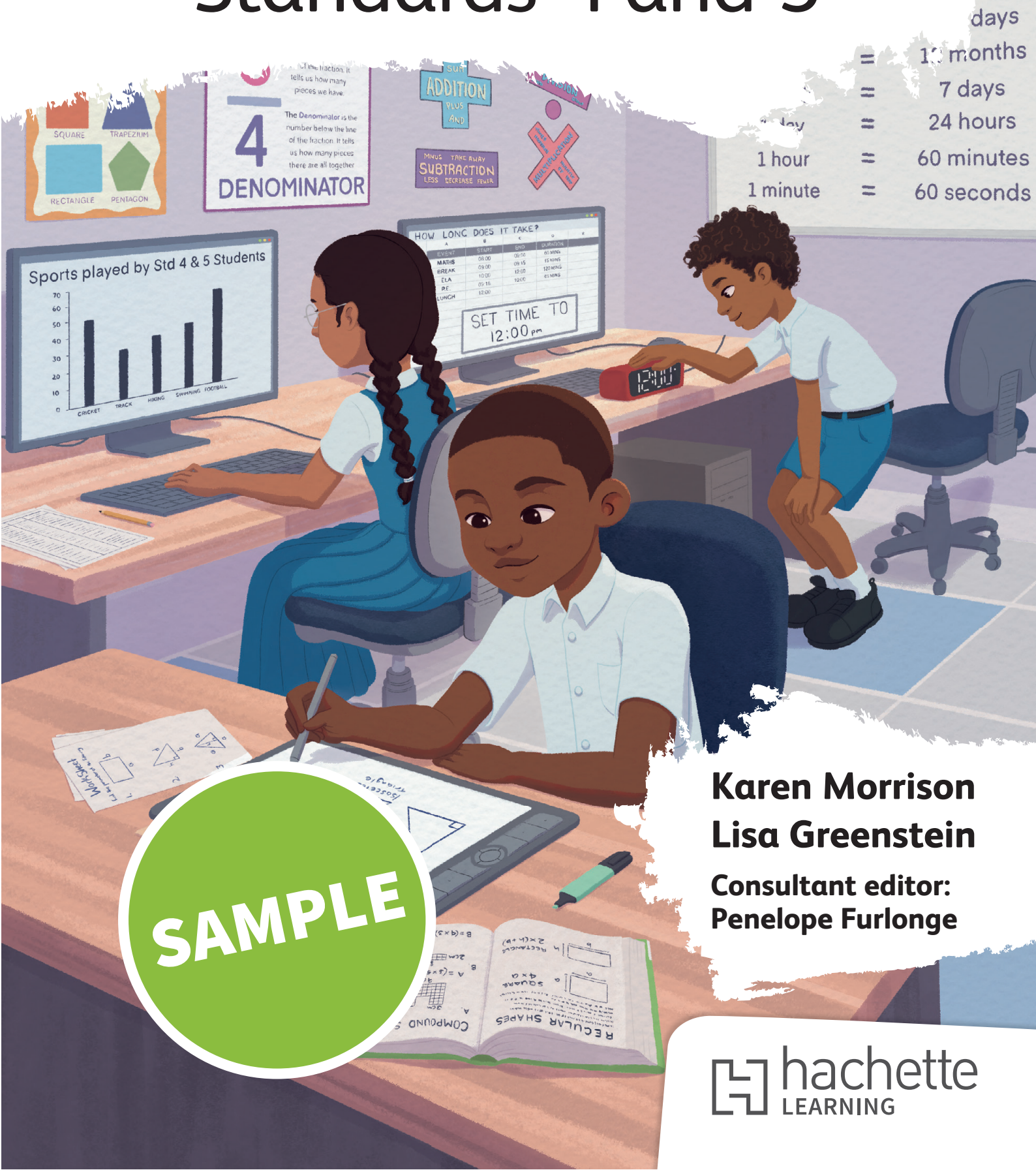


SmartMaths

Standards 4 and 5



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How to use this book

This Student's Book meets the content, skills, dispositions, outcomes and elaborations specified for Standards 4 and 5 in the primary curriculum for Trinidad and Tobago. Alongside the full coverage of the mathematics curriculum, the book is also designed to address the Assessment Framework for the Secondary Entrance Assessment (SEA).

The mathematics curriculum is divided into four broad strands: Number, Geometry, Measurement and Statistics. Each section in the book corresponds to a strand in the curriculum, and chapters are colour-coded to show which strand they belong to. The strands have been spiralled in a logical order so that students encounter concepts from all four strands throughout the year.

More information on curriculum coverage can be found in the 'Curriculum mapping' document on our website. Answers to all questions in this book can also be found there.

SECTION 1

Chapter 2 Number patterns and number relationships

In this chapter, you will:

- use algebraic thinking to recognise, describe and explore number patterns
- use patterns to understand different kinds of numbers and solve problems
- solve algebraic problems
- solve number sentences involving one unknown.

Starting point
Discuss the picture.

- 1 What do you notice? What do you wonder?
- 2 What number patterns do you notice in the rows and columns?
- 3 How can you work out the numbers of the boxes that are not shown?



