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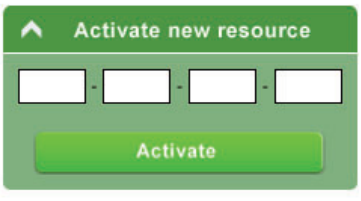

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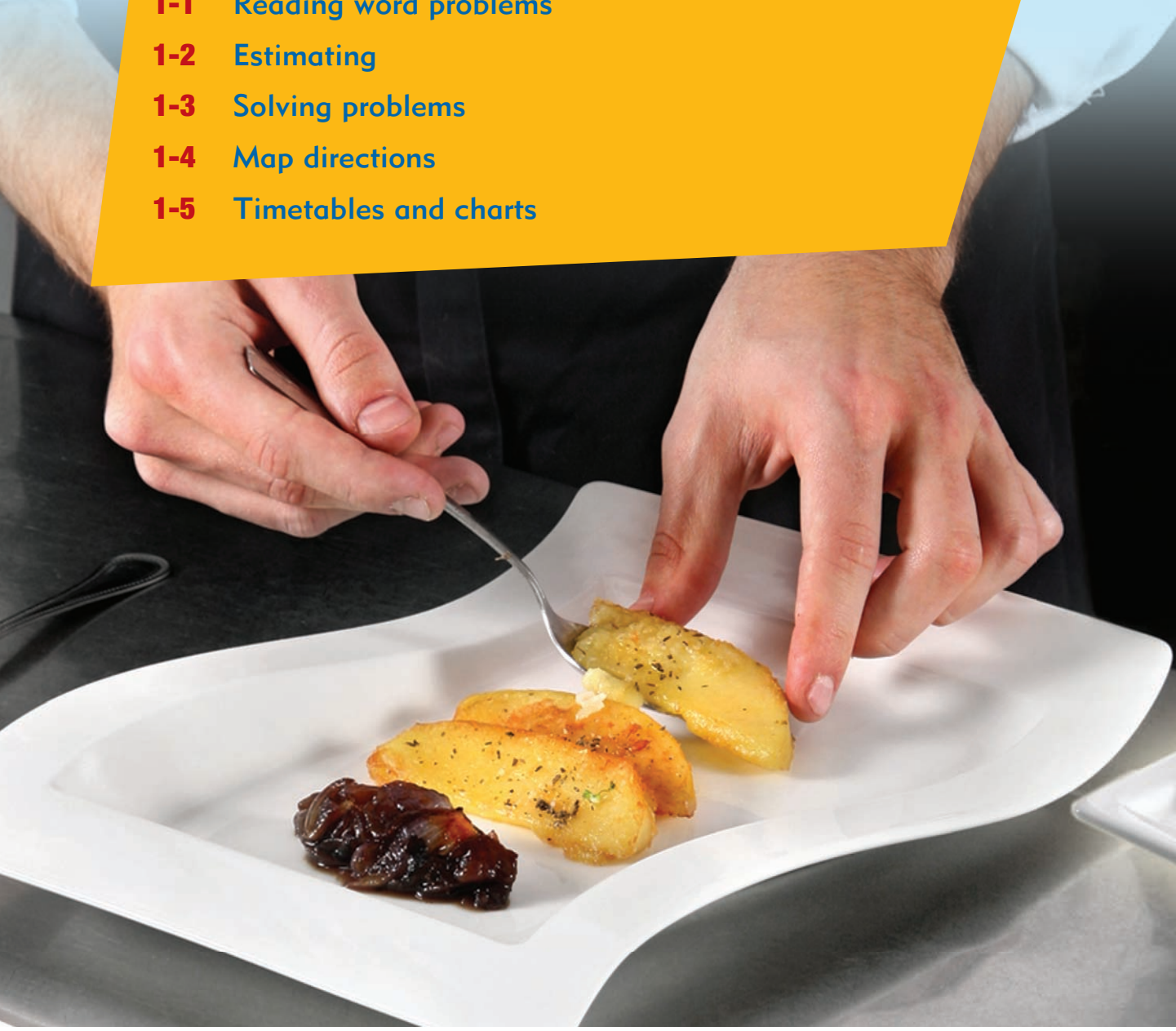
CHAPTER

1

Doing mathematics

What you will learn



Apprentice chef

It is important for a chef to understand mathematics so that they can plan menus and weigh food accurately.

Apprentice chef Conrad says,

'Maths is an important part of my training. Every day I have to weigh food and adapt recipes. Timing is important for cooking food and ensuring that plates are prepped and ready at the right time.'

'I need to be able to interpret new recipes and adapt them.'

Curriculum item

Problem solving

In a range of meaningful contexts, students will be engaged in thinking mathematically and statistically. They will solve problems and model situations.

Measurement

- Interpret and use scales, timetables and charts.

Position and orientation

- Communicate and interpret locations and directions, using compass directions, distances and grid references.

