answers

Page 1: Date Dilemma

Activity

None of the dates is ideal. Students could argue that 22 November is the best, but there is the risk of high winds. Students could argue that 1 November is the best because a lot of people will be in town for the parade and will also come to the fair if the timing is right.

Page 2: Holding a Vote

Activity

1. **a.** Books for the library: 53
   Kapa haka costumes: 50
   Computer equipment: 39
   Sports equipment: 39
   Trip to Wellington: 38

   b. Books for the library

   c. Trip to Wellington

2. Answers will vary. Possible answers are: these rooms could be planning a trip to Wellington, they may have done a study on Te Papa and want to visit it, or they may have been there before and want to go again.

3. Answers will vary. Teacher to check.

Page 3: How Many People?

Activity

1. **a.** 250

   b. 200

   c. 500

   d. 250

   e. 750

2. Answers will vary.

Pages 4–5: Terrific Treats

Activity One

1. **a.** The answer is found by doubling the ingredients.
   4 tbsp golden syrup
   200 g butter
   3 cups packed brown sugar
   2 cans sweetened condensed milk
   2 tsp vanilla essence
   150 g dark chocolate
   3 cups chopped nuts, coconuts, or dried fruit (optional)

   b. The answer is found by multiplying the ingredients by 20 or multiplying the answer to **1a** by 10.
   40 tbsp golden syrup
   2 000 g or 2 kg of butter
   30 cups packed brown sugar
   20 cans sweetened condensed milk
   20 tsp vanilla essence
   1 500 g or $1\frac{1}{2}$ kg dark chocolate
   30 cups chopped nuts, coconut, or dried fruit (optional)

2. **a.** $5 \times 9 = 45$

   b. $4 \times 8 = 32$

   c. $7 \times 11 = 77$

Activity Two

1. Practical activity

2. **a.** 6 glasses

   b. 30 glasses

   c. 48 glasses

   d. 18 glasses

   e. 90 glasses

   f. 600 glasses

Page 6: Making Boxes

Activity

Practical activity

Page 7: Is There Room?

Activity

Yes. The total area of the park used for last year's gala is $(75 \times 60) + (30 \times 25) = 5\,250\ m^2$. The area available for this year's gala is $90 \times 60 = 5\,400\ m^2$.

Page 8: Looking Good

Activity

1. **a.** Reflection (flip) – because there is a mirror line down the centre of the face
   b. Rotation (turn) – because the shapes map onto each other every 90° turn about the centre
   c. Translation (slide) – because the shapes have moved horizontally but they are still facing the same way
2. Practical activities. Teacher to check

Page 9: Gumboots Away!

Activity One

1. Suzie threw the gumboot 8 m, 8 m, and 5 m.
   Mere threw the gumboot 6 m, 9 m, and 5 m.
   Theo threw the gumboot 8 m, 7 m, and 9 m.
   Duncan threw the gumboot 9 m, 4 m, and 4 m.
2. Suzie: 16 m
   Mere: 15 m
   Theo: 17 m
   Duncan: 13 m
3. Theo, Suzie, Mere, Duncan
4. Theo, with a total of 17 m for his top two throws

Activity Two

Practical activity

Page 10: Who Am I?

Activity One

1. 5 **2.** 30 **3.** 16
4. 7 **5.** 12 **6.** 6
7. 27

Activity Two

Answers will vary.

Page 11: Aim Straight

Activity One

1. Bella, with 111 points
2. Liam would score 174 – 39 = 135 points in the second round. He could hit the numbers 5, 15, or 20:
   - three balls in orange 15
   - two balls in orange 20 and one in green 15
   - two balls in orange 20 and one in orange 5
   - one ball in orange 20, one in yellow 15, and one in orange 15
3. Feana scored 66 points in her second round. She could hit any of the numbers, for example:
   - one in orange 20 and two in green 3
   - three in yellow 11
   - one in orange 12 and two in green 15
   - one in yellow 15, one in green 20, and one in yellow 8
   - two in orange 11 and one ball missing the board

Activity Two

Practical activity

Pages 12–13: Lunchtime!

Activity

1. **a.** Yes
   b. The total is $15, which is less than $20.
2. **a.** $13
   b. Yes

3. **a.** Answers will vary, but here is an example of four different lunches that cost $6:

3 sausages $3 1 curry $3	2 sausages $2 2 fritters $4
1 sausage $1 1 fritter $2 1 curry $3	2 hamburgers $5 1 sausage $1

b. $5 and $1
$2 and $2 and $2
$2 and $2 and $1 and $1
$2 and $1 and $1 and $1 and $1
$1 and $1 and $1 and $1 and $1 and $1

4. 4 drinks. He has spent $16 ($3.50 + $2 + $7.50 + $3) so has $4 left for drinks.

5. **a.** $135

b. $90

Page 14: Clara's Cowpats

Activity

1. **a.**

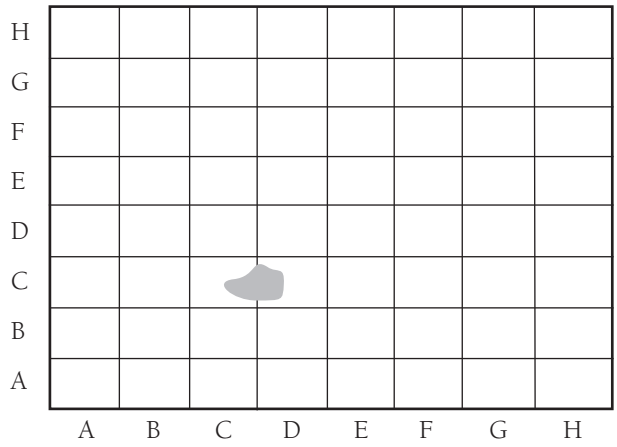
	A	B	C	D	E	F	G	H
H								
G								
F	Prema		Jo		Jack		Sam	
E			Tai			Eva		
D					Theo			
C					Ben			
B		Kate						
A								

b. F,E

c. Eva

d. Theo, Jack, and Sam

2.



Page 15: Getting Better

Activity

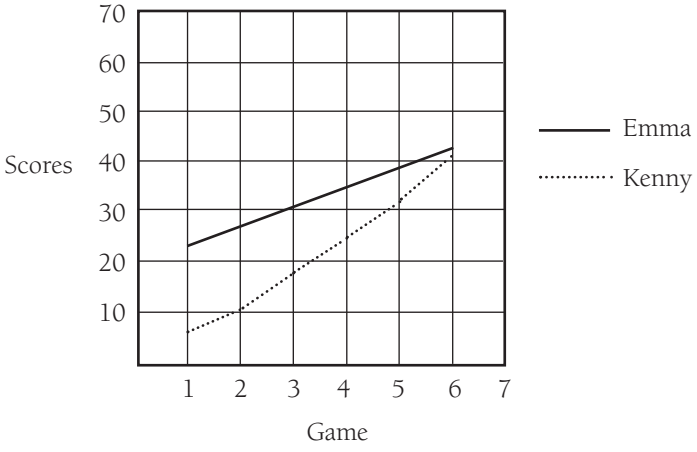
1. **a.** The scores improve by 4 each time (+ 4).

b. 39, 43

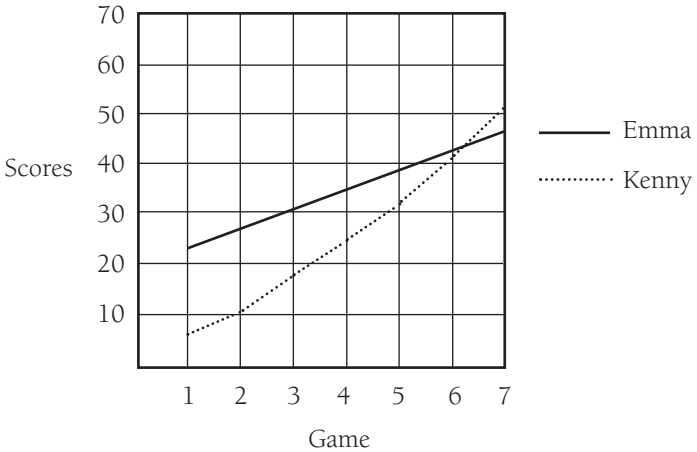
2. **a.** The number added increases by 1 each time (+ 5, + 6, + 7).

b. 32, 41

3. **a.** Students' Ball-throwing Scores



b. Students' Ball-throwing Scores



Kenny, with a predicted score of 51

Pages 16–17: Entertaining Patterns

Activity One

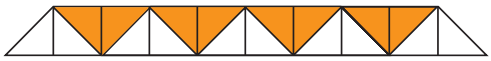
a. Discussion points should include using multiplication to count the square and rectangular groups, using triangular numbers to count the triangular groups, and using multiplication and addition or subtraction to count the remaining groups. Use subtotals to keep track of progress.

b. 165

Activity Two

1. a. 10 white, 8 orange

b.

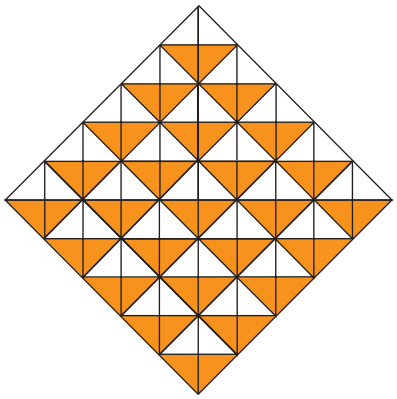


c. The number of triangles of each colour increases by 2 at each successive row.

2. a.

	White triangles	Orange triangles
Sixth row	8	10
Seventh row	6	8
Eighth row	4	6
Ninth row	2	4
Tenth row	0	2

b.



Page 18: Plant It

Activity One

1. a. ($10 x 2) + $15 = $35

b. ($3 x 2) + ($10 x 2) + ($5 x 2) = $36

c. ($15 x 2) + ($8 x 3) = $54

d. ($10 x 3) + ($8 x 3) + ($5 x 2) + $2 = $66

2. 5

Activity Two

1. Yes, because 2 x 12 = 24, so 12 is just under half of 25.

2. 12 pōhutukawa: $\frac{1}{2}$ of 24 = 24 ÷ 2 or 24 x $\frac{1}{2}$
8 kōwhai: $\frac{1}{3}$ of 24 = 24 ÷ 3 or 24 x $\frac{1}{3}$
4 puka: 24 – (12 + 8)

3. Answers will vary.

Page 19: Luck of the Draw

Activity

1. Kirk's profit is $60 – $20 = $40 $40 profit

Adele's profit is $40 – 25 = $15 $15 profit

Their raffles made $55 profit altogether.