Key maths idea

A **number pattern** is a **sequence** of numbers that follows a **rule**.
A sequence is a list of numbers in a particular order.
Look at this number pattern: 0, 200, 400, 600, 800 ...
The first **term** in this sequence is 0.
To get from each term to the next term, you use a rule.
In this pattern, the rule is add 200. We can use the rule to work out the next term.
 $800 + 200 = 1000$

Key words
number pattern
sequence
rule
term

- 1 For each sequence, identify the rule. Then say the next term in the sequence.
 - a

3	6	9	12	15	?
---	---	---	----	----	---
 - b

5	18	15	20	25	?
---	----	----	----	----	---
 - c

100	100	100	100	100	100	?
-----	-----	-----	-----	-----	-----	---

20

At the start of each chapter, you will find an **Objectives** box that lists key content and skills.

Eye-catching photographs and illustrations stimulate students' interest.

The **Starting point** activity stimulates discussion and curiosity.

Key maths idea boxes explain concepts and provide examples.

Key words boxes highlight the key vocabulary that students will need to know. A key words glossary can be found online.

Numbered questions provide practice tasks for students.

As students work through the chapters, they will find a range of features, including:

- **Talking maths:** This feature supports vocabulary and communication skills.
- **Real-life maths:** This feature links mathematical concepts to real-world applications.
- **Mental maths:** This feature includes short questions for students to work out mentally (in their heads).
- **Full STEAM ahead:** This feature provides activities that integrate mathematics with science, technology, engineering and the arts.
- **Problem solving:** This feature gives students a chance to apply their mathematical skills to problem-solving scenarios using the strategies they have learnt.
- **Hints:** This feature supplies additional background information, reminders or links to concepts that have appeared elsewhere.
- **Calculator:** This symbol appears next to questions where students are encouraged to use a calculator.
- **Extension:** This feature engages with material that goes beyond the curriculum. It presents additional questions for students who need an extra stretch or challenge.
- **What did you learn?:** This feature appears towards the end of each chapter. It assesses how confident students are feeling about the material they have just covered.

Each chapter ends with a **Review** page, which comprises:

- **Key terms and concepts:** vocabulary questions that check students understand the main terms and concepts presented in the chapter.
- **Quick check:** short questions that revise the mathematics covered through the chapter.
- **Challenge and investigate:** long questions or activities that can extend beyond the main curriculum for students who need additional challenge or stretch.

At the end of this book, there is a full chapter devoted to preparation for the SEA. This chapter begins with tips and exam skills to help students understand exactly what they will need to do in the exam, and how to prepare effectively. The chapter then provides a range of practice questions to allow students to become comfortable with the format and expectations of the exam questions.

Full STEAM ahead Make place value cups

You can use stacked paper cups for an easy way to show the expanded place value of big numbers.

You will need:

- 6 paper cups
- a marker

- Stack the cups. Mark the numbers 0 to 9 along each top strip, evenly spaced, as shown.
- Repeat step 1 for all the other cups. The numbers should line up.
- Next, add zeros and plus signs. This means you can pull the cups open to show the expanded notation. Remove the end cup (ones), and move to the tens cup. Place a zero and plus sign after each number.
- For the next cup, draw two zeros and a plus sign. This will be the hundreds. Continue in the same way with the thousands, ten thousands and hundred thousands.
- Use your place value cups to show different numbers. You can also use them in the activities that follow.

Number patterns and number relationships review

Number patterns and number relationships review

Key terms and concepts

1 Write the word that correctly completes each statement.

term increasing sequence core element repeating rule decreasing

a A list of numbers in a particular order is known as a ____.

b In the pattern 4, 8, 12, 16, 20, ... the ____ is add four.

c In the pattern above, 4 is the first ____ or ____.

d This is an example of a ____ pattern: 5, 6, 5, 6, 5, 6. The ____ is 5, 6.

e The first term of a pattern is 100, and the rule is subtract 3. It is a ____ pattern.

f Adding or multiplying usually results in an ____ pattern.

Quick check

1 Give an example of:

a an increasing pattern b a decreasing pattern c a repeating pattern.

2 Choose one of the multiplication tables. Write the first six multiples in a table. Then complete the statement of the pattern rule:
Start at ____ and ____ to get to the next term.

a 10 b 1000 c 100 000

3 Write the first ten square numbers.

4 Work out the value of the unknown in each equation.

a $\square \times 10 = 800$ b $700 - \square = 20$ c $180 + \square = 180$

Challenge and investigate

1 In a pattern, the first term is 25, the fifth term is 225 and the fourth term is 175. Write the first ten terms in the pattern.

2 The first four elements of a pattern are shown here:

a State the pattern rule.

b How many squares will make up the tenth element of this pattern?

3 Lara is building model stairs out of toy cubes. She follows this pattern:

How many cubes will Lara need to build the next model, with five steps? Show how you work it out.

Chapter 1 Numbers, place value and rounding

In this chapter, you will:

- understand, work with and compare numbers up to one million (1 000 000)
- learn about different types of numbers
- work with place value up to one million
- round numbers to the nearest thousand.

Starting point

- Imagine you have one set of balloons to make each pair of numbers.
With a partner, write down:
 - the smallest and greatest whole 3-digit numbers you can make
 - the smallest and greatest whole 4-digit numbers you can make.
- Look at the numbers you wrote. With your partner, answer these questions.
 - How did you work out your answers?
 - What pattern do you notice in each pair of numbers?
 - Which is the only digit that has the same **value** no matter which place it is in? Why?
- Write the following numbers using **numerals**:
 - five thousand, nine hundred and eighty-seven
 - six thousand and seventy
- Choose four of the ten numerals from 0 to 9.
 - Write ten different 4-digit numbers using those four numerals. You can repeat the same numeral as many times as you like in the numbers.
 - Write your numbers in order from smallest to greatest.

