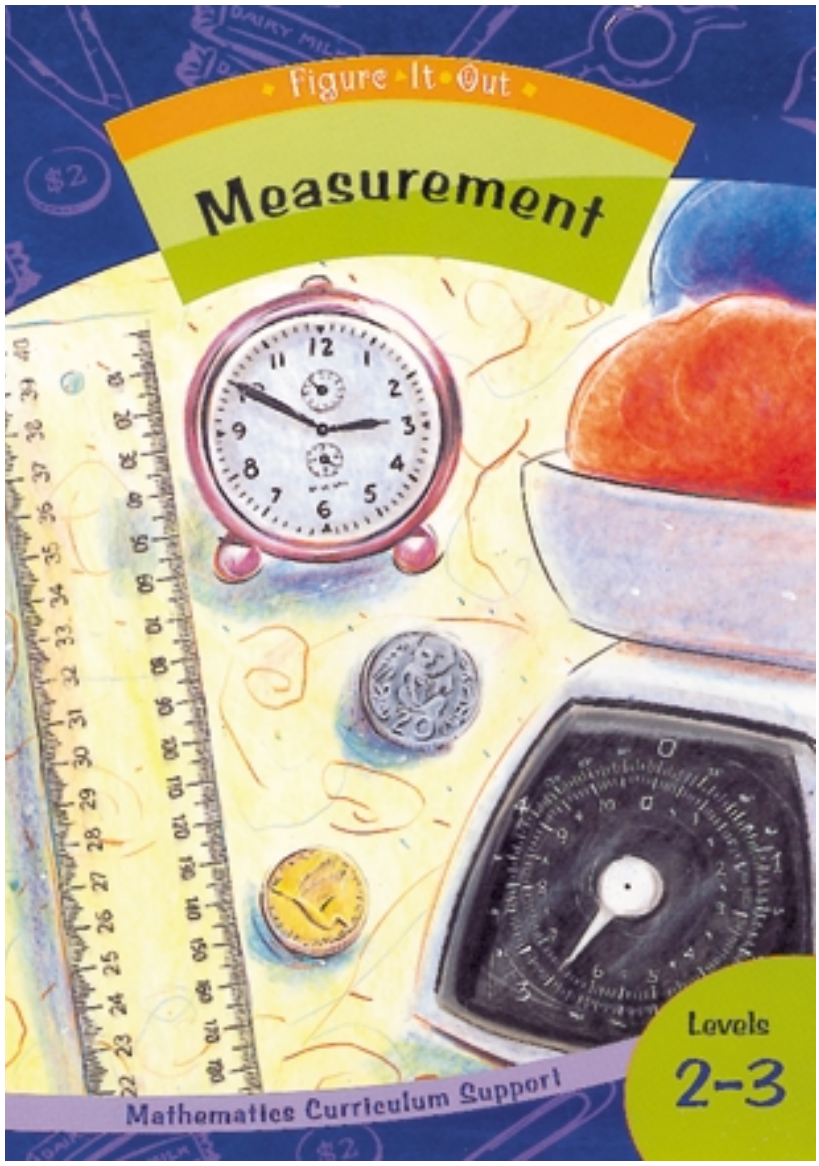
Answers and Teachers' Notes



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.

There are eight booklets for levels 2–3: one booklet for each content strand, one on problem solving, one on basic facts, and a theme booklet. 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 the students will need in order 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 the students to do this even where the suggested instruction is to write down the answer.

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

Students will have various ways of solving problems or presenting the process they have used and the solution. 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

Measurement

Answers

Page 1: Stretching It Out

Activity

1. **a.** 8 cm
   b. 16 cm
   c. 6.5 cm
   d. 8 cm
   e. 15.5 cm
   f. 10 cm
   g. 5 cm
   h. 25 cm
2. No answer
3. Answers will vary.

Page 2: Medieval Measure

Activity

1. 124 bricks
2. Answers will vary. Students may measure each defined area (for example, 2 x 2) or measure the front in two pieces and subtract the empty spaces.
3. Answers will vary.

Page 3: Mighty Metres

Activities One and Two

Answers will vary.

Page 4: Squash

Activity One

Answers will vary. Usually about 12 students of middle primary school age will fit in a 1 m square.

Activity Two

Answers will vary.

Page 5: Weigh Out

Activity

Answers will vary.

Page 6: Fill It Up

Activity One

1. **a.** 15 glasses
   b. 20 glasses
2. **a.** 20 glasses
   b. 40 glasses

Activity Two

1. **a.** The bottle holds 20 teaspoons of medicine, so it will last 7 days. There is enough for 6 days and 2 teaspoons on the seventh day.
   b. For 10 days, he needs 15 mL a day x 10. So he needs 150 mL.
2. As the bottle holds 20 teaspoons, it will last exactly 5 days if he takes 4 teaspoons a day.
3. His mum and dad must take 30 teaspoons of medicine each, and 60 teaspoons is 300 mL. They need a 300 mL bottle.

Page 7: Water Weights

Activity One

1 L of water should weigh 1 kg.

1 L = 1000 cm^3 and 1 L of water = 1 kg

Activity Two

5.5 kg

Activity Three

1. Yes.

2. She is right because $^2/_3$ of 30 kg is 20 kg. 20 kg of water is 20 L.

Page 8: Fitting It In

Activity

1. 8 multilink cubes

2. **a.** Yes, each box will hold exactly 20 Branbix.

b. Answers will vary depending on the accuracy of the box measurements.

Page 9: Dealing with Dominoes

Activity

1. The cards that are placed next to each other must have equal measurements.

2. Ellery can play the | 10c | 2 kg | domino and place it beside the | 1 kg | 1 kg | domino square.

Game

A game using Supermarket Dominoes

Page 10: Making Money

Game

A game using money dice

Activity

(John $2.00, Moana $2.20, Filisi $1.70)

1. Moana

2. $4.50

Page 11: Pocket Money

Activity One

1. Sandy's share:

Week 1: $2

Week 2: $4

Week 3: $3

2. They could each have $3.30. This leaves 10c. Students might come up with ideas, such as share the money equally and spend what is left over on something they can share or one of them takes $3.40, and next time this happens, a different person takes the extra money.

Activity Two

Examples of answers:

Dale: cola, chips, steakburger

Kim: spicy wedges, eggburger, lemonade

Sandy: chips, sauce, Paradise burger

Note: It is possible for a student to suggest that one of the children orders 2 lots of chips and an eggburger or 2 colas and nachos, depending on how the question is interpreted.

It is also possible that students may suggest that Dale, Kim, or Sandy may not spend all their $5, for example, a Paradise burger and a milkshake would cost $4.45.

Page 12: The Change Game

Game

A game using money dice

Page 13: Space Escape

Activity

1. She can play all the games once; this comes to $4.60.
2. Huia could play the four 50c games and 2 of the 20c games; this would be 6 different games altogether.
3. 10 times
4. 25 times
5. 5 times
6. She gets $3.50 change. This could be:

   5 x 20c and 5 x 50c – she can play all the 50c and 20c games.

   10 x 20c and 3 x 50c – she can play all the 20c games but must choose 3 of the 50c games.

   15 x 20c and 1 x 50c – she can play all the 20c games but must choose 1 of the 50c games.

   She can't play any of the $1 games.

Pages 14–15: Bank on It

Activity One

1. a. $24

   b. $48

2. a. 33 weeks (Before she withdrew the $10, her balance was $66.)

   b. $14 ($70 – $56 = $14)

Activity Two

1. Tyrone (He would have $42 after 14 weeks, Kelly would have $40 after 15 weeks, and Rāwhiti would have $40 after 20 weeks.)
2. Yes. He spends $3 on the present that week, but over the following 2 weeks, he would save another $6, which would give him $42.

Page 16: Change in Thinking

Activity One

Answers will vary.

Mr Patel might say his calculation out loud as he hands over the money so you can be sure you've got the right change. However, it may take longer than Mrs Grey's method.

Activity Two

Ice cream: 80c change

Chocolate bars: $1.30 change

Diary: $4.50 change

Pad and notebook: 90c change

Zinc: 15c change

Page 17: Shopping Around

Activity One

1. $2.75
2. There are no 1c or 2c coins used in New Zealand anymore.

   Note: It is possible to pay this amount by cheque, EFTPOS, or credit card.

Activity Two

Cheapfood rounded down to the 5c below the amount.

Bag 'n' Save rounded up to the 5c above the amount.

Some supermarkets round up or down depending on how close the amount is to the nearest 5c. For example:

$2.76 and $2.77 would be rounded down to $2.75.

$2.78 and $2.79 would be rounded up to $2.80.

Activity Three

1. Cheapfood: $26.65

   Bag 'n' Save: $26.70

2. Prices would have to be rounded either up or down to the nearest 10c.

Page 18: Clock It Up

Activity One

Teacher to check

Activity Two

1. **a.**

b.

c.

d.

e.

f.

g.

h.

i.

2. – 3. Answers will vary.