2. a. 35 tickets

b. Craig's profit is (15 x 2) + (35 x 1) – 30 = $35

3. a. She would have to buy 50 of Adele's tickets.

b. (50 ÷ 5) x 2 = $20

4. a. Jay's profit is (21 x 5) + (12 x 2) – 50 = $79

b. $129

Page 20: Creative Critters

Activity

1. a. 2 x 3 = 6 balloons
6 x 75 cents = $4.50 or 450 cents

b. 4 + 2 + 2 = 8 balloons
8 x 75 cents = $6 or 600 cents

c. 3 x 4 = 12 balloons
12 x 75 cents = $9 or 900 cents

d. 2 + 3 = 5 balloons
5 x 75 cents = $3.75 or 375 cents

e. 3 + 1 + 4 + 2 = 10 balloons
10 x 75 cents = $7.50 or 750 cents

2. There are several combinations that he could have bought, for example:

- 1 snake, 1 dog, and 2 aeroplanes
- 2 rabbits and 2 aeroplanes
- 4 dogs
- 2 dogs, 1 rabbit, and 1 aeroplane.

Page 21: Gala Games

Game

Pages 22–23: Counting the Costs

Activity

1.

a. Money taken at the gumboot throwing $463
Cost of the prizes – $45
Profit $418

b. Money taken at the face painting $302
Cost of the paint – $39
Profit $263

c. Money taken at the food stall $2301
Costs – $430
Profit $1871

d. Money taken at the plant stall ($254 + $480 + $66) $800
Costs – $210
Profit $590

e. Money taken at cowpat bingo ($64 x 2) $128
Cost of prizes – $20
Profit $108

f. The magician's takings were $82.50
The costs were 110 x 15c – $16.50
Profit $66.00

g. Fudge money $70
Drinks money + $155
Profit $225

h. Mystery number money (137 x 50 cents) $68.50
Cost of the prizes – $12.00
Profit $56.50

2. The food stall was the most profitable.

3. The mystery number stall was the least profitable.

4. Estimates should be between 330 and 340 books.

Page 24: Gala Graphs

Activity

1. 12 noon – because the highest point in the graph is at 12 noon, when 19 people were waiting

2. Discussion points could include that the gala started at 9 a.m., so no one had got to the stall. At 4 p.m., the stall might have run out of food or the gala might have ended.

3. Answers will vary. An example is: the bank started with a $100 float. The stalls started to make money, and people deposited the money in the bank from 9 a.m. Between 11 a.m. and 1 p.m., stallholders got change from the bank and paid out some prizes, and they didn't have time to deposit any money. Between 1 p.m. and 2 p.m., the stalls deposited their money from the lunch rush. The last increase was after 4 p.m., when stallholders deposited their last takings.

4. Answers will vary.

Figure It Out

Gala

Teachers' Notes

Overview: Gala

Title	Content	Page in students' book	Page in teachers' notes
Date Dilemma	Interpreting information	1	9
Holding a Vote	Analysing data	2	10
How Many People?	Solving and writing fraction problems	3	11
Terrific Treats	Multiplying and measuring	4–5	12
Making Boxes	Working with nets and translation, reflection, and rotation	6	14
Is There Room?	Working with area	7	17
Looking Good	Working with translation, rotation, and reflection	8	18
Gumboots Away!	Solving measurement problems	9	20
Who Am I?	Solving and creating number sentences	10	21
Aim Straight	Calculating using addition and multiplication	11	22
Lunchtime!	Solving money problems	12–13	23
Clara's Cowpats	Working with grids	14	24
Getting Better	Finding and continuing a rule	15	25
Entertaining Patterns	Using multiplication arrays and number patterns	16–17	27
Plant It	Solving problems with money and fractions	18	29
Luck of the Draw	Solving money problems	19	31
Creative Critters	Using rules to find totals	20	31
Gala Games	Using addition and subtraction	21	33
Counting the Costs	Calculating profit	22–23	34
Gala Graphs	Interpreting graphs	24	36

Page 1: Date Dilemma

Achievement Objective

- interpret information and results in context (Mathematical Processes, logic and reasoning, level 2)

Activity

This activity encourages students to discuss the problem co-operatively, interpret a calendar, and use sound reasoning. Before beginning the activity, you may need to review the students' calendar-reading skills by asking questions such as:

- How many weeks in this month?
- Which is the third Saturday?
- What is the date of the Saturday between Thursday 6 November and Tuesday 11 November?

Ensure that the students understand that a week is just 7 days, for example, Sunday to Saturday or Friday to Thursday. A common mistake made by students is that a week is from Sunday to Sunday or Friday to Friday, that is, 8 days.

You could introduce the activity by showing the students a large calendar, highlighting the dates of important events at your school, and asking the students to think about the likely reason for those days being chosen.

The students then need to work in pairs to decide which date they would choose and why. Make sure they realise that there is no right answer. This could be followed by a class discussion in which each pair shares their choice of Saturday and their reasoning.

The students may find it easier to compare Saturdays if they organise the data in a systematic way, for example:

Saturday 1 November	Saturday 8 November	Saturday 15 November	Saturday 22 November	Saturday 29 November
Town parade	Three teachers at wedding Room 4 teacher away	Rooms 5 and 6 camp Rooms 2 and 3 kapa haka practice Te Rata car rally	Strong winds	Strong winds Rooms 2 and 3 kapa haka practice

Page 2: Holding a Vote

Achievement Objectives

- make sensible statements about the situation represented by a statistical data display drawn by others (Statistics, level 2)
- collect and display category data and whole number data in pictograms, tally charts, and bar charts, as appropriate (Statistics, level 2)

Activity

This activity will give the students experience in interpreting a table of data. It also introduces them to the survey process.

You may like to begin with question **3a** before the students turn to this page. Ask the students to vote on how they think Te Rata School should use the money. Ensure that students' opinions are not influenced by others and that the wording gives clear choices. Page 7 of *Statistics*, Figure It Out, Levels 2–3, and the teachers' notes for that page contain useful information about writing survey questions.

Students could prepare a voting paper with the choices listed and put a tick in a box beside their preferred option:

Books for the library ☐
Kapa haka costumes ☐
Computer equipment ☐
Sports equipment ☐
Wellington trip ☐

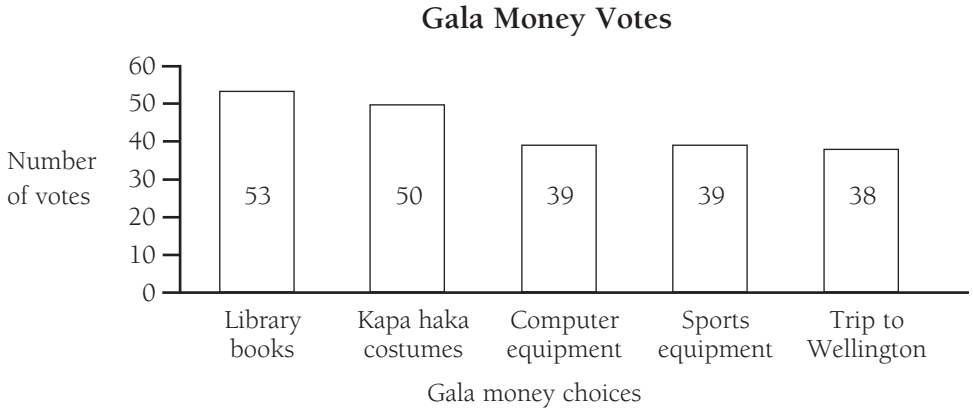
A tally chart would be a good way to record the votes. You may need to point out to the students that a vertical mark is used to represent each vote and a line drawn diagonally through the other four represents the fifth. This means that the totals can be quickly found by counting in fives.

Gala Money Options	Tally	Votes
Library books	II	2
Kapa haka costumes	𝍸 I	6
Computer equipment	𝍸 IIII	9
Sports equipment	III	3
Wellington trip	𝍸 II	7

Before you move on to the Te Rata students' votes, display the tally chart for your class. They will need to use it for question **3b**, which combines all the votes. The students could work on their own to answer question **1**, which gives them practice adding and thinking about numbers. Question **2** could be done in small groups. Some likely reasons are given in the Answers. Question **3** is a whole-class activity.

There are several ways to extend this activity:

- Ask the students to draw a bar graph using the data from question **1a** to show the results clearly.



The students could draw the graph on square grid paper or as a poster. Check that the students have included a title, that they have labelled the axes, and that the bars are evenly spaced and are the same width. The students should discuss with a classmate what their graph shows. You could also ask them to discuss why this graph shows the information so clearly.

- The class could use a computer spreadsheet to enter their own data and, separately, that of Te Rata School. They could compare the data by using various graphs, for example, a pie graph. Make sure that they think about which graphs are most useful for showing this information. If you or your students are not familiar with spreadsheets, see the teachers' notes for pages 12–13 of *Algebra*, Figure It Out, Level 3.
- Groups could prepare their own survey questions to ask the class about a gala their own school may be having. They could summarise their results on a table and share their findings. They could also use a computer spreadsheet, as suggested above.

Page 3: How Many People?

Achievement Objectives

- write and solve story problems which involve halves, quarters, thirds, and fifths (Number, level 2)
- solve practical problems which require finding fractions of a whole number and decimal amounts (Number, level 3)

Activity

Using fractions in this context will help the students to work out how to find fractions of larger whole numbers. Some students may have some difficulty visualising fractions of larger numbers such as 1 000. You could use a metre ruler or a number line and show the students halves, quarters, fifths, and so on. You could record your findings in a table:

Fraction part of 1 000	Number	As a thousandth
$\frac{1}{2}$	500	$\frac{500}{1000}$
$\frac{1}{5}$	200	$\frac{200}{1000}$

Discussing concrete examples such as: $\frac{1}{2}$ of a pack of cards, $\frac{1}{4}$ of a packet of Pebbles, $\frac{1}{2}$ of your height, $\frac{1}{2}$ of a kilogram, and $\frac{3}{4}$ of a packet of biscuits may also be useful.

Point out to the students the connections between fractions and division and multiplication so that they are able to see how to calculate the answers. For example:

- $\frac{1}{2}$ of 20 is 20 divided by 2
- $\frac{2}{3}$ of 21 is 21 divided by 3 and that answer is multiplied by 2.

The students will learn to use a calculator to find the fractional part of a larger number like 1 000. For example, $\frac{3}{4}$ of 1 000 is 1 000 divided by 4 and then that answer is multiplied by 3.

You could also explain that $\frac{2}{3}$ means 2 ÷ 3. The students need to understand that the line separating the numerator and the denominator of a fraction is the division operator. If the students grasp this at an early stage, many of their problems in later algebra will be solved. You could then discuss the following examples:

- $\frac{12}{3}$ is the same as 12 ÷ 3 = 4
- $\frac{100}{4}$ is the same as 100 ÷ 4 = 25
- $\frac{20}{4}$ of 100 is the same as 100 divided by 4 and that answer is multiplied by 20

  or

  $\frac{20}{4}$ of 100 is 20 ÷ 4 and that answer is multiplied by 100.