**Key words**

value
numeral

Place value**Mental maths**

- Add 1 for each sum. What pattern do you notice?

$$9 + 1 = \underline{\quad} \quad 99 + 1 = \underline{\quad} \quad 999 + 1 = \underline{\quad} \quad 9999 + 1 = \underline{\quad}$$

Key maths idea



Our number system uses ten numerals: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.

We use **place value** to make bigger numbers.

Example

This seed packet contains 100 seeds.



This box contains 10 seed packets.



A store sells seeds to 10 customers. Each customer buys 10 boxes.

10 groups of 1000 make **ten thousand**:

The store sells 10 boxes every day for 10 days.

Key words

place value
thousand
ten thousand

H	T	O
1	0	0

10 groups of 100 make one **thousand**:

Th	H	T	O
1	0	0	0

T Th	Th	H	T	O
1	0	0	0	0

H Th	T Th	Th	H	T	O
1	0	0	0	0	0

- Write the total value. The first one is done for you.
 - 10 tens = 100
 - 10 hundreds = _____
 - 10 thousands = _____
 - 10 ten thousands = _____
- Write the number of seeds you have if you buy:
 - one box of 1000 seeds and one more packet of 100
 - three packets of 100 and two boxes of 1000 seeds.
- If the store sells ten thousand seeds per day, how many do they sell in:
 - 2 days
 - 5 days
 - 14 days?
- Write these number names in order from greatest to smallest.

one thousand seventeen thousand

twenty-five thousand three hundred thousand
- Write each set of numbers in order from smallest to greatest.
 - 10 000 1 100 100 000 1000
 - 5000 300 000 30 000 300 500 3500
- Draw a place value table to show each number in numerals.
 - thirty-five thousand, four hundred and fifty-two
 - five hundred and six thousand, nine hundred and eighty-nine

Numerals, expanded notation and number names

Key maths idea

Think about the number 7542. Count on in thousands:

7542, 8542, 9542, 10 542, 11 542, 12 542, 13 542

You cannot have more than nine thousands in the thousands column. When you reach ten thousand, you need another column to the left in the **place value chart**. This is the ten thousands place. Look at this number: 13 542

T Th	Th	H	T	O
1	3	5	4	2

Expanded notation

$13\,542 = (1 \times 10\,000) + (3 \times 1000) + (5 \times 100) + (4 \times 10) + (2 \times 1)$

Or: $13\,542 = 10\,000 + 3000 + 500 + 40 + 2$

Number name: thirteen thousand, five hundred and forty-two

When you reach one **hundred thousand**, you need another column to the left. This is the hundred thousands place. Look at this number: 163 242

H Th	T Th	Th	H	T	O
1	6	3	2	4	2

Say: 'one hundred and sixty-three thousand, two hundred and forty-two'.

Key words

place value chart
hundred thousand
expanded notation

Hint

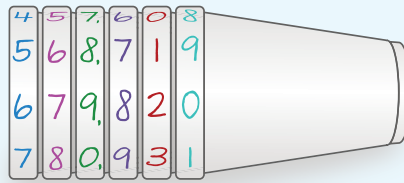
Sometimes a question asks you to express a number using **expanded notation**. If the question does not give an example, you may choose whether or not to use brackets.

- Express each number on a place value table and in expanded notation.
 - 45 213
 - 142 019
 - 18 055
 - 741 240
- Each number is given in expanded notation. Write the number name.
 - $(4 \times 10\,000) + (0 \times 1000) + (5 \times 100) + (1 \times 10) + (3 \times 1)$
 - $(9 \times 10\,000) + (2 \times 1000) + (0 \times 100) + (7 \times 10) + (8 \times 1)$
 - $(8 \times 10\,000) + (7 \times 1000) + (4 \times 100) + (3 \times 10) + (0 \times 1)$
 - $(7 \times 100\,000) + (1 \times 10\,000) + (9 \times 1000) + (0 \times 100) + (3 \times 10) + (7 \times 1)$
 - $(5 \times 100\,000) + (0 \times 10\,000) + (6 \times 1000) + (4 \times 100) + (7 \times 10) + (6 \times 1)$
- Say each number name. Choose three of them to write out.
 - 234 000
 - 300 000
 - 576 234
 - 703 000
 - 499 624
 - 100 095
 - 897 280
 - 385 040
- Write each number using numerals.
 - three hundred and ninety-one thousand, four hundred and seventy-three
 - eight hundred thousand, three hundred and seven
 - nine hundred and three thousand, five hundred and eighteen
- Write the value of the 4 in each number.
 - 456 009
 - 376 214
 - 896 437
 - 205 842

Full STEAM ahead Make place value cups



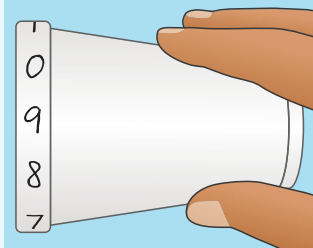
You can use stacked paper cups for an easy way to show the expanded place value of big numbers.



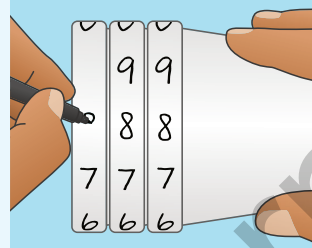
You will need:

- 6 paper cups
- a marker

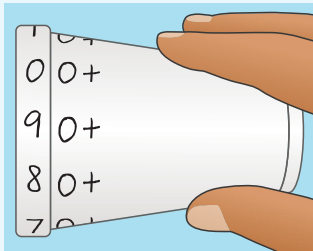
- 1 Stack the cups. Mark the numbers 0 to 9 along each top strip, evenly spaced, as shown.