Activity Three

a. 25 to 7 or 6:35

b. 25 past 7 or 7:25

c. 20 to 10 or 9:40

d. 5 past 8 or 8:05

e. 10 past 10 or 10:10

f. 10 to 1or 12:50

Page 19: Me he Karaka

Activity

1. **a.** 3 o'clock

b. half past 4

c. 10 to 9

2. 60 minutes (1 hour)

3. 12 hours

4. Answers will vary. One possible answer is:

5. 60 seconds (1 minute)

6. Just after 5 past 1

Page 20: Cut Off

Activity

1. 6:00

2. 6:30

3. 7:05

4. 8:15

Page 21: Diary Day

Activity One

1. E
2. N
3. D
4. T
5. O
6. C
7. S
8. U
9. R
10. V
11. Y

Every second counts

Activity Two

Answers will vary.

Page 22: Quench My Thirst

Sun	Mon	Tue	Wed	Thurs	Fri	Sat
	1	2 fern 20 mL	3	4 fern 20 mL rose 50 mL	5	6 fern 20 mL
7	8 fern 20 mL	9	10 fern 20 mL rose 50 mL cacti 10 mL	11	12 fern 20 mL	13
14 fern 20 mL	15 rose 50 mL	16 fern 20 mL	17	18 fern 20 mL	19	20 fern 20 mL rose 50 mL cacti 10 mL
21	22 fern 20 mL	23	24 fern 20 mL	25 rose 50mL	26 fern 20 mL	27
28 fern 20 mL	29	30 fern 20 mL rose 50 mL cacti 10 mL	31			

Totals for month:

Ferns 300 mL
Roses 300 mL
Cacti 30 mL

Page 23: Sorting Seasons

Activity One

Answers will vary, for example:

December/January/February	March/April/May	June/July/August	September/October/November
Summer	Autumn	Winter	Spring
Making hay Picking fruit Shearing	Cleaning spouting	Fixing fences Planting trees Feeding out hay	Calving

Students should be able to justify why they have placed particular activities in the seasons.
They may need to use reference material.

Activity Two

Answers will vary.

Page 24: Cool It

Activity

Answers will vary.

Figure It Out

Measurement

Teachers' Notes

Overview: Measurement

Title	Content	Page in students' book	Page in teachers' notes
Stretching It Out	Measuring lengths in centimetres	1	9
Medieval Measure	Finding the area of a shape	2	10
Mighty Metres	Measuring metre lengths	3	11
Squash	Measuring area in square metres	4	12
Weigh Out	Using scales to measure weight	5	13
Fill It Up	Measuring capacity	6	14
Water Weights	Comparing weights	7	15
Fitting It In	Volume	8	16
Dealing with Dominoes	Matching equivalent masses, capacities, and money amounts	9	17
Making Money	Adding money	10	18
Pocket Money	Dividing and adding money	11	19
The Change Game	Giving change	12	19
Space Escape	Using money	13	20
Bank on It	Adding money and giving change	14-15	21
Change in Thinking	Giving change	16	22
Shopping Around	Rounding prices	17	23
Clock It Up	Telling the time	18	24
Me he Karaka	Telling the time	19	25
Cut Off	Telling the time	20	26
Diary Day	Calculating time	21	27
Quench My Thirst	Using a calendar to plan	22	28
Sorting Seasons	Seasons of the year	23	28
Cool It	Measuring temperature	24	29

Page 1: Stretching It Out

Achievement Objective

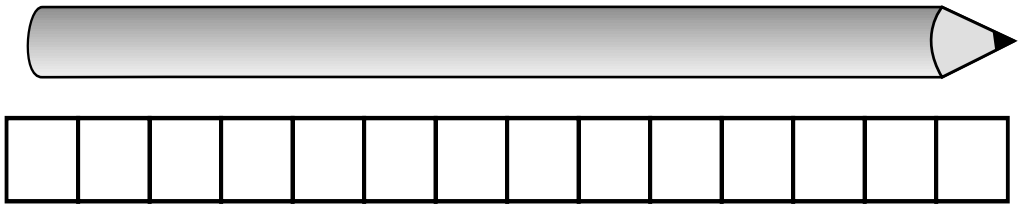
- carry out practical measuring tasks, using appropriate metric units for length, mass, and capacity (Measurement, level 2)

Activity

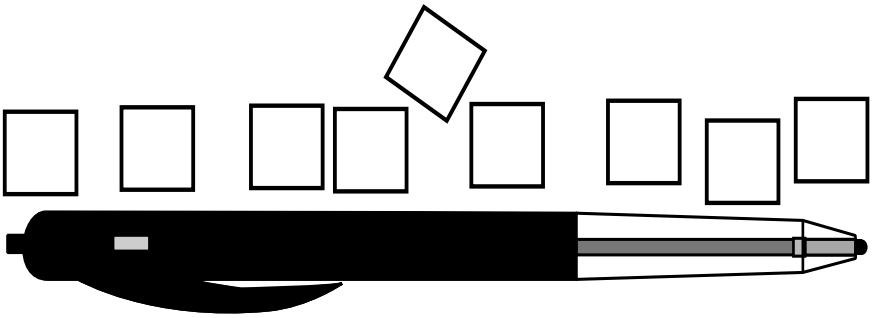
This activity focuses on length.

Many of the difficulties students have measuring lengths arise from their understanding of the ruler as a scale. Students also have difficulty with starting points or measuring from 0 on the ruler. This activity relates their repeated use of 1 centimetre lengths to a ruler.

Before students begin this activity, highlight appropriate and inappropriate ways to measure with the centimetre cubes. For example:



"What is wrong with saying that this pencil is 14 centimetres long?" This example illustrates the need for a baseline (starting point).



"Is this pen really 9 cubes long?" This example shows that a unit must be used consistently. This is vital to any scale.

Matching their marked-up strips to a real ruler will help students understand how rulers were first made. Having discovered this, students should be encouraged to put the unit idea to work. This will happen whenever one student gives another student instructions for drawing or building a structure. For example:

"Make a joined line of multilink cubes that is 20 centimetres long."

"Draw a square with sides that are 12 centimetres long."

The second student's building or drawing can be compared with the first student's original measuring device.

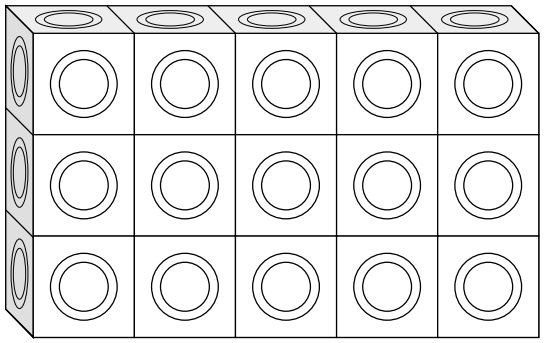
Page 2: Medieval Measure

Achievement Objective

- carry out practical measuring tasks, using appropriate metric units for length, mass, and capacity (Measurement, level 2)

Activity

Measuring an area has strong connections to tessellation in Geometry and multiplication in Number. For example, when using multilink cubes to find the area of a rectangle, students are creating a tessellation of squares:



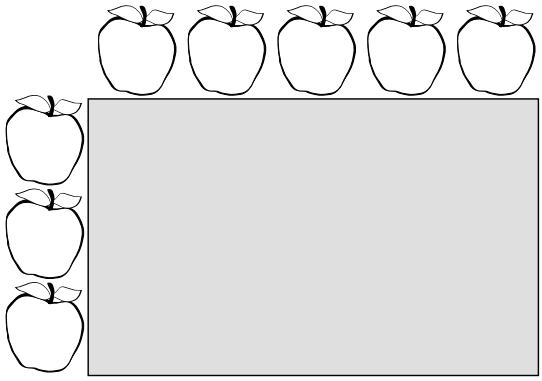
Students may use "one-by-one" counting to find the total number of cubes, but encourage them to use addition and multiplication as increasingly efficient strategies.

In this activity, it is important for students to describe the strategies they used by recording the number sentences. For the rectangle given above, the sentence might be:

5 + 5 + 5 = 15 or 3 x 5 = 15

3 + 3 + 3 + 3 + 3 = 15 or 5 x 3 = 15

This idea can be extended by using other arrays and masking parts of the arrays to encourage visualisation. For example:



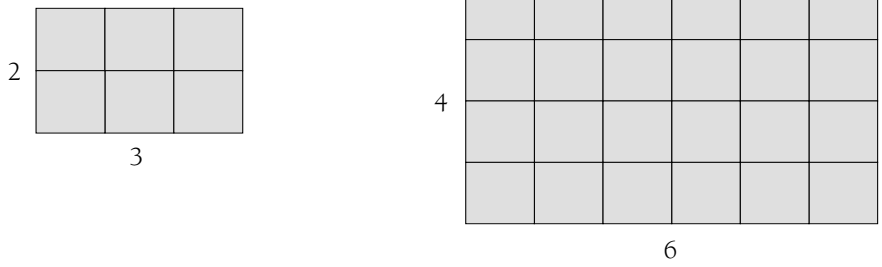
How many apples are in the whole array?

When students use place value blocks as their unit of area, they should find that their answer is four times the answer they would get with multilink cubes. Their answers from the place value blocks could be written as cm^2, as in 15 cm^2 or 15 square centimetres.

one multilink cube

four unit place value blocks

This is a simple way of demonstrating enlargement in geometry. If the sides of a shape are enlarged by a factor of two (that is, the lengths are doubled), then its area will quadruple. For example:



Page 3: Mighty Metres

Achievement Objective

- carry out practical measuring tasks, using appropriate metric units for length, mass, and capacity (Measurement, level 2)

Activity One

This activity focuses on length.