In question **2**, encourage the students to use mental reasoning by explaining how they worked their classmate's problem out and why they know their answer is right.

The students also deal with fractions of sets in question **2**, **Activity Two**, page 18.
Page 20 of *Number*, Figure It Out, Levels 2–3, deals with finding fractions of two-digit numbers. This page and its teachers' notes could tie in well with How Many People?

Pages 4–5: Terrific Treats

Achievement Objectives

- carry out practical measuring tasks, using appropriate metric units for length, mass, and capacity (Measurement, level 2)
- perform measuring tasks, using a range of units and scales (Measurement, level 3)
- demonstrate the ability to use the multiplication facts (Number, level 2)
- write and solve problems which involve whole numbers and decimals and which require a choice of one or more of the four arithmetic operations (Number, level 3)

Activity One

The students could do this activity in small groups. They will need to see the relationship between the amounts of ingredients in the recipe and the number of boxes: 6, 12 (6 x 2), and 120 (12 x 10 or 6 x 20). The students could summarise their results in a table.

	6 boxes	12 boxes (6 x 2)	120 boxes (12 x 10)
golden syrup	2 tbs	4 tbs	40 tbs
butter	100 g	200 g	2 kg or 2 000 g
brown sugar	$1\frac{1}{2}$ cups	3 cups	30 cups
condensed milk	1 can	2 cans	20 cans
vanilla essence	1 tsp	2 tsp	20 tsp
chocolate	75 g	150 g	1.5 kg or 1500 g
nuts, coconut, or fruit	$1\frac{1}{2}$ cups	3 cups	30 cups

For question **2**, the students may be able to use their knowledge of basic facts to mentally interpret the array patterns. For example, they may know that 4 rows of 8 is the multiplication fact $4 \times 8 = 32$. If they don't know that, they may know 4×4 and recognise question **2b** as double that. Encourage the students to make links to known facts by marking off parts of the array pattern they already know. Alternatively, they may mentally use repeated addition of the rows, which gives the multiples of 8: 8, 16, 24, 32, or the columns, which gives the multiples of 4: 4, 8, 12, 16, 20, 24, 28, 32.

As an extension, the students could:

- investigate other numbers up to 50 that would make rectangles suitable for fudge tins
- survey their classmates to find out whether nuts, coconut, or dried fruit is the most popular addition to fudge
- find out how much it costs to make 6, 12, and 120 boxes of fudge and suggest a charge per box. This assumes that no ingredients were donated.

Activity Two

This activity gives the students good experience in using equipment to measure accurately and in using measuring language. Discuss the quantities needed with the students and work through the recipe step by step. They may need to measure 25 grams by dividing up a larger quantity weighed on the kitchen scales.

You will need to explain the relationship between millilitres and litres before the students set about solving question **2**.

Some students may need support or hints with aspects of this task, such as:

- understanding the question
- deciding which operation is appropriate
- changing litres to millilitres (for example, converting 1.5 litres to 1500 millilitres)
- seeing that 1.5 litres is double 750 millilitres.

You could begin by working with the students to find out how many glasses there are in a 750 millilitre bottle and in a 1.5 litre bottle. A table is an excellent way to record results systematically. For example:

	Bottle size	Number of glasses in that bottle size	Number of bottles of that size	Total number of glasses (number of glasses × number of bottles)
a.	750 mL	3	2	6
b.	750 mL	3	10	30
c.	750 mL	3	16	48
d.	1.5 L (1 500 mL)	6	3	18
e.	1.5 L (1 500 mL)	6	15	90
f.	1.5 L (1 500 mL)	6	100	600

If the students record their results systematically, they may be able to figure out how to combine their answers to previous questions to answer later questions. For example, the answer to **2b** is 5 times **2a**.

You could extend the activity by:

- Using the quantities in question **2** to work with fractions. For example, "What fraction of a small bottle is a glass?" "What fraction of a large bottle is a glass?" "What fraction of a large bottle is three glasses?"

- Calculating the cost of making lemonade. Compare the cost with the prices for the same-sized bottle sold in a supermarket.
- Finding out how much of the solution needs to be mixed with water for best-tasting cordial. Calculate how much undiluted cordial would be needed for each part of question **2**.

Page 6: Making Boxes

Achievement Objectives

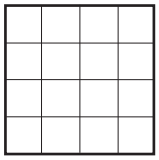
- carry out practical measuring tasks, using appropriate metric units for length, mass, and capacity (Measurement, level 2)
- design and make containers to specified requirements (Geometry, level 3)
- design and make a pattern which involves translation, reflection, or rotation (Geometry, level 3)
- enlarge, on grid paper, simple shapes to a specified scale (Geometry, level 3)

Activity

This activity allows the students to explore the relationship between 3-D packaging shapes and 2-D flat designs.

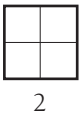
Pulling a box apart will enable the students to see how the box is made and to note the relationships between the sides, top, and base. The students will need to take care to only pull apart glued joints and not to tear the cardboard. They should look for the glued tabs that hold the sides together. Ask the class to look carefully at the pulled-apart box and discuss what they notice about how the boxes have been made.

Because the boxes will vary in size, demonstrating how to draw an enlarged and reduced shape will be useful. Begin with a basic shape like a square, taking care that the enlarged and reduced copies have the same proportions as the original.

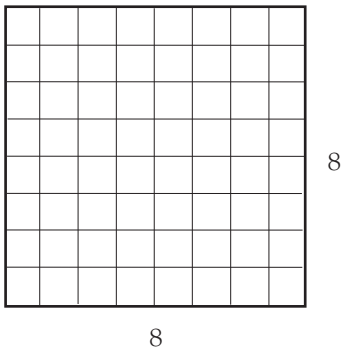


Draw this onto an overhead transparency marked with a square grid.

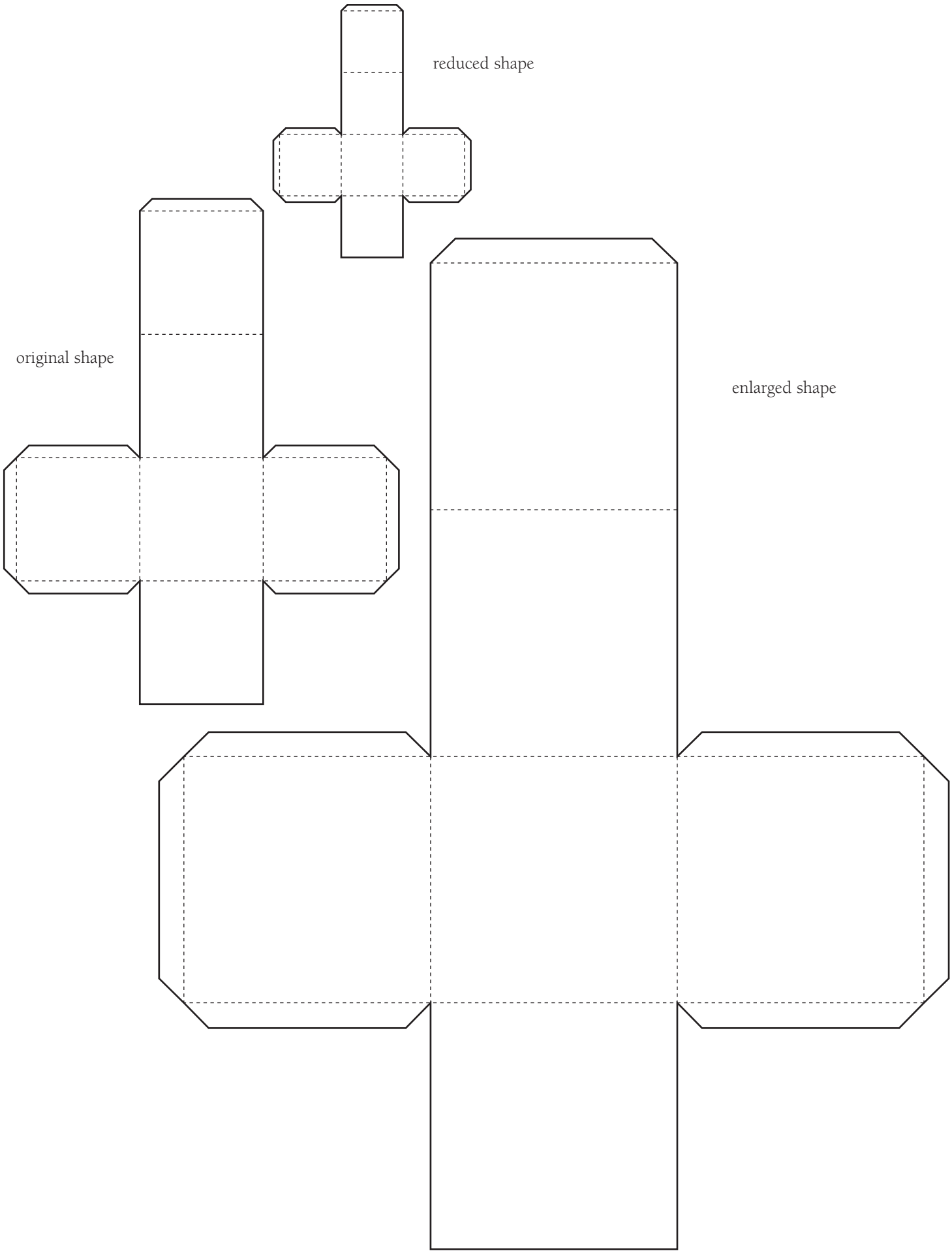
Use the squares to show the effect of reducing each side by a half



and enlarging each side by a factor of two.



When the students understand enlargement and reduction of a simple shape (such as the square above), show them an enlarged and a reduced shape of a net.