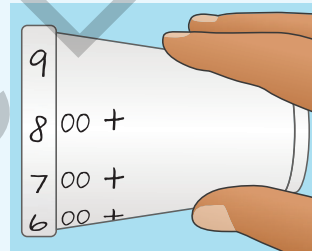
- 2 Repeat step 1 for all the other cups. The numbers should line up.



- 3 Next, add zeros and plus signs. This means you can pull the cups open to show the expanded notation. Remove the end cup (ones), and move to the tens cup. Place a zero and plus sign after each number.



- 4 For the next cup, draw two zeros and a plus sign. This will be the hundreds. Continue in the same way with the thousands, ten thousands and hundred thousands.



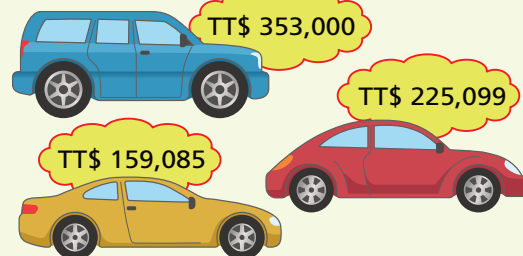
- 5 Use your place value cups to show different numbers. You can also use them in the activities that follow.

Key maths idea



We can use a place value chart to organise numbers by value, in other words, to arrange them from smallest to greatest. These cars have prices in hundreds of thousands. Here are the prices in a place value table. Say each number aloud.

H Th	T Th	Th	H	T	O
3	5	3	0	0	0
2	2	5	0	9	9
1	5	9	0	8	5



To see which is the highest price, compare the digits with the greatest place value. The prices all have six digits. Their greatest place value is hundred thousands. \$353 000 has 3 in the hundred thousands place. This is the highest price.

1 Write the value of each expanded number. The first one is done for you.

a $3000 + 400 + 50 + 8 = 3458$

b $6000 + 20 + 9$

c $10\ 000 + 2000 + 700 + 80 + 1$

d $20\ 000 + 40 + 3$

e $90\ 000 + 40\ 000 + 500 + 2$

f $70\ 000 + 9000 + 30$

g $300\ 000 + 9000 + 50 + 4$

h $800\ 000 + 20\ 000 + 800 + 80$

Hint

If you have made place value cups, use them to make the numbers.

2 Write these numbers using numerals. Then check a partner's work.

a ten thousand and twenty

b eleven thousand and fifteen

c one hundred thousand

d two hundred and ten thousand

e three hundred and forty-five thousand

f six hundred and ninety-eight thousand and fifty-seven

Sometimes there is not a value given for all the places, for example $2000 + 70$. Why?



3 Write the value of the digit highlighted in colour.

a 49 **1**30

b **5**9 428

c 19 **3**02

d **4**6 616

e 740 4**9**8

f **3**99 999

g **7**84 033

h 271 7**4**7

4 Write each number name.

a 10 487

b 14 051

c 42 075

d 73 958

e 104 039

f 284 803

g 972 099

h 703 001

5 Look at this example.

$52\ 308 = 5$ ten thousands, 2 thousands, 3 hundreds, 0 tens, 8 ones

Write each number in the expanded form shown.

a 18 377

b 26 439

c 71 898

d 30 856

e 478 207

f 500 214

g 375 753

h 101 221

6 Make up three different six-digit numbers. Write them in word form. Check a partner's work.

7 Write each number in expanded form.

Use this form: $451\ 298 = 400\ 000 + 50\ 000 + 1000 + 200 + 90 + 8$

a 829 407

b 482 371

c 314 099

d 840 570

8 Write each number in expanded form.

Use this form: $60\ 392 = (6 \times 10\ 000) + (3 \times 100) + (9 \times 10) + (2 \times 1)$

a 683 914

b 932 010

c 209 957

Up to one million

Talking maths

What do these expressions mean?
Discuss your ideas with a partner.

You are one in a million.

That is the million-dollar question.

Thanks a million!

Key maths idea

$$999\,999 + 1 = 1\,000\,000 \quad \text{one million}$$

You can see from the zeros that one million is one thousand thousands.

You can also think of it as ten groups of 100 000.

M	H Th	T Th	T	H	T	O
1	0	0	0	0	0	0

Key words

million
place value mat

A **place value mat** can help you to see numbers up to thousands. Instead of writing a number in each column, you use objects or shapes.

For numbers up to thousands, you can use blocks to show ones, sticks of ten blocks to show tens, squares or bundles of ten to show hundreds and cubes to show thousands. For bigger numbers, it can help to use different shapes.

Th	H	T	O

- Write the number names of these numbers.
 - 901 999
 - 902 000
 - 999 000
 - 999 999
 - 1 000 0000
 - 990 590
- Write the ten numbers that come after 999 990.
- Lee used objects on a place value mat to represent the number 124 523. Look what he did.
 - How many of the heart shapes does the pink circle represent?
 - How many of the brown cubes does each green star represent?
- Use a place value mat to show:
 - 540 802
 - 103 876
 - one million

M	H Th	T Th	Th	H	T	O

Extension

- Use your place value mat to show:
 - half a million
 - 3000 less than 248 478
 - 15 000 more than 143 900

Hint

If you do not have place value mats in your classroom, you can make your own.

Rounding to the nearest thousand

Talking maths

1 Read these statements.

- 'The Hasely Crawford stadium can hold **about** 27 000 people.'
- 'In 2023, the Caribbean received **approximately** 3 million cruise visits.'
- 'There were **around** 140 000 children of school-going age in Trinidad and Tobago in 2020.'