The use of body measures has been a common practice in the historical development of measurement in most cultures. Paces have long been used as an informal measure of length.

This activity aims to make the students proficient at estimating short distances in metres. For most of them, their natural walking stride will be about 50 centimetres or half a metre. They will need to halve the number of steps they have taken to estimate the number of metres involved in the distance they travel.

Activity Two

After some experience of measuring, such as in this activity, you can encourage students to estimate distances outside the classroom. Students will need to apply a different benchmark, such as 10 metres or 20 metres. Students may be given Pirates instructions, which involve paces and/or metres. For example:

"Walk 40 paces towards the library."

Other activities include marking out an 800 metre triathlon circuit around the school grounds; working out the distance another student covers during interval (playtime); solving data-related problems such as, "How far can an 8-year-old child throw a tennis ball?" or "How far does the shadow of your school's tallest tree move during the day?"; and drawing scale maps of the classroom on 1 centimetre square paper (1 cm : 1 m).

Page 4: Squash

Achievement Objective

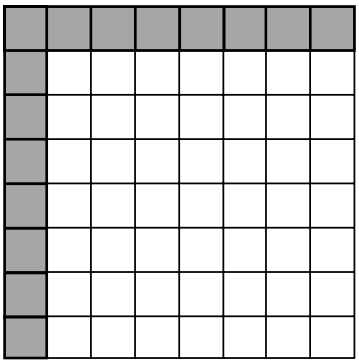
- carry out practical measuring tasks, using appropriate metric units for length, mass, and capacity (Measurement, level 2)

Activity

Although measurement of area is not explicitly stated in the mathematics curriculum achievement objectives, it is implied through the work with lengths and volumes. The area or array model is vital to the early development of multiplication and division and has other connections to finding all the outcomes of an event in probability.

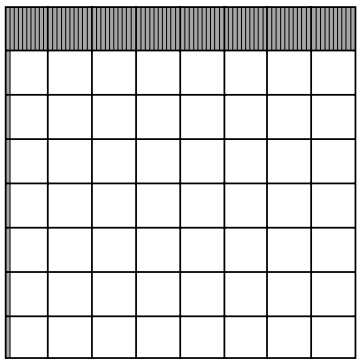
A 1 metre square is a deceptively large unit of area, which will become apparent to students when they draw or construct one with newspaper and tape. Students can be asked questions such as, "How many flat place value blocks would fit in a 1 metre square? (10 x 10 = 100) How many longs? (100 x 10 = 1000) How many unit cubes? (1000 x 10 or 100 x 100 = 10 000)" This helps students to build up their working concept of a 1 metre square as well as representing larger place values. The diagrams below show this process:

i.



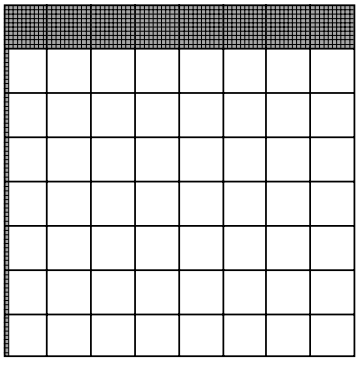
flats 10 x 10 = 100

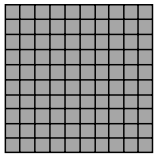
ii.



longs 100 x 10 = 1000

iii.





enlargement of **iii** block using unit cubes

units ▫ 100 x 100 = 10 000 or (1000 x 10)

Usually about 12 students of middle primary school age can stand comfortably in a 1 metre square. Using this result to find out how many standing students will fit in the classroom requires students to calculate the classroom area. Encourage students to use multiplication strategies (see the notes for page 2) rather than one-by-one counting by moving a 1 metre square model around.

As an additional activity, you could focus on student desks. They come in a variety of sizes and shapes, but generally a student sitting at an isolated desk needs nearly 1 square metre of space. Moving desks together saves space as two students seated at two facing desks that are joined need only about 1.5 square metres of floor area. Let students discover this result and then ask them to design a desk arrangement that maximises space for movement and for a mat area, book corner, etc.

Page 5: Weigh Out

Achievement Objective

- carry out practical measuring tasks, using appropriate metric units for length, mass, and capacity (Measurement, level 2)

Activity

This activity focuses on mass.

You will need to make up blocks of clay or play dough for this activity. Where possible, the pieces should be of different colours and have masses of about 100, 200, 300, 400, and 600 grams. This allows students to apply ratios when they are answering the questions, for example, "The red piece is about half the mass of the blue piece."

This activity is aimed at students developing some benchmark masses from which they can estimate other masses. This is in keeping with the common practice of relating unfamiliar masses to known benchmarks, for example, "It's slightly heavier than a 500 gram block of butter." The students get better at estimating unknown masses as the activity progresses. Some may need leading questions, such as, "Before you estimate, how heavy is that piece compared to others you know about?"

Selecting objects of a mass similar to a selected piece opens up the concept of density. That is, the mass of an object is not just related to its size. For example, a piece of wood may be lighter than a smaller piece of steel. Aim for students to hypothetically balance the selected object and the piece of clay or play dough. Encourage them to check their judgment by weighing the object on a set of scales. Students should explain differences between the expected and actual mass, for example, "The stapler looked heavy because it seemed to be made of metal, but most of it turned out to be plastic."

Page 6: Fill It Up

Achievement Objective

- carry out practical measuring tasks, using appropriate metric units for length, mass, and capacity (Measurement, level 2)

Activity One

This activity focuses on capacity.

The most common capacity of glasses is either 200 or 250 millilitres. Small glasses, such as those that hold sandwich spreads, often contain 100 millilitres. Many students will solve these types of problems by pouring liquid into the bottle glass by glass and will make no reference to the units at all. The mechanical drudgery of such methods will leave students receptive to more efficient methods that use metric units.

Understanding the connection between millilitres and litres involves some comprehension of place value because the metric system is based on ten. Encourage students to discover the relationship from their findings, with questions such as:

"You think the 2 litre bottle holds 10 glasses. How many glasses would a 1 litre bottle hold?"

"Does your answer match with the number of glasses in the 1.5 litre bottle?"

"Use a measuring jug to find out how much water one glass holds. How much water will a 1 litre bottle hold, then?" (The capacity of the glass will be read in millilitres.)

"How many millilitres are there in 1 litre? I wonder what 'milli' means?" (1000)

Once students have developed a feel for the capacity of glasses and bottles, this understanding can be applied by getting containers such as a 3 litre fruit juice bottle and asking how many glasses of juice it holds. Estimates can be revised as successive glasses of water are poured in.

Activity Two

Using medicine bottles is an excellent way of helping students to relate to capacity. Medicine bottles commonly come in 100 millilitre or 200 millilitre capacities and are available cheaply from chemist shops. Students often solve Isao's problem by pouring out spoonfuls one at a time. Medicine bottles have their capacity written on the bottom, and this can be used as a hint to encourage more efficient strategies. Appropriate recording is important in solving these problems. Encourage efforts such as:

$5 + 5 + 5 + 5 + \ldots + 5 + 5 = 100$ (20 teaspoons)

or $5 + 5 + 5 = 15$

$15 + 15 + 15 + \ldots + 15 = 105$ Not enough for 7 days!

Such recording often reveals the use of repeated addition, which can be used to develop more efficient multiplication and division strategies. You could ask, "Is there an easier way to work out $5 + 5 + 5 + 5 \ldots$?"

Page 7: Water Weights

Achievement Objective

- carry out practical measuring tasks, using appropriate metric units for length, mass, and capacity (Measurement, level 2)

Activity One

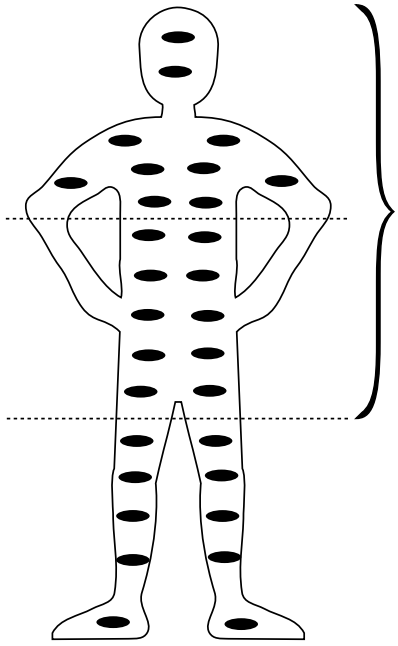
The relationship between mass and capacity – 1 litre of water has a mass of 1 kilogram – is discovered and applied in this activity. Students can also explore the relationship between capacity and volume. Some schools will have cubic 1 litre capacity measures, which students can push the 1 litre bag of water into. This is the same size as a large place value block (10 centimetres x 10 centimetres x 10 centimetres or 1000 cubic centimetres). Alternatively, students can make an open cube of the same size from card, using what they know about nets (see page 8 of the levels 2-3 *Geometry* booklet).