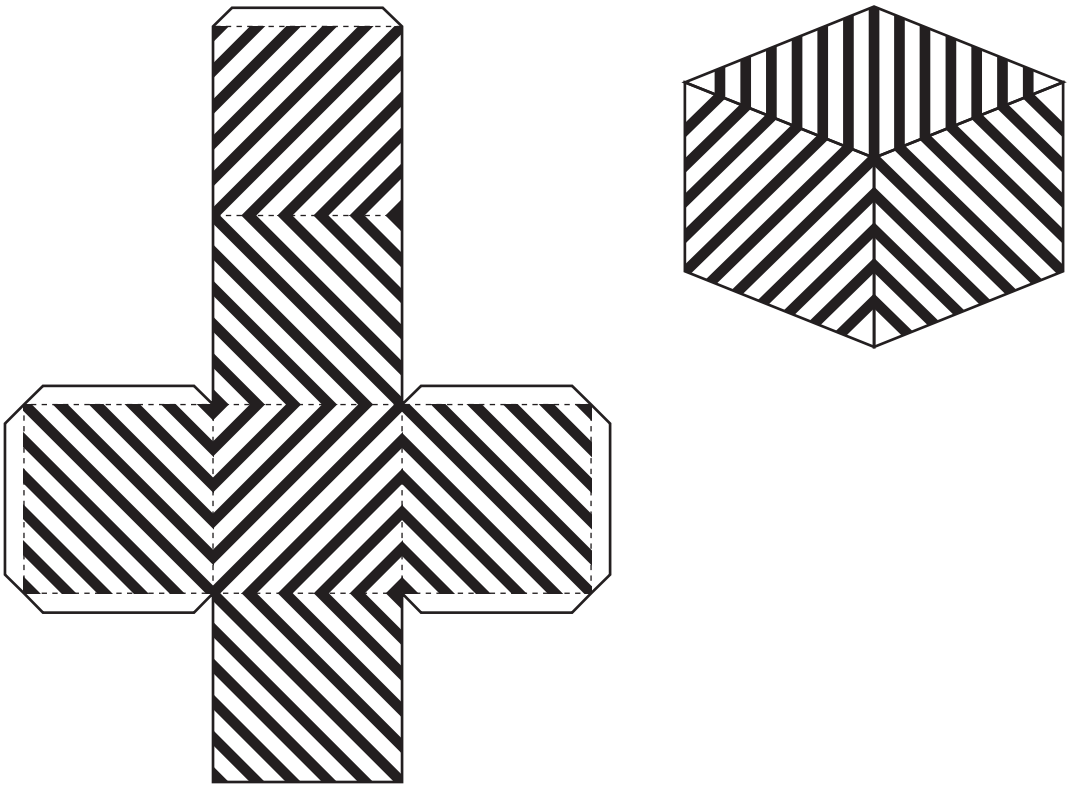


Note that the enlarged and reduced nets still have the same proportions as the original.

When you check the students' answers, make sure that the enlargements and reductions have the same proportions as their original designs. Listen to the students describing their designs to their classmates to check their understanding of translation, reflection, and rotation.

Growing Changes on page 24 of *Geometry*, Figure It Out, Level 3, shows how overhead projectors can be moved closer or further away from the screen to demonstrate enlargement and reduction of a shape. The shape will still have the same proportions. Note that in Growing Changes, the students are projecting onto a screen that is marked with a square grid. The overhead transparency does not have a grid on it.

In question **2**, the students make a decorated box. They could use a stencil and light pencil to try out various positions and to visualise what the end product may look like once it is folded and taped.



This net pattern shows horizontal reflection between two centre folds and vertical reflection between the centre and ends.

Before showing their boxes to classmates, the students could write a set of instructions for making boxes, using the language of geometry. The classmates could follow the instructions to make the boxes and then compare them with the original boxes. The boxes should be displayed around the classroom. If not used for gala stall sweets, they would make nice gift boxes to use at home for events such as birthdays.

Page 7: Is There Room?

Achievement Objectives

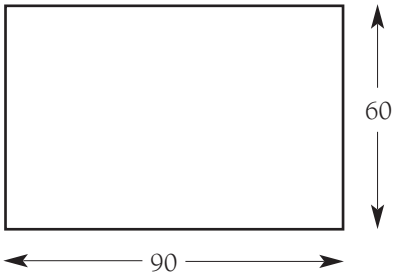
- perform measuring tasks, using a range of units and scales (Measurement, level 3)
- demonstrate knowledge of the basic units of length, mass, area, volume (capacity), and temperature by making reasonable estimates (Measurement, level 3)

Activity

In this activity, the students will need to apply their knowledge of area and how to calculate the area of rectangular shapes. This may be the first time they have found area from a diagram drawn to scale. You should discuss why it is not possible to do a drawing of the actual park in the book and why it has to be represented by a diagram drawn to scale. In this case, the scale is 1 : 1 000 or 1 centimetre : 10 metres.

The students will have had previous experiences finding area by counting non-standard units and concrete units, such as 1 centimetre cubes and squared diagrams (or pieces of fudge, as on page 4). From this, you will need to check that they understand and can express in their own words that the area is found by "multiplying the measurement along the length by the measurement across the width" as they may have done with a multiplication array. Some visual models of 1 metre square would also be helpful for imagining dimensions involved in the task. The students will have worked with 1 metre square in page 4 of *Measurement*, Figure It Out, Levels 2–3.

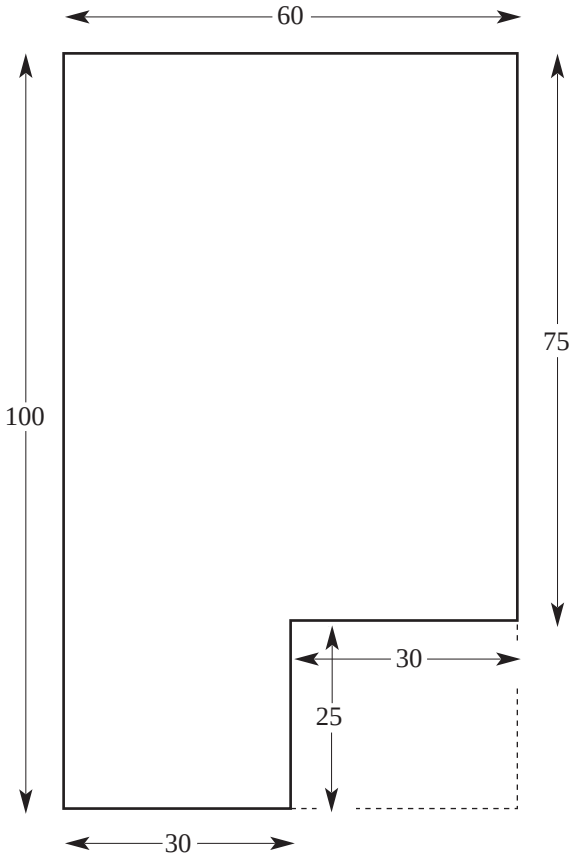
The students will probably find it easier to begin by calculating the area of this year's gala.



$90 \times 60 = 5\,400\ m^2$

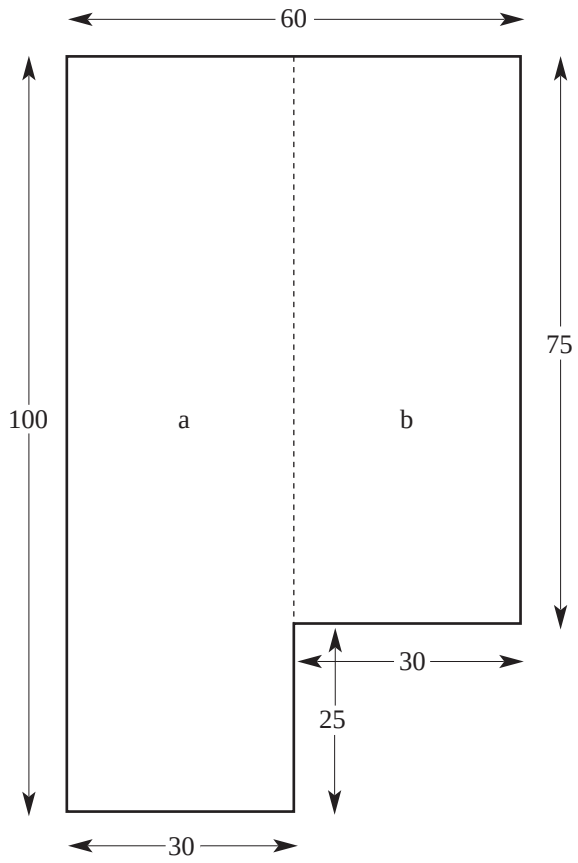
Encourage the students to use a problem-solving approach to investigate different ways of finding the area of last year's gala. This may include:

- taking the smaller rectangle away from the larger



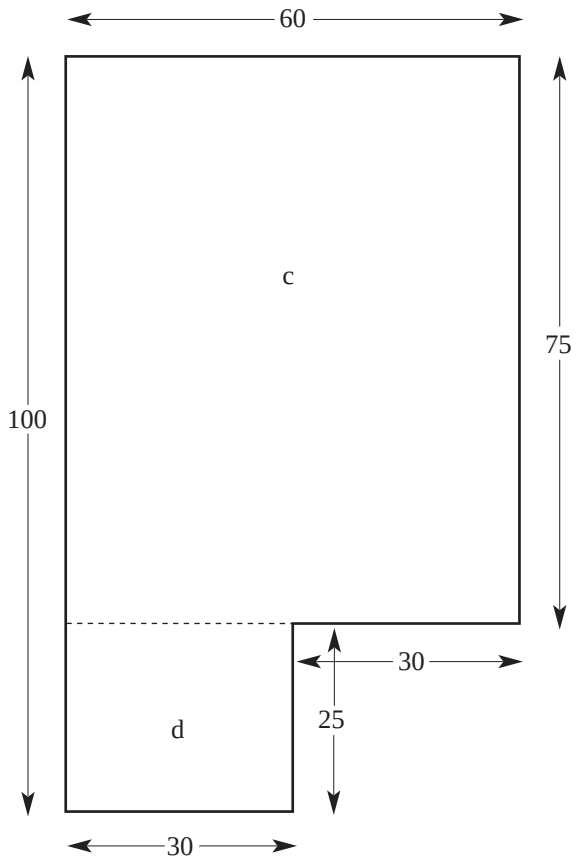
$(60 \times 100) - (25 \times 30) = 5\,250\ m^2$

- combining shapes a and b



$(100 \times 30) + (75 \times 30) = 5\ 250\ m^2$

- combining c and d



$(60 \times 75) + (30 \times 25) = 5\ 250\ m^2$

During the activity, encourage the students to stop to discuss and share the strategies that the groups are using before they continue to work out other strategies. Students having difficulty with formal measurement could compare the two shapes using concrete materials and non-standard units.

Don't forget to compare the measurements of the two diagrams to answer the original problem.

As an extension, the students could attempt to draw an irregular shape with the same area as this year's gala field.

Page 8: Looking Good

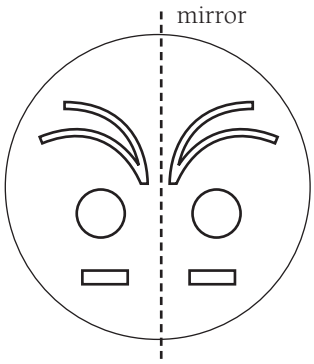
Achievement Objective

- create and talk about geometric patterns which repeat (show translation), or which have rotational or reflection symmetry (Geometry, level 2)

Activity

In this activity, the students practise distinguishing between the ways shapes can change by reflecting (flipping), rotating (turning), and translating (sliding or moving along in any direction).