2 Discuss.

- Which word in each sentence tells you the numbers are not exact?
- Why do you think we need numbers that are not exact?
- In which other real-life situations would you use numbers in the tens or hundreds of thousands, or millions?

3 Two students both **round** the number 4193. Sharon writes 4190. Sasha writes 4200. The teacher says both are correct. Why did they get different answers?

Key words

about
approximately
around
round

Key maths idea

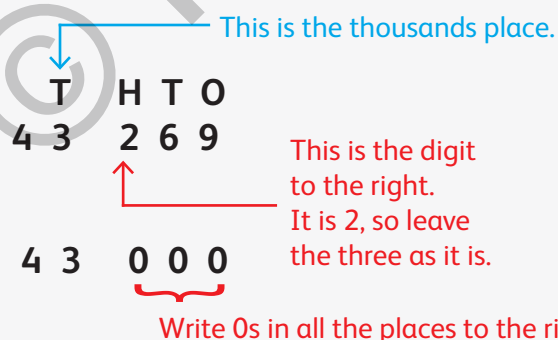


You use place value to round numbers. Follow these steps.

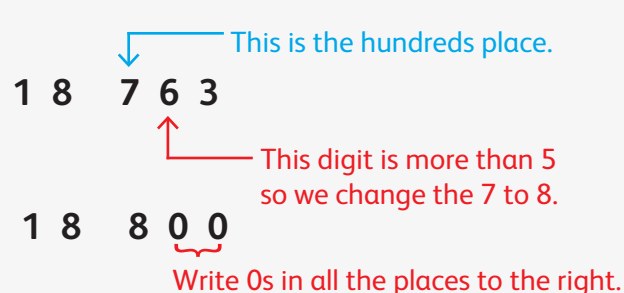
- Decide which place you are rounding to. For example, if the question says 'round to the nearest hundred', look at the digit in the hundreds place.
- Look at the digit to the right of the rounding place.
 - If the digit to the right is 0, 1, 2, 3 or 4, the digit in the rounding place stays the same. This is called 'rounding down'.
 - If the digit to the right is 5, 6, 7, 8 or 9, add 1. This is called 'rounding up'.
- Change all the digits to the right of the rounding place to 0.

Here are two examples:

Round 43 269 to the **nearest thousand**.



Round 18 763 to the **nearest hundred**.



Work in pairs or in your book.

1 Round each number to the nearest hundred.

a 2345

b 3470

c 1399

d 6238

e 10 260

f 32 309

g 74 861

h 89 055

i 411 287

j 567 648

k 200 962

l 791 126

2 Round each number in question 1 to the nearest thousand.

3 Decide which of these numbers will give 6000 when they are rounded to the nearest thousand.

5098

5890

5499

6023

6500

5500

7023

6499

4 True or false? Give a reason.

a 8731 rounds to 9000

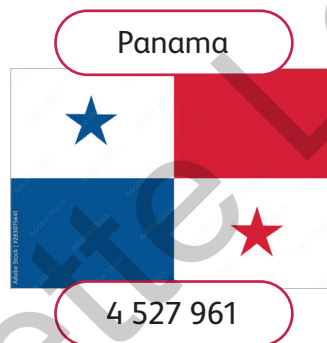
b 12 458 rounds to 12 500

c 112 987 rounds to 114 000

Extension

These questions use numbers that are greater than one million. Try them for a challenge!

5 Look at the populations of these three Central American countries from 2024.



Round these three populations to the nearest thousand, and use the rounded numbers to estimate the combined population of these three countries.

6 A Caribbean news website reported that The Bahamas had 9 654 000 visitors in 2023.

a Do you think this was the exact number of tourists? Give a reason.

b Between January and May 2024, the number of cruise visitors to The Bahamas was 3 928 529. Round this to the nearest thousand.

Problem solving



1 A number is rounded to the nearest thousand to get 416 000.

a What is the smallest number that could have been rounded to get this answer?

b What is the greatest possible number that could have been rounded to get this answer?

2 Can you find this number?

I am a 4-digit number. I am odd. The digit in the ones place is one more than the digit in the thousands. The digit in the tens place is two less than the digit in the ones. The digit in the hundreds place is the smallest even number. The sum of my digits is 14.

What number am I?

Comparing and ordering numbers

Key maths idea

We use the **greater than**, **less than** and **equals signs** to compare numbers. You have used these signs in earlier standards.

> greater than

< less than

= equals

Example 1

Which is greater: 4500 or 12 400?

You can use place value to compare the numbers:

You can also use expanded notation:

$$4500 = 4000 + 500 + 0 + 0$$

$$12\,400 = 10\,000 + 2000 + 400 + 0 + 0$$

You can see that 12 400 has 1 in the ten thousands place. 4500 only goes up to thousands.

$$12\,400 > 4500$$

H Th	T Th	Th	H	T	O
		4	5	0	0
	1	2	4	0	0

Example 2

Copy and complete. Fill in the blank with the >, < or = sign.

$$438\,267 \text{ ____ } 430\,999$$

If two numbers have the same number of digits, start by comparing the values in the highest place value.

Both the numbers have 4 in the hundred thousands place and 3 in the ten thousands place.

438 267 has 8 in the thousands place. 430 999 has 0 in the thousands place.

$$438\,267 > 430\,999$$

Work in pairs or in your book.