Activities Two and Three

These two activities require students to apply ratio. Some may need help interpreting 1.5 litres as $1\ ^1/_2$ litres. Similar, more difficult questions can be posed using plastic household containers such as 500 millilitres, 750 millilitres, and 1.25 litre bottles. This is likely to lead to students discovering that the mass of 1 cubic centimetre (1 millilitre) of water is 1 gram. This means that 750 millilitres of water has a mass of 750 grams.

Rita's problem involves finding a fraction of a whole number. A pictorial model involving 30 counters may help:

Thirty counters are shared equally among the three regions of the body.



$^2/_3$ of 30 kilograms is 20 kilograms.

(Each counter represents one kilogram.)

Page 8: Fitting It In

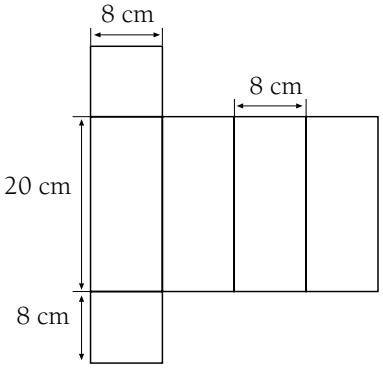
Achievement Objective

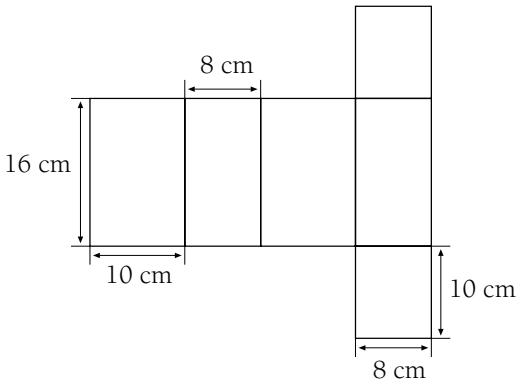
- carry out practical measuring tasks, using appropriate metric units for length, mass, and capacity (Measurement, level 2)

Activity

This activity provides a useful connection to the work on nets, which students do in the levels 2-3 *Geometry* booklet. Encourage them to apply their spatial knowledge to visualise what each box will look like when opened up. This can be rehearsed using grocery packets, if necessary.

The nets concerned might look like this, though other forms are possible:

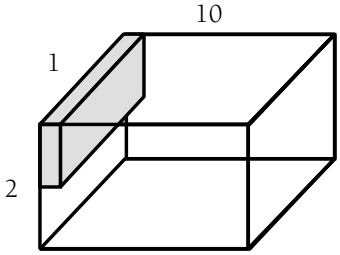


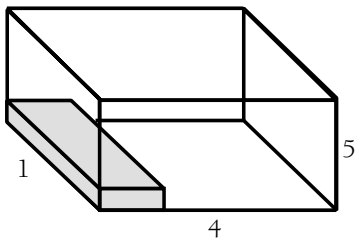


The easiest way to check whether a box can hold 20 Branbix is to follow these steps:

i. Decide the most efficient positioning of the Branbix so they fit exactly.

ii. Work out how many Branbix will fit along each side given the positioning decided on in the first step.

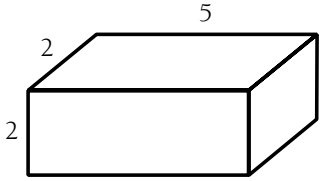




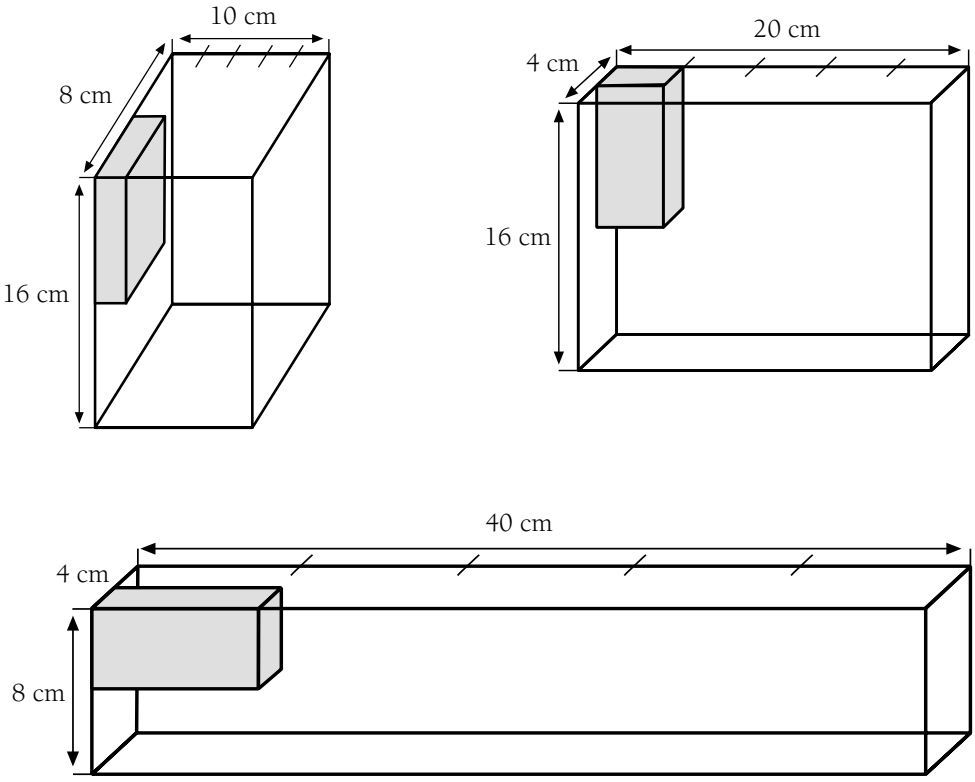
iii. If the length of each side of the box is a multiple of the length of the corresponding side of the Branbix (in the same ratio), then the box is the correct size.

Many students will need to put their multilink model of the Branbix in a box they have made to help them visualise the suitable positioning and to calculate the number of Branbix their box can hold. Students will often do this by adding layers, such as "Ten along the top and ten along the bottom." Encourage students to link this layering to multiplication: "What if you had five layers? How many Branbix would that be?"

There are many different boxes that will hold 20 Branbix. One way to find them is to work with side factors that have a product of 20. For example:



Based on that, the different positioning of the Branbix will lead to different side lengths:



If making boxes for 20 Branbix proves too difficult, tell the students to make up a packet for a hiker's breakfast, which holds only eight.

Page 9: Dealing with Dominoes

Achievement Objectives

- represent a sum of money by two or more different combinations of notes and coins (Measurement, level 2)
- carry out practical measuring tasks, using appropriate metric units for length, mass, and capacity (Measurement, level 2)

Game

This domino game is designed to develop students' concepts of equivalent units of measurement and equivalent sums of money. There is a copymaster for Supermarket Dominoes at the back of this booklet. Students will need to cut out the dominoes before playing, taking care that they cut along the solid line rather than along the dotted line so that they cut out a full domino.

To work out the rule for joining dominoes, students may need to use their set of dominoes to act out the game shown on the page. Dominoes can be joined where the matching squares contain equivalent measures or amounts of money.

Before the students play this game using the full set of Supermarket Dominoes, it is important that they have learnt about equivalent measures by investigating different containers and masses and manipulating sums of money. It is easy to find containers with capacities of 250 millilitres, 500 millilitres, 750 millilitres, 1 litre, and 1.5 litres. Ask students to discover equivalence relationships by pouring amounts from one container to the other.

Page 10: Making Money

Achievement Objective

- represent a sum of money by two or more different combinations of notes and coins (Measurement, level 2)

Game

This game involves some interesting connections with probability. Students will realise that getting a $2 amount is equivalent to two $1 throws. It is also far more valuable than many throws of the other amounts. This will make students cautious about accepting a throw if the coin shown is small.

However, if each player fills four spaces, that will leave six unfilled spaces. This constraint means that a "take what you can get" philosophy will develop as well.

Students might investigate the result of applying various tactics, such as:

- reject any throw until you get $2 or $1
- take whatever you get and be first to finish placing counters
- take any throw 50c or over
- take anything except 5c or 10c coins.

This can be carried out by players taking turns to use different strategies and playing many games to find out which method is most successful.

Activity

This activity requires students to look for the tactics that the players might be using. Moana has the largest sum of coins ($2.20) and has been using the "finish first" strategy (perhaps because her first throw gave her the only $2).

From the coins listed, John has probably been going for anything 50c or over, and Filisi has been rejecting 5c and 10c coins.

Although it is very unlikely that one player could get all three dollar-value amounts, it is possible for a player to get $4.50 with $2, $1, $1, and 50c. The smallest possible sum is 20 cents (5c, 5c, 5c, and 5c). Aiming for the smallest amount rather than the greatest is an excellent variation on the game.

Page 11: Pocket Money

Achievement Objective

- represent a sum of money by two or more different combinations of notes and coins (Measurement, level 2)

Activity One

Students need access to toy money if you want them to model sharing the amount shown in this activity. As there are three car cleaners, the total amount will need to be divided by three to calculate how much each individual receives.