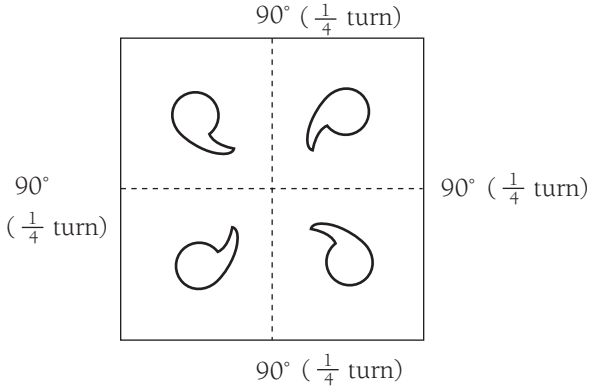
To see whether **design a** shows reflection, the students could put a perspex mirror on the half-fold (mirror line) and confirm that this completes the design.



The orientation is reversed or flipped. The reflecting shape has the same relationship to the mirror line as the original shape has.

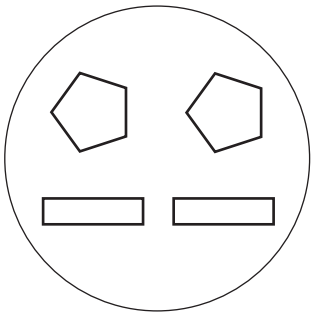
The students need to note that the shape in **design b** has turned about a point to complete a full circle. They should also explain how it has turned. They can check this by using tracing paper and a pin and then tracing over the shape in the top left corner. Using a pin to hold the tracing paper at the point of rotation, the students can turn the paper to describe the path and $\frac{1}{4}$ turn rotation of the face design.

The shape is turned clockwise around a point.
The orientation does not change.



The students need to recognise the shapes that have moved along without changing their shape or orientation, such as the shapes in **design c**.

The shapes have slid without changing their shape or orientation.



In question **2**, the students can create designs by making card stencils for shapes they would like to use on the face. They can move the shape(s) in different ways to create their face-painting pattern. Use the words "translating", "reflecting", and "rotating" as you encourage the students to experiment with the pattern they have created. Once the students are satisfied, they can colour their designs, using plenty of colour to highlight interesting patterns.

The activity may be extended further by:

- the teacher selecting and copying some of the students' designs for use on the overhead projector and the students explaining those designs to the class
- the students combining more than one transformation within a design. For example, the design could rotate, then translate, rotate, and then translate.

Page 9: Gumboots Away!

Achievement Objectives

- carry out practical measuring tasks, using appropriate metric units for length, mass, and capacity (Measurement, level 2)
- write and solve problems which involve whole numbers and decimals and which require a choice of one or more of the four arithmetic operations (Number, level 3)

Activity One

The students will need to measure accurately in centimetres, calculate a simple scale, and organise their results. They need to appreciate that although the representation is simply a matter of switching the unit from centimetres to metres, the scale is actually 1 : 100 because 1 centimetre on the line drawn shows 100 centimetres (1 metre) of actual distance. This is represented by the scale statement at the top of the results chart, "1 centimetre : 1 metre".

A table will be useful to record, convert, and analyse results.

Contestant	Scale measure of best throw	Distance	Scale measure of 2nd best throw	Distance	Total	Place
Suzie	8 cm	8 m	8 cm	8 m	16 m	2
Mere	9 cm	9 m	6 cm	6 m	15 m	3
Theo	9 cm	9 m	8 cm	8 m	17 m	1
Duncan	9 cm	9 m	4 cm	4 m	13 m	4

Activity Two

The class will need to discuss the rules for the gumboot-throwing competition, for example, where they will throw from, how long the run up (if any) can be, and whether the throw is underarm or overarm. They will need to measure accurately with a tape measure, making sure that the tape is held taut by a partner and locked in place when reading the scale. Encourage the students to estimate the length of their throws before they measure them.

Here is an opportunity to demonstrate the relationship between metres and centimetres and to use simple decimals. A measurement such as 7 metres and 55 centimetres can be converted to 7.55 metres or 7 and $\frac{55}{100}$ metres. 7.55 metres will then convert to 755 centimetres.

As an extension, the students could represent their throws on a scale drawing using a scale of 1 centimetre : 1 metre. This means that a throw of 7.55 metres would be represented by a line 7.55 centimetres long. The students could then draw lines to scale for their two best gumboot throws on the whiteboard or display them with string or wool on a classroom wall space. Results that compare the students' performances may be summarised on a class chart using similar headings to that suggested for **Activity One**.

A further extension could be to hold another contest, but this time using a different scale to represent the results, for example, 1 centimetre : 5 metres, or throw, measure, represent, and compare different objects, such as a tennis ball or a rugby ball. Throws may be estimated and measured with a trundle wheel or markers set out on the grounds, which students can use to measure their throws.

Page 10: Who Am I?

Achievement Objective

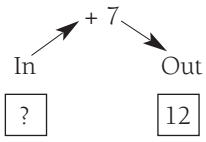
- solve problems of the type $\square + 15 = 39$ (Algebra, level 3)

Activity One

In this activity, the students should have fun being detectives and attempting to find the mystery numbers. At the same time, they will be further enhancing their understanding of balance or equality in the structure of equations. The students will also apply their knowledge of the nature of addition, subtraction, multiplication, and division. Remind the students that they need to identify the inverse of those operations (backtracking). You may have to work through a puzzle to highlight this and to help the students to follow what is happening.

Some students may have had some previous experience with input and output machines, for example, pages 10–11 of *Algebra*, Figure It Out, Level 3.

Example



In this activity, the output is given and the original input number has to be found. The students will need to think of the inverse operation to help find the input number that will balance the equation. For example, in question **1**, some students may be able to process this operation mentally by thinking "7 added to a number is equal to 12. 12 minus 7 gives 5. The number must have been 5 before 7 was added."

The input number before the 7 was added to give the output number of 12 must be 5: $5 + 7 = 12$.

The students should find that writing down problems to chart their course will be easier than doing them mentally. This will help the students to understand the need to retain balance when working with true equations and to think about how to backtrack the equations.

If the students are having trouble calculating the answers mentally or on paper, you could work through the first question with them:

$\square + 7 = 12$

$\square + 7 - 7 = 12 - 7$ Subtract 7 from each side so the equation is still balanced.

$\square = 12 - 7$

$\square = 5$

Here are some ways the students might chart or write number statements to solve the puzzles:

1. $\square + 7 = 12$ $\square = 12 - 7$

2. $\square \div 2 = 15$ $\square = 15 \times 2$

3. $\square - 6 = 10$ $\square = 10 + 6$

4. $29 + \square = 36$ $\square = 36 - 29$

5. $\square - 2 = 20 \div 2$ $\square = 10 + 2$

6. $(\square + 3) \times 2 = 18$ $3 + \square = 18 \div 2$ $\square = 9 - 3$

7. $\square + \frac{12}{4} = 30$ $\square + 3 = 30$ $\square = 30 - 3$

There are other ways to think out or chart these puzzles, including guess and check. Ask the students to share all the strategies they used in solving these puzzles.

Activity Two

The students can create their own number puzzles. Writing the equation first could be helpful. For example:

$5 \times 6 + 4 = 34$ $\square \times 6 + 4 = 34$

This could become: Multiply me by 6 and add 4 to me to make 34.

As an extension, you could challenge the students to include context problems. For example:

If you multiply the number of pairs of shoes in my wardrobe by 6 and add 4, there will be 34 pairs of shoes altogether.

Page 11: Aim Straight

Achievement Objectives

- write and solve story problems which require a choice of any combination of the four arithmetic operations (Number, level 2)
- mentally perform calculations involving addition and subtraction (Number, level 2)

Activity One

In this activity, the students will need to think about number combinations to solve puzzles involving addition and subtraction. They should be able to find the correct answers by using mental estimates and trial and improvement.

As a starter, you could ask the students to brainstorm how many different ways they can see that one of the friends could score 50 points in one round. For example,

20 + 15 + 15, double 5 + 20 + 20, double 20 + 5 + 5, double 15 + double 5 + double 5.

The students should be able to find answers to questions **2** and **3** if they use a guess-and-improve strategy and work from a systematic list of numbers possible to hit. Encourage the students to mentally estimate the answer before they confirm it with a calculator. They will need to find the sum of combinations of up to three of the numbers listed below. Encourage them to look for more than one answer. You may like to point out that if a ball misses the board altogether, the player scores no points for that ball. The students could work in groups and then compare results with other groups.

> Possible green totals each throw (that is, the numbers shown on the game board):
> 3, 4, 5, 8, 11, 12, 15, 20.
>
> Possible yellow totals each throw (that is, twice the numbers shown on the game board):
> 6, 8, 10, 16, 22, 24, 30, 40.
>
> Possible orange totals each throw (that is, three times the numbers shown on the game board):
> 9, 12, 15, 24, 33, 36, 45, 60.

Some students may wish to investigate the scores more systematically by listing all the possible combinations, that is, if all three shots are trebles, doubles, or single scores; if two shots hit one target area and one of the others; and so on. Finding all the possible combinations will take a considerable amount of time.

Activity Two

This activity gives the students practice adding and multiplying one- and two-digit whole numbers. Encourage the students to do the calculations mentally or on paper. Calculators may be used to check calculations. The students could use string, coloured chalk, and cricket wickets to describe circles. You will need to discuss with the students issues such as the relative size of concentric

circles for targets and how far back and how to stand for the throw. The students will need to decide what to do for a stone or bag that lands half in one section and half in another.

As an extension, you could develop the game by changing the rules, for example:

- The person scoring closest to a specified number, for example, 200, wins. This will encourage mental estimation.
- Increase the number of throws in a round.

Pages 12–13: Lunchtime!

Achievement Objectives

- give change for sums of money (Measurement, level 2)
- represent a sum of money by two or more different combinations of notes and coins (Measurement, level 2)
- write and solve problems which involve whole numbers and decimals and which require a choice of one or more of the four arithmetic operations (Number, level 3)

Activity

Encourage the students to work out the problems mentally, using their own preferred and varied methods. Your main task will be to ensure that the students think carefully about the information given, understand what the problem is asking them to do, and look for the important information that will help them to solve the problems.

Ask supplementary questions or give hints if the students are stuck. For example:

- What is the question asking you to do?
- How many hamburgers does he buy?
- How much is that?
- How did you work that out?
- Can you add them all together?

A few students may need to model the situations with toy money, and others may like to keep some brief records on scratch paper or in a calculator memory. You might also suggest that some organised listing could help keep track of their progress:

	Customer has	Orders paid for	Do they have enough money?
Question **1**	$20	2 burgers @ $2.50 = $5.00 2 fritters @ $2.00 = $4.00 2 curries @ $3.00 = $6.00	Yes
Question **2**	...	...	...