1 True or false? Give a reason if it is false.

a 921 001 > one million

b half a million = 500 000

c 582 105 > 977 088

d 523 599 < 91 599

e 35 089 < 301 089

f 728 043 < 1 000 000

2 Say the smallest possible whole number that could complete each statement.

a 498 999 < ____

b 745 312 < ____

c 299 999 < ____

3 Say the greatest possible whole number that could complete each statement.

a 578 011 > ____

b 1 000 000 > ____

c 2 hundred thousand > ____

Talking maths

Tell your partner how you worked out the answers to questions 2 and 3.

4 What is the missing number on each number line?

a 714 800 715 000 715 100

b 850 000 900 000 1 million

c 125 000 145 000 185 000

5 Write each set of numbers in ascending order (from smallest to greatest).

a 328 938 497 637 1 million 4960 four hundred thousand

b sixteen thousand 900 000 25 899 198 000 189 399

6 Write each set of numbers in descending order (from greatest to smallest).

a 734 721 300 000 37 000 307 007 797 733

b 488 481 804 408 840 004 480 008 840 000

7 What is the number that comes between each pair of numbers?

a 247 398 ____ 247 400

b 998 999 ____ 1 000 000

c 163 038 ____ 163 040

d 783 909 ____ 783 911

8 Identify the incorrect number in each sequence.

a 314 578 314 577 314 580 314 581

b 857 350 857 352 857 355 857 356

c 798 200 798 300 798 350 798 500

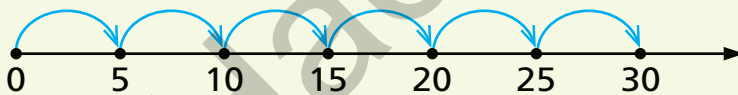
d 910 550 910 560 910 565 910 580

Multiples and factors

Key maths idea



This number line shows what happens if we count in fives:



We can count: 0, 5, 10, 15, 20, 25, 30

Each number in a **skip counting** pattern from 0 is a **multiple**.

These are multiples of 5. What are the next three multiples of 5?

Factors are numbers you multiply to make a different **product**.

5 is a **prime number**. A prime number has only two factors: 1 and itself.

$5 \times 2 = 10$ 10 is the product of 5 and 2 Factors of 10: 1, 2, 5 and 10

$5 \times 3 = 15$ 15 is the product of 5 and 3 Factors of 15: 1, 3, 5 and 15

10 and 15 are **composite numbers**. They have other factors besides 1 and themselves.

When you divide a composite number by one of its factors, it gives a whole-number answer with no **remainder**.

For example: $15 \div 3 = 5$

Key words

skip counting
multiple
factor
product
prime number
composite number
remainder



Mental maths

Work with a partner.

- Say the first ten multiples of:
a 2 **b** 3 **c** 4 **d** 10
- Write out all the factors of:
a 16 **b** 28 **c** 36
- a** What is the only prime number that is even?
b Why are all the other prime numbers odd?
- Keisha says it is impossible for a prime number to end in a zero. Do you agree? Give a reason.

- Work out whether each of these numbers is prime or composite.

a 21 **b** 31 **c** 87 **d** 49 **e** 99

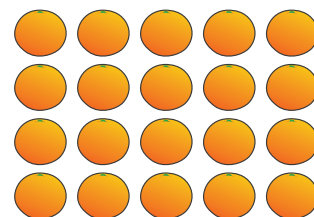


Key word

array

- We can use **arrays** to model composite numbers. An array is an arrangement of shapes or objects in columns and rows.

- Look at this array. Write the multiplication and division facts that it shows.
- Suggest a different arrangement that would show the same total, but a different pair of factors.



Problem solving



- Jaden has baked 24 cookies. He wants to share them into boxes with equal numbers of cookies. He has thought of two ways to do it.

I can make 1 big box with 24 cookies; or 2 boxes, each with 12.

- If he makes 3 boxes, how many would be in each box?
- Why is it possible to make 6 boxes but not 5?
- What other ways could he do it?



7 is a prime number. Its array would only have one row of seven.



I disagree! It could have seven rows of one.

How many arrays can you make with a prime number? Why?

Factor trees

Key maths idea

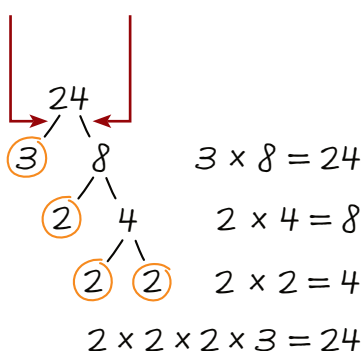
Let us look again at the question about Jaden's cookies.

Sadia uses a **factor tree** to work out the answer. A factor tree expresses a composite number as a product of its prime factors. This is called **prime factorisation**.

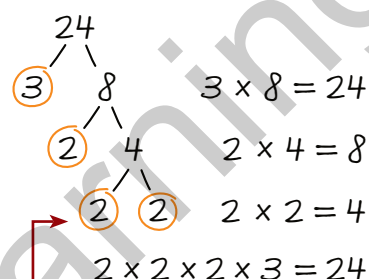
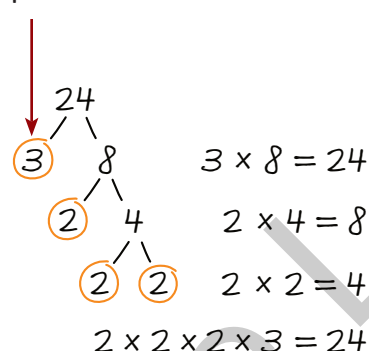
Key words

factor tree
prime factorisation

Sadia drew two branches under the number 24, leading to a pair of factors. She used 3 and 8 as the factors because $3 \times 8 = 24$



She chose 3 and 8 as factors because 3 is a prime number. She has circled 3 to show that it is a prime number.