Students frequently solve such sharing problems by using equal addition methods, for example, $\square + \square + \square = 12$, and find the value of $\square$ by trial and improvement. Although this is a productive method, it can be cumbersome with more complex amounts. Students need to be shown the efficiency of a division strategy.

Sharing out $10 cannot be done exactly. The closest possible individual amount is $3.30, which leaves 10 cents remaining. Students will have various ideas about how to allocate this extra money.

Activity Two

Students should look for combinations of items that produce whole dollar amounts. For example, nachos and either an eggburger or spicy wedges add to exactly $5. The 5 cent component of the price for Hawaiian or Paradise burgers must be matched by buying sauce at 55 cents. An interesting scenario is sauce, Paradise burger, and milkshake, but it would be unusual for sauce to be eaten without chips.

The practical considerations must be taken into account when determining whether solutions are correct. For example, a lunch of two colas and two milkshakes is not sensible. However, a lemonade, a milkshake, and a steakburger might be.

Page 12: The Change Game

Achievement Objective

- give change for sums of money (Measurement, level 2)

Game

This game is designed to encourage students to practise calculating change. Students will need to practise making change before playing this game. A "counting on" strategy rather than a subtraction strategy is most useful in these situations.

For example, given an item costing 35 cents that is paid for with a $1 coin, the change can be found by:

	+ 5c		+ 10c		+ 50c	
35c	→	40c	→	50c	→	$1.00

Totalling 5c + 10c + 50c = 65c gives the change and the coins that could be used.

You could also ask students to add their item card prices to find out who has the highest total value at the end of each game.

Page 13: Space Escape

Achievement Objective

- represent a sum of money by two or more different combinations of notes and coins (Measurement, level 2)

Activity

Students will probably do the calculations for this activity mentally, although some may need to use toy money.

As the total amount required to play every game once is $4.60, it is possible for Huia to play each game once and have 40 cents left over. Many different combinations of games are possible with $2.50, but she must play 20 cent games in lots of five in order to get rounded dollar amounts.

Ask students to explain how they worked out their answers, keeping in mind that many strategies are possible. They may say:

"Five 20 cent coins make $1, so I went 5 + 5 + 5 + 5 + 5, which is 25."

"Ten 20 cent coins is $2, so I went 10 + 10 + 5 is 25."

"Fifty cents is half of $1, so $5 is 10 half dollars. The answer is 10."

"Fifty times 10 is 500. There are 500 cents in $5."

The best way to answer question **6** is to develop a system to find all the possible combinations of 20 cent and 50 cent coins that add to $3.50. This can be done by using a table:

Number of 20 cent coins	Number of 50 cent coins	Total
15	1	$3.50
10	3	$3.50
5	5	$3.50
0	7	$3.50

Pages 14–15: Bank on It

Achievement Objectives

- give change for sums of money (Measurement, level 2)
- read any 3-digit whole number (Number, level 2)
- write and solve story problems which require a choice of any combination of the four arithmetic operations (Number, level 2)

Activity One

You will need to clarify the terms "withdrawal" (removing money from the account), "deposit" (putting money in), and "balance" (the amount of money in the account).

Students can answer question **1** in a variety of ways. It is vital that students record and explain their reasoning: "Twelve weeks is 2 more weeks. That's another $4."

"Twenty-four weeks is 12 x 2. Twelve weeks was $24, so I multiplied that by two."

With question **2**, which is expressed in words, encourage students to make sense of the problems before trying to solve them. Use questions such as:

"What is the question asking you to do?"

"Can you find the important information you need to solve this problem?"

"What is a likely answer to this problem?" (to encourage students to estimate)

Question **2b** involves finding the difference between the $56 Ani has saved and the $70 she needs. This may be done by adding on or subtracting:

$$\begin{array}{ccccccc} & +4 & & +5 & & +5 & \\ 56 & \rightarrow & 60 & \rightarrow & 65 & \rightarrow & 70 \\ & & & & 4+5+5=14 & & \end{array} \qquad \text{or} \qquad \begin{array}{r} 70 \\ -\,56 \\ \hline 14 \end{array}$$

Activity Two

Students will need to organise their calculations in order to find a solution. They may find a table helpful. For example:

Week	Kelly	Tyrone	Rāwhiti
Start	$10	$0	$20
1	$12	$3	$21
2	$14	$6	$22
3	$16	$9	$23
4	$18	$12	$24
5	$20	$18	$25
etc.	etc.	etc.	etc.

Various scenarios can be used, such as, "If Rāwhiti saved $5 each week, who would be the first person to buy their skates?"

A computer spreadsheet could be used to solve the problem. Again, this would be set up in a table:

	A	B	C
1	Kelly	Tyrone	Rāwhiti
2	10.00	0.00	20.00
3	= A2+2	= B2+3	= C2+1

Row 3 contains the formula for each person. Use the fill-down function to get weekly balances.

Question **2** requires students to think carefully about the information on the table and the weeks involved. A useful strategy would be to repeat the table with the changed information inserted.

Page 16: Change in Thinking

Achievement Objective

- give change for sums of money (Measurement, level 2)

Activity One

This activity contrasts two methods for calculating change: adding on and subtracting. Generally, the adding-on method works best with small sums of money, but it is not always easy to use when large numbers are involved.

Students will have their own variations based on these main strategies. For example:

"A $1 price would mean $1 change. A $1.50 price would mean 50 cents change. $1.25 is between the two, so that means 75 cents change."

"It's like paying for something that costs 25 cents with a $1 coin. Four lots of 25 cents make $1. That leaves three lots of 25 cents, which is 75 cents."

Activity Two

In attempting this activity, students may find that their preferred strategy changes, depending on the example. Students usually prefer adding on when this can be done easily. For example, paying for a $2.70 drink with two $2 coins:

$$\$2.70 \xrightarrow{+\ 30c} \$3 \xrightarrow{+\ \$1} \$4$$

Totalling 30c + $1 = $1.30 gives the change.

Page 17: Shopping Around

Achievement Objective

- represent a sum of money by two or more different combinations of notes and coins (Measurement, level 2)

"Swedish rounding" involves rounding to the nearest 5 cents. Most supermarkets use this method on the total bill. So a bill of $1.98 is rounded to $2.00, and a bill of $1.97 is rounded to $1.95.

Rounding in New Zealand is now necessary following the abolition of 1 and 2 cent coins. This means that an amount such as $3.28 cannot be made exactly with coins.

Activity Two

This activity shows how the price of a single purchase is rounded up or down. Other rounding options exist when numerous items are bought. These are:

- Round each item up or down or use Swedish rounding and then find the total.
- Find the total and then round up or down or use Swedish rounding.

Activity Three

As an extension to question **1**, explore a number of rounding scenarios.

The following methods could be used for Veronica's shopping:

• Round each item down and then total (for example, CheapFood)		$26.35
• Round each item up and then total (for example, Bag 'n' Save)		$26.95
• Round each item by Swedish rounding and then total		$26.65
• Find the total and then	… round up	$26.70
	… round down	$26.65
	… use Swedish rounding	$26.65

If the Reserve Bank removed 5 cent coins from circulation, as suggested in question **2**, the effects of rounding schemes would be accentuated because each total would be rounded to the nearest 10 cents.

Page 18: Clock it Up

Achievement Objective

- read time and know the units of time – minute, hour, day, week, month, and year (Measurement, level 2)

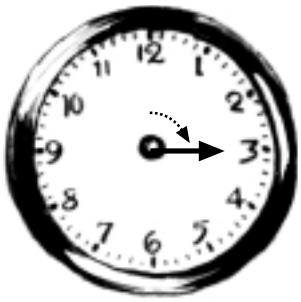
Activity One

Following the instructions to fold a circle into 12 equal parts is valuable in that it reinforces the need for the numbers on a clock to be evenly spaced. Some card is difficult to flatten after folding, so students may need to stick the circle to firm card in order to make a clock they can use. A hole punch helps to make holes for the split pin in both the hands and the clock face.

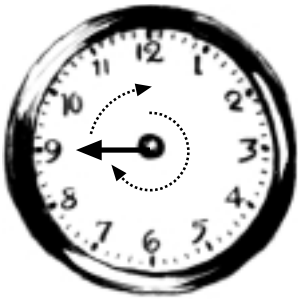
Activity Two

This activity illustrates the connection between movement and position in geometry and measurement of time.

"Half past" means a half turn of the minute hand past 12 (the hour).



"Quarter past" means a quarter turn of the minute hand past 12 (the hour).



"Quarter to" means that another quarter turn is needed for the minute hand to reach 12 (the hour).

Although the clocks the students have made are measured in 5 minute marks, point out that the marks around the clock face of most clocks show a period of 1 minute when measured by the minute hand. Encourage students to count the passage of time as the minute hand rotates, with particular emphasis on the 5 minute count as the minute hand meets each face number, "5 past, 10 past, 15 past, 20 past …" This can be matched to digital time, "1:05, 1:10, 1:15, 1:20 …", using digit cards placed on a [:] frame.