For question **3b**, the students could use a table to find all the possible ways they could pay for a $6 lunch, using notes and/or gold coins:

$5	$2	$1
I		I
	III	
	II	II
	I	IIII
		IIIIII

Ask the students to explain how they worked out the answers, especially combining small amounts of money. You could follow up the set task by asking the students to write and share their own lunchtime problems with the class.

The students will need to understand profit and how to calculate it to answer question **5**. You could work through a simple problem with the students before they begin the question. For example, Mr Larson sells 50 sausages at $1 each. He has bought the sausages for 25 cents each. How much profit did he make?

Page 14: Clara's Cowpats

Achievement Objectives

- describe and interpret position, using the language of direction and distance (Geometry, level 2)
- draw and interpret simple scale maps (Geometry, level 3)

Activity

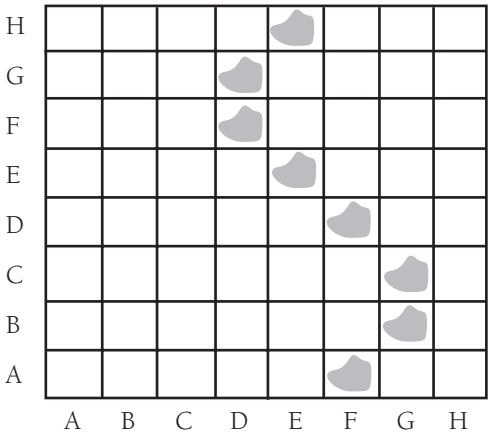
In this activity, the students will gain experience in reading and plotting positions on a grid. The activity explores the idea of using letters to explain the position of something. The students need to realise that the order of the letters is important. For example, in A,F, Prema's guess, the across letter (the distance along the horizontal axis) is written first. Note, though, that the labels refer to the square spaces rather than the intersecting lines of the ordered pair and co-ordinate system.

Explain to the students how we need such a location system when we find places on maps or find a seat at the movies. A possible introduction could be to prepare two sets of alphabet cards labelled A to H and model the grid on the classroom floor. Students could be randomly assigned to a square on the grid or could be placed on a spot and asked to state the label of their square.

Question **2** will be useful for sharing and discussion. The students need to realise that Clara's second cowpat lands on two squares.

Some extension ideas include:

- Two students play a game similar to Battleships. Each player has a grid and marks on it a trail of cowpats in adjacent squares that starts on one side of the grid and goes to the other. The other player tries to find the trail by calling out labels of squares where cowpats might be. The first player to complete a trail as marked on their partner's grid wins.



Cowpat trail

- Two players each have a grid on which they place six items typically sold at a school gala, for example, fudge, a pot plant, a drink, clothing, comics, and books. The players take turns trying to collect all six items into their basket by calling the correct labels for squares. Their partner is required to indicate a near miss if a player's call is only one square away.
- Two players have a 6 x 6 grid between them. They throw two dice marked A to F or spin a spinner. One throw or spin gives the horizontal reference, and the second gives the vertical reference. The player puts a counter in the square. The first player to have three of their counters in consecutive squares (vertical, horizontal, or diagonal) is the winner.

Treasure Trove on pages 6–7 of *Under the Sea*, Figure It Out, Levels 2–3, also deals with grids and co-ordinates. Note, though, that this activity uses co-ordinates that refer to intersecting lines rather than the square spaces.

Page 15: Getting Better

Achievement Objectives

- describe in words, rules for continuing number and spatial sequential patterns (Algebra, level 3)
- use words and symbols to describe and continue patterns (Mathematical Processes, logic and reasoning, levels 2 and 3)
- use graphs to represent number, or informal, relations (Algebra, level 3)

Activity

This activity requires students to continue a pattern, first by observation and secondly by plotting a relationship onto a linear graph to make a prediction. Some students will spot the patterns quite quickly. Nevertheless, they will still need to organise the information to accurately plot the ordered pairs onto a number plane for question **3**.

Organising data in a table is a useful way to find and describe patterns.

Emma's games	1	2	3	4	5	6
Scores	23	27	31	35	39	...

Kenny's games	1	2	3	4	5	6
Scores	6	11	17	24	32	...

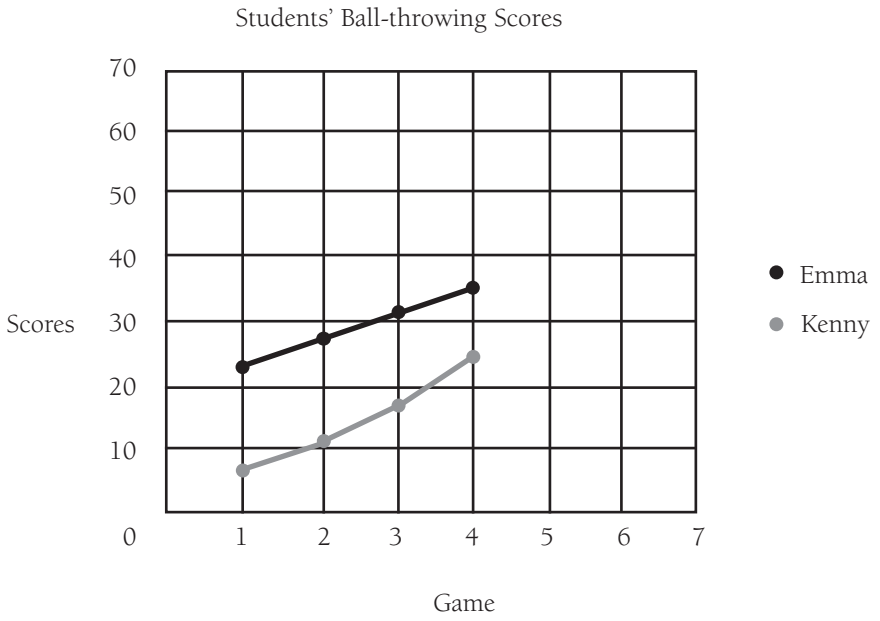
+ 5 + 6 + 7 + 8 + 9

Encourage the students to explain the patterns in their own words, for example, "going up by four each game", "going up by one more each time", and so on.

The students can use the tables for questions **1** and **2** to list ordered pairs for question **3**:

- (1, 23), (2, 27), (3, 31), (4, 35), (5, 39), (6, 43)
- (1, 6), (2, 11), (3, 17), (4, 24), (5, 32), (6, 41)

This will enable the students to plot the relationship between the two variables, games and scores, onto a linear graph. You will need to emphasise the importance of accuracy in plotting the points, otherwise the students won't be able to draw an accurate line. The students should draw graphs that are bigger than the one shown in the students' book. Larger squares make it easier to plot accurately. Make sure you also emphasise that the students put the game (the independent variable) on the horizontal axis and the score (the dependent variable) on the vertical axis.



In question **3b**, future predictions can be made by extending the line a stage further and reading the corresponding dependent variable for game seven. Providing the line was drawn accurately, the prediction will also be accurate. Highlight and discuss with the students the comparison between the tables and their numeric prediction and the prediction on the graph.

As an extension, you could ask the students to compare their graph with a reducing pattern or an unpredictable score. For example:

- Ask them a question with scores that decrease at a constant rate (for example, four less each time). How does this change on the linear graph?
- Ask them a question with random scores showing no pattern. How will this appear on the graph?
- Ask them to discuss how Te Rata School could be sure to make a profit on this game. They will need to decide or find out:
  - what the players need to do to win a prize (do they need to reach a certain score, or will they be the players with the highest scores at the end of the day?)

– how much the prizes cost

– how much they should charge people to play.

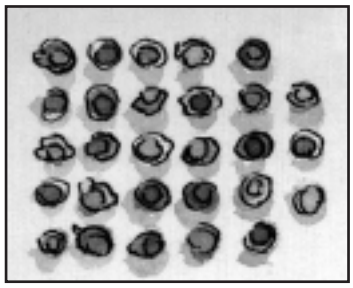
Pages 16–17: Entertaining Patterns

Achievement Objectives

- demonstrate the ability to use the multiplication facts (Number, level 2)
- mentally perform calculations involving addition and subtraction (Number, level 2)
- continue a sequential pattern and describe a rule for this (Algebra, level 2)

Activity One

This activity gives the students a chance to apply their number-sense skills and knowledge of operations. They should be able to do quick mental operations by translating readily seen patterns into numbers of subtotals. You will need to give the students an opportunity to share and to discover which methods are most efficient. For example, the students may see this group of people as:



$(5 \times 5) + 3 = 28$

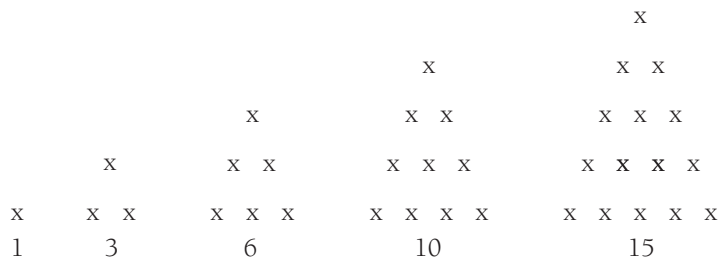
or

$(5 \times 6) - 2 = 28$

or

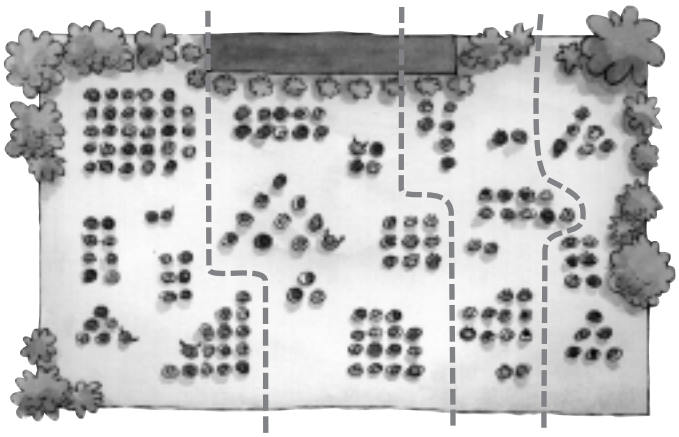
$5 + 5 + 5 + 5 + 5 + 3 = 28$

The students will find that they can easily count some groups if they use the multiplication array and their knowledge of triangular numbers. For example, the first five triangular numbers are:



The students will see that this group of people is the third triangular number, 6.

Any number up to 4 can be seen instantly and could be added mentally as a separate group. It may be helpful to break the diagram into regions, as shown below.



Activity Two

The students can use several strategies to identify and continue the pattern on the adults' costumes. They could use the mosaic pattern blocks issued as part of the Beginning School Mathematics resource (Ministry of Education, 1985–1993) to make up the pattern as shown and then extend it to the fifth row. They could then count the number of triangles of each colour.