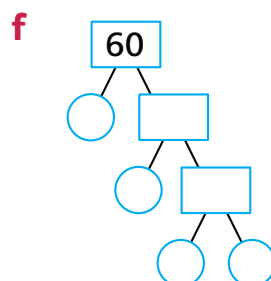
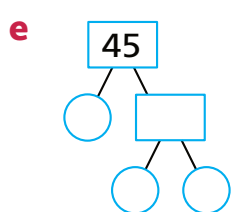
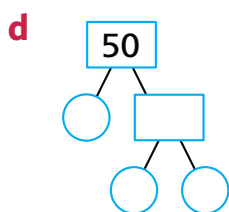
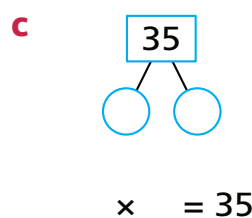
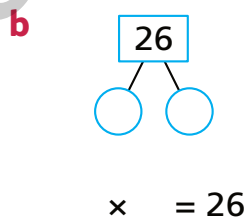
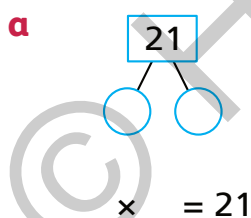
Sadia keeps factorising until all the factors are prime numbers. She cannot factorise any of the numbers to get a pair of smaller prime number.

Sadia can use the factor tree to write 24 as a product of its prime factors.

She writes down all the numbers she has circled:

$$3 \times 2 \times 2 \times 2 = 24$$

- 1 Why are some of the numbers not circled in Sadia's factor tree?
- 2 Six is also a factor of 24, but Sadia did not write a 6. Explain why she did not have to.
- 3 Copy and complete these factor trees.





Full STEAM ahead Play the factorisation dice game

Number of players: 2 to 4

Aim: To finish with the highest score

How to play: There are four categories of number in this game.

You are trying to get a high score for each of the categories.

The categories are:

- an even number
- an odd number
- a multiple of 10
- a multiple of 100.

When it is your turn, roll all four dice.

After the first roll, you may choose to pick up and roll any or all of the dice again. After the second roll, write the four numbers you rolled, and multiply them together to get your score. If the score fits one of the categories on the scorecard, write that score next to the category it matches. If it does not match a category, you score zero.

After one of the players has at least one score for all four categories, the players add up their scores. The highest score wins.

You will need:

- 4 dice
- paper
- pencil

Hint

Think about each category of number, and what possible combinations of dice rolls could produce that category. What strategy could you use to try to get as high a number as possible? How will you decide which dice to roll again on your second roll? Discuss your ideas as you play.

What did you learn?

Look back at the work you did in this chapter. Rate your progress.

1 = I cannot do this. 2 = I need more practice. 3 = I understand it and feel confident.

Can you:

- write numbers to one million in numerals and number names and using expanded notation?
- use place value to compare numbers up to one million using the $<$, $>$ and $=$ signs?
- identify multiples and factors of numbers?
- work out whether a number is prime or composite?
- round numbers to the nearest thousand?

Numbers, place value and rounding review

Key terms and concepts

- 1 a** You can represent the number 143 801 like this:
 $143\,801 = (1 \times 100\,000) + (4 \times 10\,000) + (3 \times 1000) + (8 \times 100) + (0 \times 10) + (1 \times 1)$
 This is called ____ notation.
- b** You can also write it like this:
 one hundred and forty-three thousand, eight hundred and one
 This is called the ____ name.
- 2 a** If you multiply 4 by 5, the ____ is 20. **b** 4 and 5 are both ____ of 20.
c ____ numbers are all multiples of 2. **d** ____ numbers end in 1, 3, 5, 7 or 9.
- 3** A ____ number can only be divided by itself and 1 without leaving a remainder.
 Examples are 5, 7 and 13.

Quick check

- 1** Write the number name for each number:
a 10 000 **b** 100 000 **c** 1 000 000
- 2** Write the number name for the total if you make ten groups of:
a 10 **b** 1000 **c** 100 000
- 3** Write the number 682 356 in expanded notation without brackets.
- 4** Round each number to the nearest thousand.
a 472 540 **b** 509 489
- 5** Write the following numbers in ascending order.
 387 200 889 428 871 152 900 288 445 999 9999
- 6** The prime factors of a number are 2, 3, 5 and 7. What is the smallest number it could be?
- 7** List:
a all the factors of 24 **b** the first ten multiples of 12

Challenge and investigate

- 1** Use the table to answer the questions that follow.
a Which of these six countries has the greatest population?
b Which of these six countries has the smallest population?
c Round the smallest population to the nearest ten thousand.
d Write the population of Barbados using expanded notation.
- 2** Do your own research on the internet. Identify a Caribbean island that falls into each category:
a Population smaller than 25 000
b Population between 60 000 and 100 000
c Population closest to one million
- 3 a** Draw a factor tree for the number 340. 
b Express it as a product of all its prime factors.

Saint Kitts and Nevis	47 755
Belize	410 825
Barbados	281 996
Saint Lucia	180 251
Dominica	73 040
Bahamas	412 624

Chapter 2 Number patterns and number relationships

In this chapter, you will:

- use algebraic thinking to recognise, describe and explore number patterns
- use patterns to understand different kinds of numbers and solve problems
- solve algebraic problems
- solve number sentences involving one unknown.