Do now

1 Write a tidy number close to:

a 197 **b** 19.5 **c** 302 **d** 2996

2 Work out these answers without using a calculator.

a 18 + 5 **b** 27 − 9 **c** 78 + 6 **d** 103 − 5

3 Work out these answers without using a calculator.

a 9 × 5 **b** 21 × 6 **c** 15 × 10 **d** 23 × 100

4 Work out these answers without using a calculator.

a 28 ÷ 2 **b** 27 ÷ 3 **c** 100 ÷ 5 **d** 150 ÷ 3

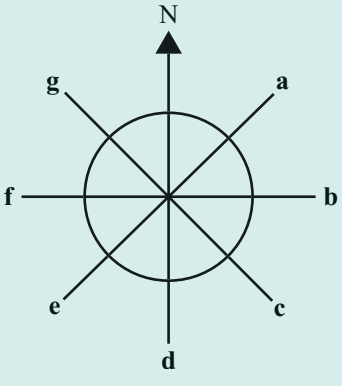
5 Write these numbers as words.

a 73 **b** 101 **c** 945 **d** 2570

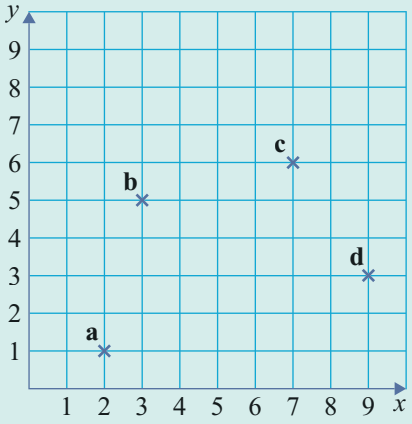
6 Write these in numerals.

a sixty-three
b three hundred and ten
c one thousand and seventy-six

7 Name the compass directions **a**–**g**.



8 List these co-ordinate pairs.



Vocabulary – words you should know

add (tāpiri)
subtract, minus, take away (tango)
multiply (whakarea)
divide (whakawehe)
problem (rapanga)
estimate (whakatau tata)
tidy number (tau mama)
map (mahere)
north (raki)
south (tonga)
east (rāwhiti)
west (uru)
table (tūtohi)

1-1 Reading word problems

Kylie has a new baby brother Jason. He weighed 4 kilograms when he was born. Three months later the nurse weighs him and says, 'His weight has increased by half'.
Kylie thinks this means he now weighs 4.5 kilograms, but her mother says, 'No, he weighs 6 kilograms'.
Explore their reasoning.
Who do you think is correct?

Key ideas

- To solve mathematical word problems we need to **decode** them.
- Questions to ask when decoding a mathematical word problem are:
  - What are **the numbers being used**?
  - What are **the important mathematical concepts**?
  - What are **the key mathematical operations**?
- To make sense of a mathematical word problem, it is important to remember:
  - A word can have a different meaning in mathematics from its everyday use.
  - The same mathematical operation or idea can be described in different ways or with different words.
  - Key words can help identify mathematical operations.
  - Small words such as **by** and **of** are important.
  - Reading the whole sentence or story helps you make sense of the problem.

Example 1

Solve these problems.

a Sita earned $73 one week and $81 the next week. What was the total of her earnings for these two weeks?

b Winnings of $150 is to be shared equally among five people. How much will they each receive?

Solution	Explanation
a 73 + 81 = 154 $154	Start by decoding the word problem using the three questions in the key ideas. **The numbers used** are the dollar amount ($) earned each week. **The important mathematical concept** is that we want to know the combined earnings for two weeks. **The key operation** is **addition** because **total** is a key word for addition. Add 73 + 81 = 154
b 150 ÷ 5 = 30 $30	Start by decoding the word problem. **The numbers used** are the $ amount to be shared and the number of people to share it among. **The important mathematical concept** is that this money is to be shared **equally**. This means they will all receive the same amount. **The key operation** is division because **shared equally** is a key word for dividing. As there are five people we need to divide 150 by 5. 150 ÷ 5 = 30

Example 2

a A warehouse provides space for storing boxes. Altogether it has room for two hundred 10 litre boxes **and** five hundred 20 litre boxes.
What is the total volume of storage space available in the warehouse?

b At the start of the year, the warehouse was only storing one hundred 10 litre boxes and one hundred 20 litre boxes. What fraction of the total available storage space was being used at the start of the year?

c What is the answer to part b as a percentage?

Solution	Explanation
a $200 \times 10 = 2000$ $500 \times 20 = 10\,000$ Total volume of storage space is 12 000 litres.	Start by decoding the word problem. **The numbers used** are two hundred and five hundred for the numbers of each type of box, and 10 litre and 20 litre as the volumes of each type of box. **The important mathematical concept** is that volume is the amount of three-dimensional (3D) space each box takes up. The **total** volume of the warehouse is how much 3D space is inside the warehouse. **The key operations** are finding the total volume of each kind of box then adding these volumes together to get the **total** volume of storage space available. **Total** is a key word for addition. We find the volume available for each kind of box by multiplying the number of boxes by the volume of one box. Volume of 10 litre boxes $= 200 \times 10$ $= 2000$ litres Volume of 20 litre boxes $= 500 \times 20$ $= 10\,000$ We add the volume of each type of box find the **total** volume available. Total volume $= 2000 + 10\,000$ $= 12\,000$ litres
b $100 \times 10 = 1000$ $100 \times 20 = 2000$ Total $= 3000$ litres Fraction $= \frac{3000}{12\,000}$ $= \frac{1}{4}$	**The numbers used** are one hundred for the number of each type of box; and 10 litres and 20 litres as the volumes of each type of box. **The important mathematical concept** is that the warehouse is not full and the volume taken up by the boxes can be expressed as a fraction or percentage of the total volume of available storage space. **The key operations** are finding the total volume of each kind of box then adding these volumes together to find the total volume of the boxes. We find the total volume of each kind of box by multiplying the number of boxes by their volume. **Fraction** is a key word for divide so the volume of the boxes must be divided by the volume of warehouse which is 12 000 litres.