Another strategy is to record the number of triangles in each row in a table and then analyse it:

Row number	1	2	3	4
White triangles	2	4	6	8
Orange triangles	0	2	4	6

The students should quickly see that the number of triangles of each colour increases by two in each successive row. The students could generate this sequence from most calculators, using the constant function:

+ 2 = = = = = .

Finally, the students could draw the fifth row of the pattern, as they are required to do for question **1b**.

Before the students begin question **2**, make sure that they understand that after the fifth row of the adults' costumes, the number of triangles decreases in each successive row. (The copymaster shows how the overall shape comes back in again.) You could draw the sixth row with the students. You might also like to ask them to work in small groups to make up the complete, 10-row pattern.

The number of triangles in each row of the adults' costumes is:

Row number	1	2	3	4	5	6	7	8	9	10
White triangles	2	4	6	8	10	8	6	4	2	0
Orange triangles	0	2	4	6	8	10	8	6	4	2

As an extension, you could encourage the students to look at and analyse pictures or examples of other kapa haka costumes or tukutuku patterns. Two other patterns that could be extended and analysed include:

Tapatoru pattern

```
                              X
                 X          X X
  X            X X        X X X
1 cross     3 crosses    6 crosses
```

Tapawha pattern

```
                          X X X
               X X        X X X
  X            X X        X X X
1 cross     4 crosses    9 crosses
```

The first pattern, and others, are explored on page 3 of *Algebra*, Figure It Out, Level 3.

Page 18: Plant It

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)

Activity One

This activity will give students further experience in breaking down calculations into key steps. They are likely to attempt the problem in various ways, such as written equations, using a table, mental calculation, or using a calculator memory function.

Talk through the table with the students and make sure they understand how to choose the appropriate pricing category. For example:

- "If you bought six trays of flowers, how much would you pay?" ($8 x 2)
- "How do you combine the cost of two types of plant?"

The students could use a table, such as the one below, to help itemise purchases and to avoid having wrong answers caused by the incorrect order of operations, which can happen if they use a basic calculator.

Gardeners	First item bought	Second item bought	Third item bought	Total cost
Grace	$20	$15	–	$35
Mr Puketapu	$6	$20	$10	$36
Mike	$30	$24	–	$54
George	$30	$24	$12	$66

Encourage the students to develop their own table format to share with the class.

Using the calculator memory on a basic calculator avoids this incorrect order of operations. This type of question is excellent for giving the students experience in using a calculator memory to efficiently solve problems. For example, for question **1b**, they would key in:

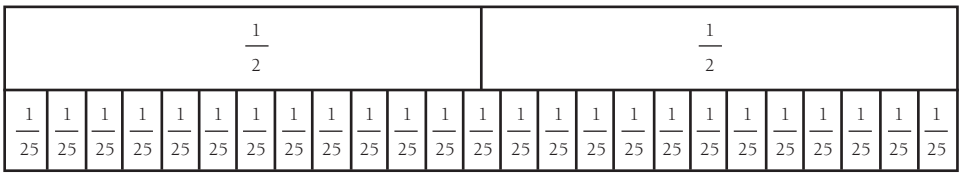
2 x 3 M+
2 x 10 M+
2 x 5 M+
MRC

Encourage the students to mentally estimate the answer as well as using a calculator so they can be alerted if their answer is not sensible.

Activity Two

In this activity, the students are dealing with fractions. Finding half of an odd number, as in question **1**, is not as straightforward as finding half an even number. There are several ways you could help students answer question **1**:

- Ask them what half of 24 is and how they worked that out. "What about half of 26? What about half of 25?"
- Begin with a similar question with lower numbers. For example, "Malcolm kicked seven goals out of 11. Was he successful with more than half or fewer than half of his attempts? How do you know?"
- Model the question with toy money. You could start with denominations such as two $10 notes, two $2 coins, and two 50 cent pieces and then try other denominations that don't divide into halves so easily.
- Create a model, such as a fraction chart, and ask the students where halfway is.



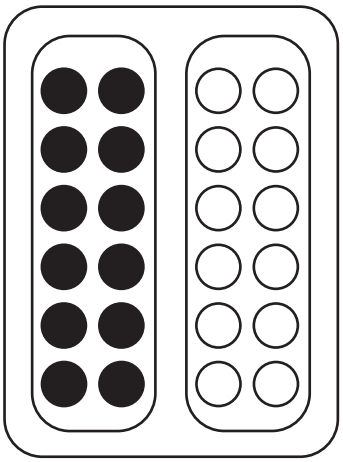
As an extension, the students might like to investigate the relationship between $\frac{101}{201}$ and a half.

Some students may like to model question **2** with materials such as counters, beans, or their classmates. For example, "If there are 24 beans (or children), how do you find a half? How do you find a third? How many are left?"

Some students may also need to use concrete materials to write new problems for question **3**.

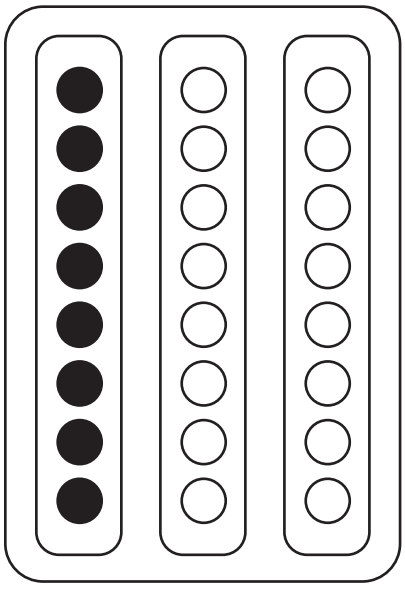
$\frac{1}{2}$ of 24 = 12

($\frac{1}{2}$ of 24 is 24 divided by 2 and the answer multiplied by 1)



$\frac{1}{3}$ of 24 = 8

($\frac{1}{3}$ of 24 is 24 divided by 3 and the answer multiplied by 1)



Some students may have noticed the relationship between equal subsets (that is, fractions) and division and will therefore be able to use their knowledge of division to calculate the answer. You will need to use your own judgment as to which approach will be best for your students.

Page 19: Luck of the Draw

Achievement Objectives

- write and solve problems which involve whole numbers and decimals and which require a choice of one or more of the four arithmetic operations (Number, level 3)
- predict the likelihood of outcomes on the basis of a set of observations (Statistics, level 3)

Activity

This activity involves a range of computational skills in a problem-solving context. It gives the students useful experience in choosing the appropriate computational strategy and keeping track of progress. Discuss with the students the concept of profit as the selling price minus the costs and illustrate this with appropriate examples. For example, for question **1**:

Kirk sold 60 tickets at \$1 each: $60 \times \$1 = \$60$.
He paid \$20 for the prize: $\$60 - \$20 = \$40$.
Kirk's profit = \$40.

Adele sold 100 tickets in lots of 5: $100 \div 5 = 20$ lots of 5 tickets.
One lot of 5 tickets costs \$2, so 20 lots of 5 tickets is $20 \times \$2 = \$40$.
The prize costs \$25: $\$40 - \$25 = \$15$.
Adele's profit = \$15.

Total profit: $\$40 + \$15 = \$55$.

Thinking about procedures and organising data are the key aspects of this question, so make calculators readily available for the computational parts of the question. Encourage the students to systematically record each step and explain their reasoning for it.

At this level, the students will have explored chance by investigating games or discussing real world events, such as the weather. Discuss the idea of even chance (for example, a 50–50 chance or half chance) compared with certain chance or no chance. For example, for question **3**, Susie would need to buy 50 (half) the tickets to give her a $\frac{50}{100}$ or $\frac{1}{2}$ chance of winning. To buy 50 tickets, she spends $10 \times \$2 = \$20$, which is only \$5 less than the value of the chocolates. Your students might like to debate the wisdom of buying the tickets. Would she be better off to spend \$25 and be sure of getting the chocolates? But the purpose of the gala is to raise money, so she might be quite happy to spend a lot on raffle tickets.

Page 20: Creative Critters

Achievement Objectives

- continue a sequential pattern and describe a rule for this (Algebra, level 2)
- write and solve story problems which require a choice of any combination of the four arithmetic operations (Number, level 2)

Activity

Talk this problem through with your students to make sure that they know what information is important and what needs to be done.

- "What is the question asking you to find out?"
- "What information is important to solve the problems?"
- "Which do you think is going to be the most expensive set of toys?"
- "Two rabbits mean how many balloons altogether?"
- "What should you do before solving the problem?" (Find the cost of each toy.)

Students will either use repeated addition or multiply. Encourage them to multiply, especially when calculating the same toy. Some students may need to model the problem with concrete objects or drawings on cards. Another strategy is to simplify the process in a table.

Toy	Snake	Rabbit	Dog	Aeroplane	Total cost
Number of balloons	1	2	3	4	
Cost of toy	75c	$1.50	$2.25	$3.00	
Child A	–	–	2	–	$4.50
Child B	–	2	–	1	$6.00
Child C	–	–	–	3	$9.00
Child D	–	1	1	–	$3.75
Child E	1	1	1	1	$7.50

The students may have different levels of understanding of operations that involve money and where to place the decimal point to express the answer in dollars and cents. You may find it beneficial to discuss similarities and differences between multiplying whole numbers and money that involves cents. Students will need to multiply by 75 cents mentally, with a pencil, or on a calculator. Some students may have trouble knowing where to put the point that separates the dollars and the cents after they have multiplied by 75 cents. For example, one aeroplane and two rabbits will be $8 \times 75 = 600$. The students know that 75 cents is a bit less than $1, and $8 \times \$1 = \$8$, so the answer to 8×75 must be a bit less than $8. It should then be clear that the separating point goes between the 6 and the first 0, that is, $6.00.

Question **2** is quite a challenging problem. There are two important pieces of information: the price, $9, which when divided by 75 cents gives a total of 12 balloons altogether, and the fact that there must be four toys.

The students will find a few solutions through guess and check and using a table.

Animal	Snake	Rabbit	Dog	Aeroplane	Total balloons
Number of balloons	1	2	3	4	
First guess	1	1	1	1	10 No
Second guess	2	1	1	–	7 No
Third guess	–	2	–	2	12 Yes

First guess 4 animals but only 10 balloons – wrong
Second guess 4 animals but only 7 balloons – wrong
Third guess 2 rabbits and 2 planes, 12 balloons – right

If they are systematic, the students should find all the possible solutions. They could do this by listing all combinations of four toys and checking off those that total 12 balloons (or $9). All the possible solutions are given in the Answers.

S (x 1)	R (x 2)	D (x 3)	P (x 4)	Total balloons
1	1	1	1	10
1	2	1		8
1	2		1	9
1	1	2		9
1		1	2	12 Yes
1	1		2	11
2	1	1		7
2		1	1	9
2	1		1	8
2	2			6
2		2		8
2			2	10
3	1			5
3		1		6
3			1	7
4				4

As an extension, the students may like to convince their teacher that they know they have found all the possible answers. This will mean continuing the table above to cover all possible combinations.