Once 30 minutes (half past) is reached, students must learn to count down to the hour, initially by fives. So the count progresses:

"half past 1 (or 1:30), 25 to 2, 20 to 2, quarter to 2 …"

An interesting question is, "Why is '15 minutes to' more commonly called quarter to?" Similarly, students must realise that the hour hand moves over the same marks but its travel to each face number takes place over the period of one hour. Most classroom clocks have setting knobs on the back that can be used to demonstrate the relationship between the passage of the minute and hour hands. Ask questions like "As the big (minute) hand turns all the way around, how far does the small hand travel?", "What will be the time on this clock 1 hour later?", and "What about 30 minutes earlier?".

Page 19: Me he Karaka

Achievement Objective

- read time and know the units of time – minute, hour, day, week, month, and year (Measurement, level 2)

Activity

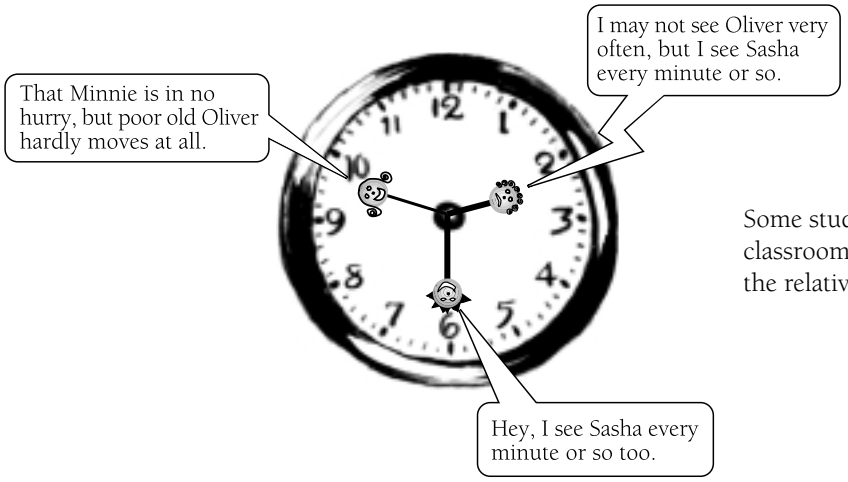
This activity builds on the previous page by asking students to show the time taken for each hand to complete a full turn:

Minnie Minute Hand: 1 hour

Oliver Hour Hand: 12 hours

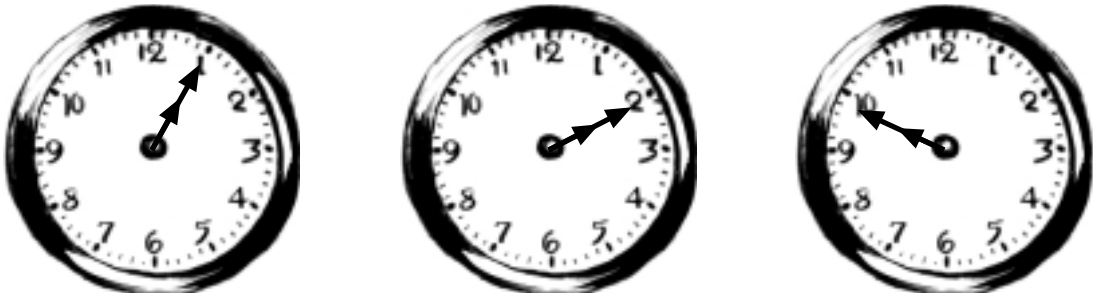
Sasha Second Hand: 1 minute

The students' cartoons for question **4** will reveal their understanding of the role of each hand:



Some students will need to study analogue classroom clocks or wristwatches to work out the relative speeds of each hand.

Turning the setting knob of an analogue classroom clock can establish the times when the hour and minute hand meet. Encourage the students to try to find a pattern in these times:



Note that the times are not exactly "5 past 1", "10 past 2", etc.

The further the hour hand is around the clock, the further on from the hour number it is when the hands meet again. Students may be able to establish that there are 11 times on an analogue clock when the minute and hour hands meet. These times are (approximately):

1:05, 2:11, 3:16, 4:22, 5:27, 6:33, 7:38, 8:43, 9:49, 10:54, 12:00.

Page 20: Cut Off

Achievement Objective

- read time and know the units of time – minute, hour, day, week, month, and year (Measurement, level 2)

Activity

In this activity, students convert analogue time (clock face with hands) to digital time. Students need to realise that digital time shows minutes past the hour only, and this can cause problems with "to the hour" times, such as "quarter to".

The activities suggested for page 18 can help students who have difficulty with this aspect of time. You could use the following example to show that "25 to 7" is the same as "6:35".

An important point here is that digital time is different from decimal notation. Time is based on 60, due mainly to the ancient Babylonians, who had an annual calendar based on 6 months of 60 days. Decimal notation is based on 10. There is potential confusion here. Consider the decimal 3.59: if hundredths are added, the decimals progress as 3.60, 3.61, 3.62, 3.63 … etc. Time in minutes progresses from 3:59 to 4:00, 4:01, 4:02 … etc. Since digital time is based on 60, times such as 2:63 and 7:98 cannot exist.

Page 21: Diary Day

Achievement Objective

- read and interpret everyday statements involving time (Measurement, level 3)

Activity One

This activity involves students reading a timetable. Students must be able to understand the seconds, minutes, and hours units and be able to calculate the time elapsed between two given digital times. This is quite difficult.

A digital clock can help students to make sense of the diary. The setting buttons change the minutes and the hours. For example, to find out how long Aroha spent doing homework, the time can be set to 4:30 and then the minute setting button clicked until 4:50 is reached. Students can count the clicks to find out that 20 minutes elapsed. In calculating the time taken to walk the dog, from 4:50 to 5:25, students should start at 4:50 and push the minute setting button to get to 4:00 (10 clicks) and then push the hour button once to allow for the extra hour (5:00). Continue with the minute button to get to 5:25. The total count, 10 + 25 = 35, is the number of minutes taken to walk the dog.

After some experience of this, encourage students to calculate from the digital times. Adding on is a less troublesome method than subtraction. For example, to find how long Aroha spent watching television:

$$7{:}45 \xrightarrow{+15} 8{:}00 \xrightarrow{+30} 8{:}30$$

15 + 30 = 45 minutes

When subtracting, students can get confused between digital time and decimal notation.
For example:

$$\begin{array}{r} 8{:}30 \\ -\ 7{:}45 \\ \hline 0{:}45 \end{array}$$

Decomposition in this case is complex and potentially confusing.

A useful exercise before students attempt this page is some simple conversions of time, such as:

"How many seconds are in 1 minute?" (60)

"How many minutes are in 2 hours?" (120)

"How many seconds make 3 minutes?" (180)

Page 22: Quench My Thirst

Achievement Objective

- read time and know the units of time – minute, hour, day, week, month, and year (Measurement, level 2)

Activity

To begin this activity, students will need to have an idea of how much water each plant gets with each watering. Provide small measuring cylinders so the students can see 20, 50, and 10 millilitres of water. This will give them a benchmark for estimating the solutions to go on the calendar.

Students will need to work out the watering dates in an organised manner. Using a different-coloured counter for each plant and moving it on the calendar will help. Writing the dates in an organised way can also help.

Ferns: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30 (15 times)

Roses: 5, 10, 15, 20, 25, 30 (6 times)

Cacti: 10, 20, 30 (3 times)

Page 23: Sorting Seasons

Achievement Objective

- read time and know the units of time – minute, hour, day, week, month, and year (Measurement, level 2)

Activity One

Students need to have some knowledge of when the farming activities that are shown actually take place. Students may be able to work out from the pictures that making hay and picking fruit are activities that occur in hot weather and feeding out hay is most likely to take place in winter when the grass grows slowly.

Encourage the students to place the activities they know about first and work out the rest by elimination.

For example:

December/January/February	March/April/May	June/July/August	September/October/November
Summer	Autumn	Winter	Spring
Making hay Picking fruit	Cleaning spouting	Fixing fences	Calving

Shearing is most likely to occur in summer or spring when the weather is warmer, while planting trees and fixing fences might occur in cooler times of the year.

Activity Two

Get students to call on their own experiences to list jobs that might be done around their house during the year. Such experiences could include painting, cleaning out the swimming pool, raking leaves, stacking firewood, making fences, wallpapering, cleaning windows, and watering the garden. They will then need to consider what the weather is usually like when these tasks are done and find the appropriate season to put them in.

Page 24: Cool It

Achievement Objective

- carry out practical measuring tasks, using appropriate metric units …
  (Measurement, level 2)

Activity

Have students work in groups. Young students usually find graduating four cups of water from coolest to hottest relatively easy. Take care that the water is no hotter than about 40°C. Ice cubes can be used to create a water temperature that is close to 0°C. The thermometer is an example of a linear scale and is easily related to the number line.