Calculate the volume of each type of box first.

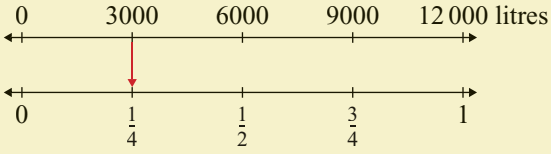
Volume of 10 litre boxes $= 100 \times 10$
$= 1000$ litres

Volume of 20 litre boxes $= 100 \times 20$
$= 2000$ litres

Total volume of boxes $= 1000 + 2000$
$= 3000$ litres

Total available storage $= 12\,000$ litres (from answer to part **a**).

We can use a double number line to find the **fraction** of the total available storage.

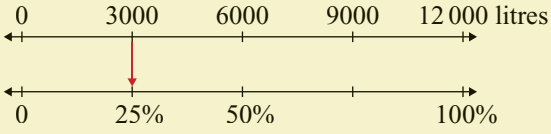


$\frac{3000}{12\,000} = \frac{1}{4}$

c Percentage $= 3000 \div 12\,000 \times 100$
$= 25\%$

Percentage is another way of writing a fraction with denominator 100.

We can use a double number line to find $\frac{3000}{12\,000}$ as a percentage.



$= 25\%$

Or $\frac{3000}{12\,000} \times 100 = 25\%$

Exercise 1A

1 Copy this table or use the worksheet.

- Tick the relevant column for the key operation (addition or subtraction).
- Solve the problem.

	Key words	Addition	Subtraction	Solution
a	Total of 10 and 7			
b	Difference between 10 and 7			
c	Take away 6 from 15			
d	6 plus 9			
e	12 minus 5			
f	5 fewer than 12 is			
g	Raise 9 by 6			
h	Increase of 8 from 4			
i	Gain of 7 on 16			
j	23 decreased by 9			
k	14 increased by 9			
l	Sum of 19 and 8			
m	Loss of 9 from 45			
n	10 more than 24			

2 Copy this table or use the worksheet.

- Tick the relevant column for the key operation (multiplication or division).
- Solve the problem.

	Key words	Multiplication	Division	Solution
a	The product of 5 and 6			
b	30 divided by 5			
c	Multiply 9 and 8			
d	Triple 7			
e	What fraction of 6 is 3?			
f	Divide 18 by 9			
g	10 per cent of 50			
h	Twice 9			
i	Quotient of 50 and 5			
j	Double 12			
k	4 times 7 is			
l	30 shared equally by 3			
m	Share $30 equally between 3 people			

3 Identify the key mathematical operation and then work out the answers to these without using a calculator.

- **a** The sum of 47 and 101
- **b** Multiply 12 and 5
- **c** The total of 59 and 60
- **d** The difference between 89 and 79
- **e** Half of 50
- **f** 25 times 4
- **g** 41 tripled
- **h** 12 fewer than 41

4 For each of these statements:

- **i** Decide if it is always true, sometimes true or never true.
- **ii** If you decide a statement is sometimes true give an example of when it is true and an example of when it isn't.
  - **a** It doesn't matter in which order you add, you get the same answer.
  - **b** It doesn't matter in which order you subtract, you get the same answer.
  - **c** It doesn't matter in which order you multiply, you get the same answer.
  - **d** It doesn't matter in which order you divide, you get the same answer.
  - **e** If you multiply a whole number by 2 the answer will be even.
  - **f** If you divide a whole number by 2 the answer will be even.
  - **g** If you add 10 to a number the answer will be more than 10.
  - **h** If you subtract 4 from a number the answer will be 4 less than that number.
  - **i** If you multiply a number by 10 the answer will end in zero.

Example 1

5 Here is a word problem:

Jonah takes his two younger brothers to the skate park. His ticket costs $12 and theirs cost $5 each. How much will the three tickets cost altogether?

a Match these cards

A The numbers used are	B The important mathematical concepts are	C The key operations are

with their decoding cards.

i The total cost is found by adding all the ticket costs.	ii multiplication and addition	iii 2, $12, $5

b Solve the problem.

Example 1

6 Here is a word problem:

Frank buys a bike for $390 and sells it two years later for $200. Did he make a profit or a loss? How much was this? Complete the decoding to solve this problem.