Page 21: Gala Games

Achievement Objective

- write and solve problems which involve whole numbers and decimals and which require a choice of one or more of the four arithmetic operations (Number, level 3)

Game

This is a game of chance designed to give the students practice adding and subtracting small amounts of money while keeping a running total. In particular, it can give the students excellent experience in:

- calculating mentally (with partners checking calculations)
- using the memory function of a calculator.

Some students may need help to interpret the problems, particularly where more than one item is asked for. Encourage the students to read carefully and identify the relevant information for each calculation. For example, square 28 says "Buy yourself *and* a friend a drink each."

The students could use tables to keep a running total. For example:

I have	Gained	Lost	New amount
$20.00	$2.00		$22.00
$22.00		50c	$21.50
$21.50	$4.00		$25.50

or

Lauren	Rex
$20.00	$20.00
$22.00	$26.00
$21.50	$24.00
$25.50	$44.00

Ask the students to play at least one game keeping a running total in writing and using the memory function of a calculator. For example:

Key in [20], [M+], [4], [M+], [2], [M–] ... [MRC].

This shows the memory key in actions, and they have a paper record of what happened in the calculator memory. When they press [MR] or [MRC] at the end of the game, they can only buy an ice cream if the total they state from mental computation is the same as that in the display.

The game can be made easier by having the students work physically with toy money. The game can be made more challenging by adding a zero to all the money amounts (or other adjustments).

The game can be further developed by giving each student a square grid on which to design their own version of the game, to be swapped with classmates and put on a maths table.

Some students may run out of money. If this happens, as the rules state, the student must start again. You could ask the students to keep a record of how often this happens and how much money they have at the end of the game. After many students have played the game, you could use this data to discuss the following:

- In 10 games, how often do you think you could afford an ice cream?
- How much money on average would you expect players to have at the end?
- How likely are you to run out of money during the game?

Pages 22–23: Counting the Costs

Achievement Objective

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

Activity

This activity gives the students further experience in calculating profit and working with more than one operation to find an answer. It is also a useful activity for students to practise estimation skills.

The students can use several tools to answer question **1**:

- A table will help keep track of progress overall, give continuity to the activity, and further reinforce the concept of profit as money taken minus the costs.

Stall	Money taken	Costs	Profit (money taken minus the costs)
Gumboot throw	$463.00	$45.00	$418.00
Face painting	$302.00	$39.00	$263.00
Food stall	$2,301.00	$430.00	$1,871.00
Plant stall	$800.00	$210.00	$590.00
Cowpat bingo	$128.00	$20.00	$108.00
Max the magician	$82.50	$16.50	$66.00
Fudge and cordial	$225.00		$225.00
Mystery number	$68.50	$12.00	$56.50
Total			

The total profit in the right-hand column should balance with the total money taken minus the total costs. This is a good check for students to do on their calculators.

The calculator memory can be useful for some questions if the students make use of the [M–] key to calculate the profit. For example, for number **1b**:

[151] [x] [2] [M+] [39] [M–] [MR]

Some students may enjoy preparing a spreadsheet to calculate the profit. If so, they could use the formula =B2-C2 and fill down to calculate profits. You could introduce the autosum function for column and row totals. The students could then explore the sort feature and the different ways the spreadsheet presents the data. They could sort the table by alphabetical order of event, by increasing or decreasing costs, and by increasing or decreasing profit. This will be a very useful skill that they will use in later work on ranking and order. If you or your students are not familiar with spreadsheets, see the teachers' notes for pages 12–13 of *Algebra*, Figure It Out, Level 3.

You may need to work through an example of multiplying amounts in cents and then converting the answer to dollars. For example, to calculate the magician's costs for question **1f**: 15 cents x 110 = 1650 cents. There are 100 cents in a dollar, so the magician's costs are 1650 ÷ 100 = $16.50.

Encourage the students to estimate the profit for each activity so that they can check whether their answer from a calculator or a spreadsheet is reasonable.

Question **4** does not require an exact answer. The question should build on the daily maintenance of sharing estimation and efficient mental strategies. The students could work in small groups of three to share solutions and then discuss with other groups which methods are best. A variety of methods could be put on a wall poster, thus reinforcing the idea that the students' own best and varied methods are all acceptable as long as the answer is within a reasonable range.

Rounding is likely to be a strategy used by many groups. For example:

$4,231 rounded to 4 200 ÷ 100 = 42
42 x 8 may be performed mentally as (40 x 8) + (2 x 8)
= 320 + 16
= 336 (estimate)

Alternatively, rather than calculating 42 x 8, some students may round the 8 up to 10 and then compensate for this rounding by subtracting 40 x 2:

(42 x 10) – (40 x 2)

= 420 – 80

= 340

Page 24: Gala Graphs

Achievement Objectives

- use graphs to represent number, or informal, relations (Algebra, level 3)
- interpret information and results in context (Mathematical Processes, developing logic and reasoning, levels 2 and 3)

Activity

If the students are able to read and interpret the relationships between the x axis (horizontal line) and the y axis (vertical line), they will be able to make sense of the situations represented by these graphs.

Questions **1** and **2** deal with the highest and lowest points of the graph, which need to be located and explained. You could discuss other features of the graph to help the students make sense of it. For example:

- "What has happened between 9 a.m. and 10 a.m.?"
- "Explain the sudden increase in people from 11.30 a.m. to 12 noon."
- "How many people left the stall between 1 p.m. and 1.30 p.m.?"
- "How many staff would be needed at 3 p.m.?"

The students can be as creative as they like when they write a story for question **3**, but they must make sure that everything they say is represented on the graph and that their story explains all the changes on the graph. Their classmate can then assess the story for relevance and any inaccuracies. If they wish, they can tell more than one story about the graph.

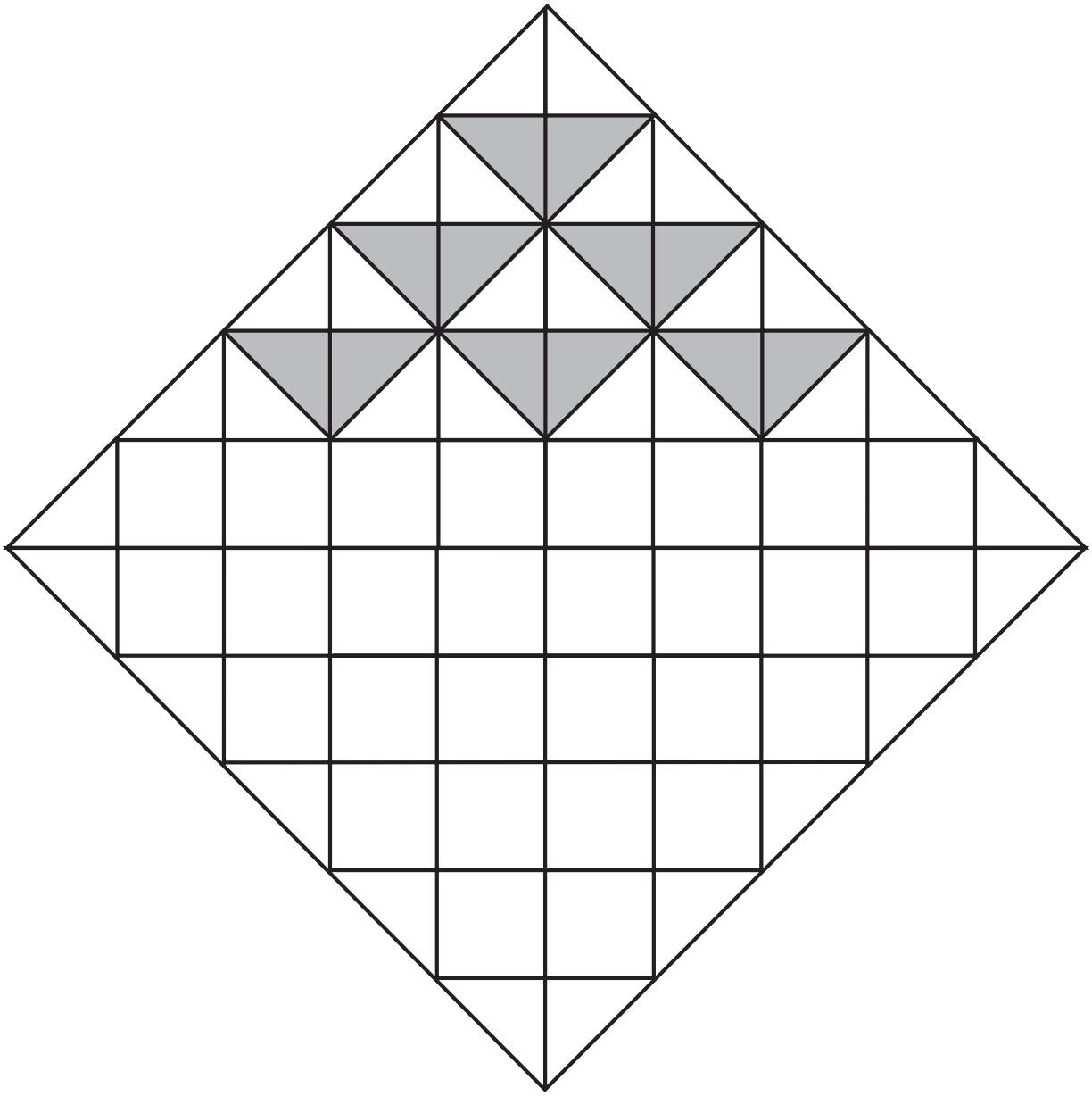
Small groups could then each prepare a story to share with the class as an oral presentation. You could conclude this experience by listing with the class the important aspects to consider when reading a graph. The points you list may include:

- Read the title and axis labels to see what the graph is about.
- Read the axis labels carefully to find out what relationship is described.
- Look carefully at the points shown on the graph, for example, at 12 noon, there were 19 people waiting at the food stall.
- Note the high points and low points and explain these.
- Divide the graph into parts or sections and explain what is happening in each part.
- Look for important trends indicated by the graphs.
- Note whether the slope on the line of Pene's graph is gentle or steep.
- Calculate the difference between the highest and lowest values.
- Consider the overall effect of the scale of the graph, that is, the vertical and horizontal spacing of axis labels, because this can affect the appearance of the graph and may exaggerate some aspects.

You can extend or follow up this activity by:

- making up a story for another gala stall, which the students then graph, or the students could make up their own stories and graph them
- asking the students to draw a bar graph from the information on the line graph, as an alternative model
- asking the students how they could use the graphs to help plan for next year's gala.

Copymaster: Entertaining Patterns



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