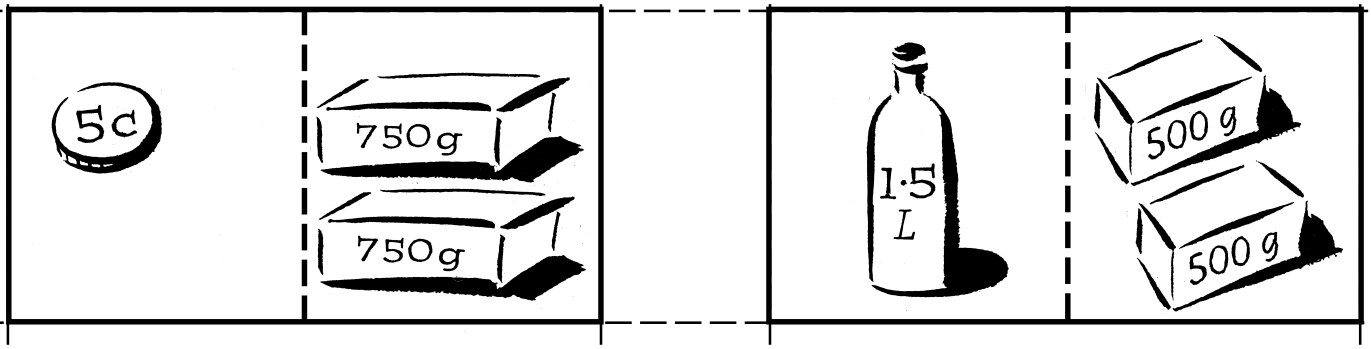
A good introduction is to give each group of students a thermometer and tell them to find out how it works. Their explanations, although lacking scientific rigour, often reveal that they know that increased height in the column of alcohol means that the temperature is higher. For example, "As it gets hotter, the red stuff gets pushed up higher."

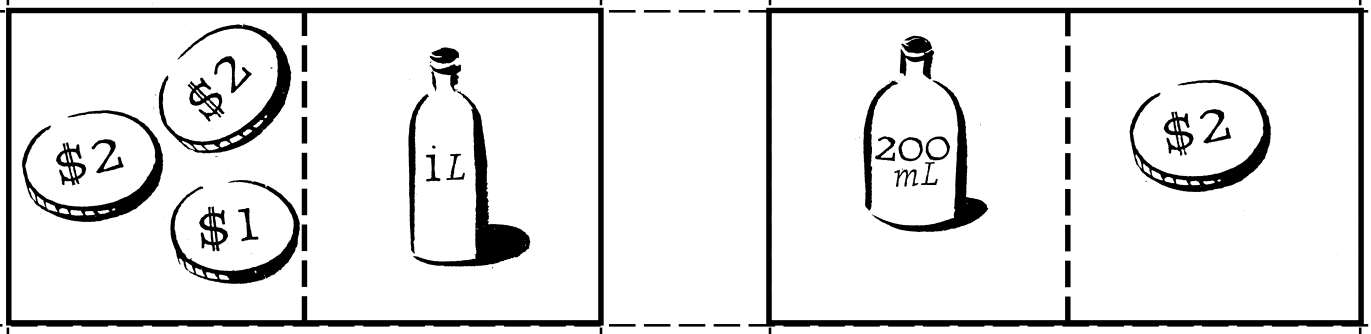
You will need to tell students that the numbers up the side of the column show the temperature in degrees Celsius and that these temperatures can be written as □°C (for example, 17°C). A simple thermometer can be drawn on card and strips of red stuck on it to show different temperatures. This gives students practice reading the thermometer scale.

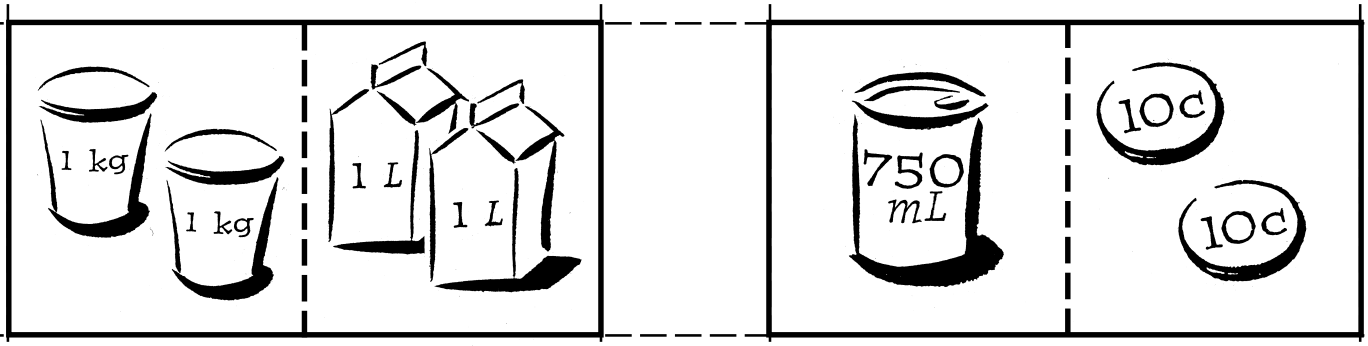
Of the cups of water, the hottest cup will cool fastest as the difference between its water temperature and the air temperature is greatest. Eventually, all four cups will end up with a water temperature close to that of the air, though this can take a period of hours.

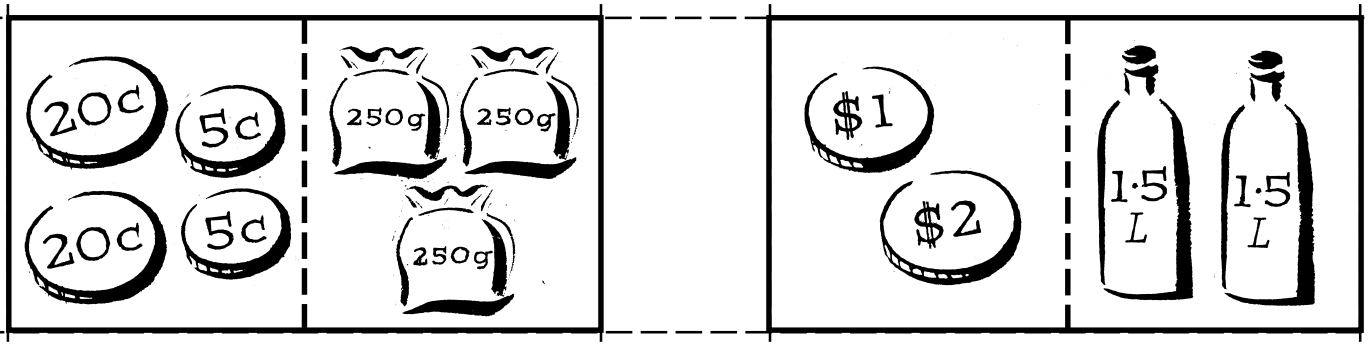
Once students have some experience with these known temperatures, you can ask them to make up by feel a cup of water with a given temperature (for example, 25°C). You can check their attempts with a thermometer to see how close they got to the target temperature.

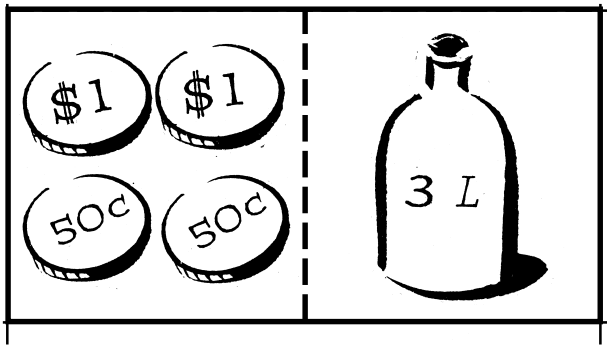
Copymaster: Dealing with Dominoes

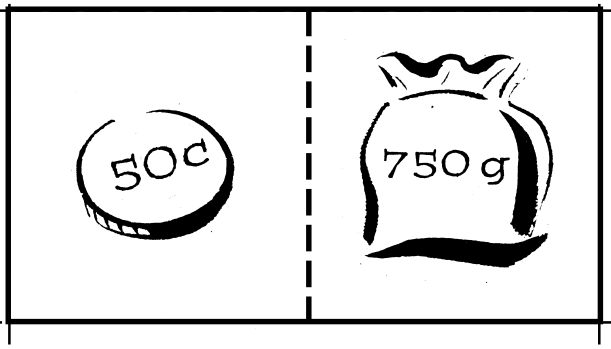


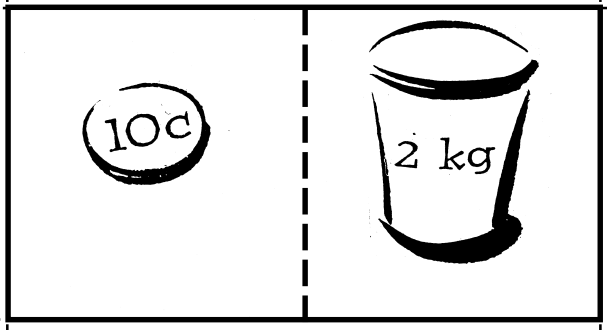


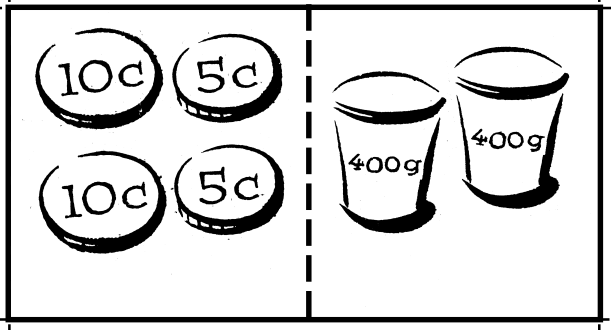


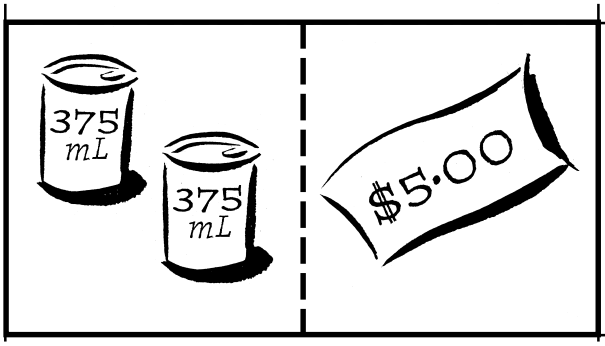


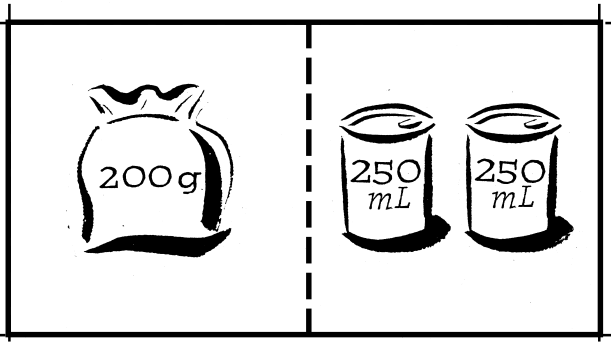

$1
$1
50c
50c
3 L

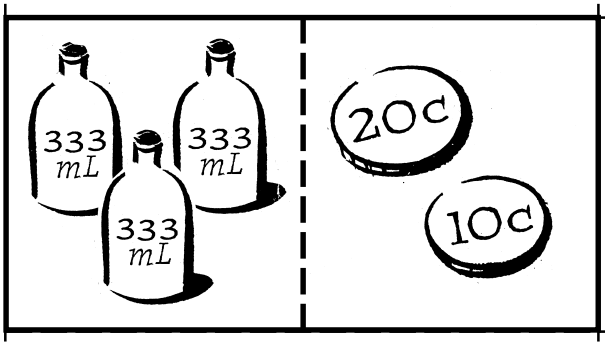

50c
750 g

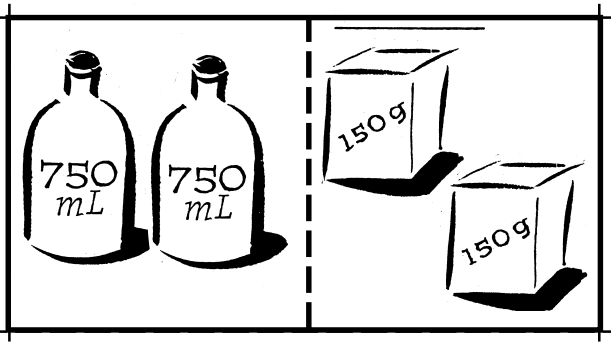

10c
2 kg

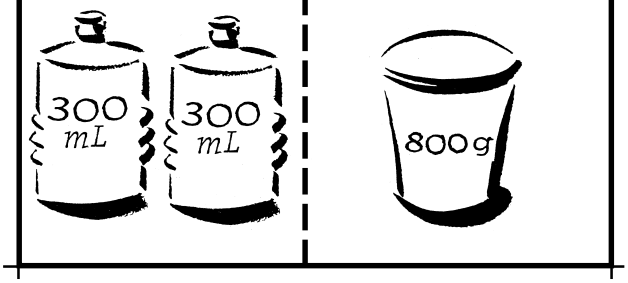

10c
5c
10c
5c
400g
400g

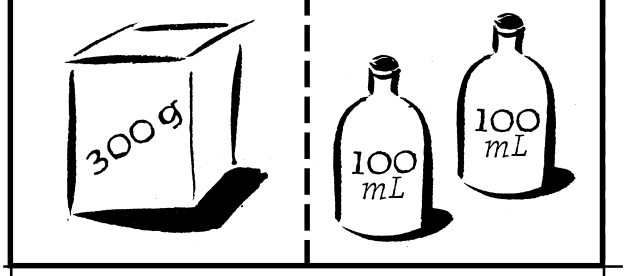

375 mL
375 mL
$5.00

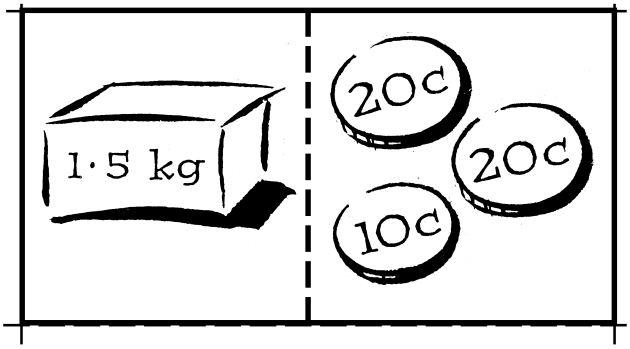

200g
250 mL
250 mL

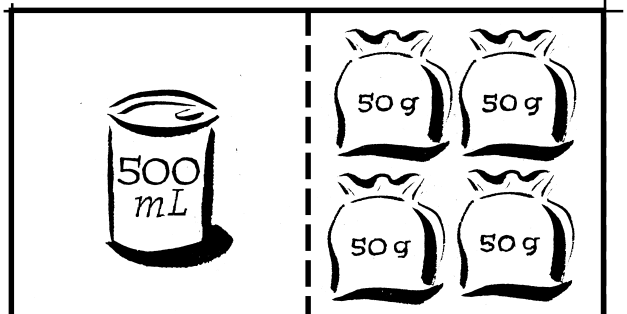

333 mL
333 mL
333 mL
20c
10c

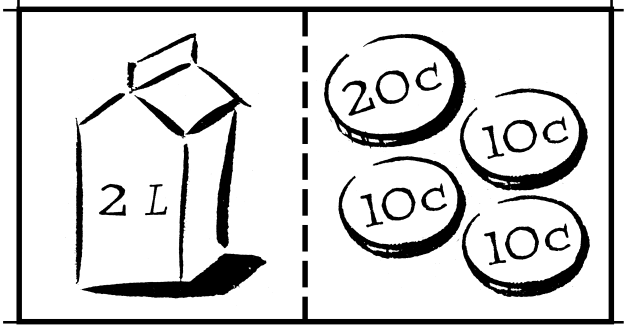

750 mL
750 mL
150g
150g

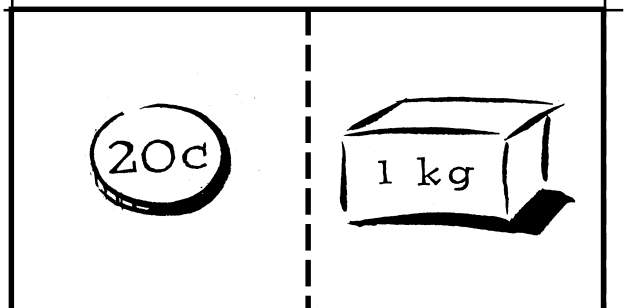

300 mL
300 mL
800 g

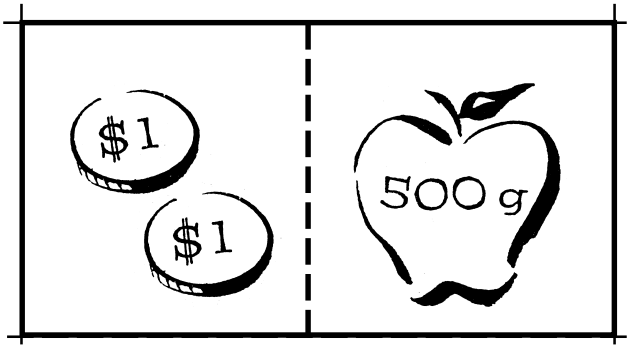

300 g
100 mL
100 mL

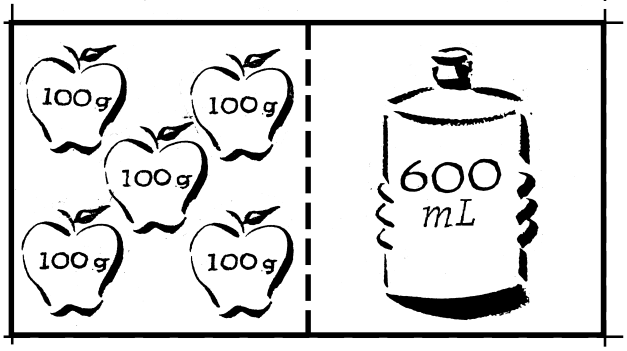

1·5 kg
20c
20c
10c


500 mL
50 g
50 g
50 g
50 g


2 L
20c
10c
10c
10c


20c
1 kg


$1
$1
500 g


100 g
100 g
100 g
100 g
100 g
600 mL

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