Starting point

Discuss the picture.

- 1 What do you notice? What do you wonder?
- 2 What number patterns do you notice in the rows and columns?
- 3 How can you work out the numbers of the boxes that are not shown?



Key maths idea

A **number pattern** is a **sequence** of numbers that follows a **rule**.

A sequence is a list of numbers in a particular order.

Look at this number pattern: 0, 200, 400, 600, 800 ...

The first **term** in this sequence is 0.

To get from each term to the next term, you use a rule.

In this pattern, the rule is add 200. We can use the rule to work out the next term.

$$800 + 200 = 1000$$

Key words

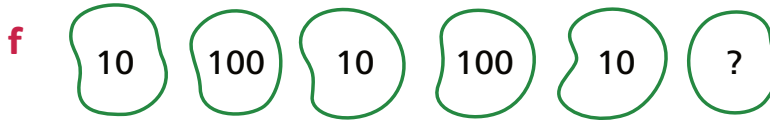
number pattern
sequence
rule
term

- 1 For each sequence, identify the rule. Then say the next term in the sequence.

a 3 — 6 — 9 — 12 — 15 — ?

b 5 — 18 — 15 — 20 — 25 — ?

c 100 100 100 100 100 100 ?



- 2** Make up a sequence of your own. Ask a partner to work out the next term in the sequence.

Repeating patterns

Key maths idea



To 'repeat' means to happen or appear over and over again.

A **repeating pattern** has numbers or shapes that repeat in a regular way.

The **core** is the smallest unit that repeats to make the pattern. Once you find the core, you can work out the **element** that comes next. The elements of a pattern are another name for the terms. Look at this shape pattern:



In this pattern, the core is:



The next three elements must be:



Here are two repeating number patterns:

- 50, 100, 50, 100, 50 ... The core is: 50, 100

The next three terms must be 100, 50, 100

- 90, 100, 110, 100, 90, 100 ... The core is: 90, 100, 110, 100

The next three elements must be 110, 100, 90

Key words

repeating pattern
core
element

- 1** Find the core of each pattern. Then draw the three shapes that come next.



- 2** Find the core of each number pattern. Then write the three numbers that come next.

a 5, 50, 5, 50, 5, ...

b 1, 10, 100, 1, 10, 100, 1 ...

c 2, 7, 3, 2, 7, 3, 2, ...

d 20, 40, 6, 20, 40, 6, 20 ...

- 3** One of the elements in each pattern is incorrect. Say which one and the number that should be in its place.

a 100, 200, 100, 200, 300, 200

b 40, 80, 40, 100, 40, 80

c 99, 77, 99, 66, 99, 77

d 12, 24, 36, 24, 12, 24, 12

Real-life maths



Patterns are all around you. Look at these pictures. Can you see the patterns these photos show? Are there any other real-life patterns you can think of?

Increasing and decreasing number patterns

Key maths idea

When you look at a pattern, think:

- What is the first element?
- How does each element change from the one before?

Type of pattern	Description	Examples	Type of operations
Increasing	The numbers or values get bigger with each term	15, 30, 45, 60 ... 1, 2, 4, 8, 16 ...	Addition or multiplication
Decreasing	The numbers or values get smaller with each term	78, 77, 76 ... 1000, 500, 250 ...	Subtraction or division

For example: 7, 14, 21, 28, 35 ...

The first element is 7. The rule is: add 7

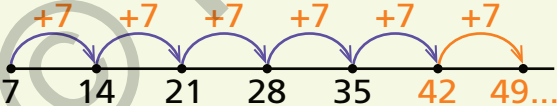
You can see that the numbers get greater with each element. This tells you that it is an increasing pattern.

Hint

Once you have guessed the rule, check whether it works in the same way for each element in the sequence.

Key words

increasing
decreasing



- 1** For each pattern, write I for increasing, D for decreasing or R for repeating. Then write the next three elements in the sequence.
- a** 10, 20, 30, 40, 50, 60, ...

c 350, 300, 250, 200, ...

b 7, 7, 5, 7, 7, 5, 7, 7, 5, ...

d 40, 80, 120, 160, ...

2 a Press these keys on your calculator, and write the resulting number pattern.



b Keep pressing the $=$ key until your pattern has ten terms. Write them down.

c Copy and complete the rule for the pattern you have made:
Start at ____ and ____ ____ to get the next term.

d Is it an increasing, decreasing or repeating pattern? How do you know?

Hint

This works on the calculator apps on a smartphone.

3 Use your calculator to make a decreasing pattern with ten number terms. Write it down. Ask a partner to work out the rule you used.



4 Write the terms missing from each sequence.

a 12 17 ____ 27 32 ____

b 250 ____ 230 220 210 ____

c 890 894 ____ 902 ____ 910

d 81 72 ____ ____ 45 36

5 Each sentence has one element that is incorrect. Write which one is incorrect, and what the correct element should be in its place.

a 40 80 100 160 200

b 750 700 650 500 550

6 Write a sequence with one element incorrect, for a partner to solve.

Explore patterns in different kinds of numbers

Key maths idea



When you divide an **even** number by 2, it leaves no remainder. When you count in twos, each number is even.

Even numbers: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20 ...

An **odd** number is always 1 more or 1 less than an even number. When you divide an odd number by 2, it leaves a remainder of 1.

Odd numbers: 1, 3, 5, 7, 9, 11, 13, 15, 17, 19 ...

When you multiply a factor by itself, you get a **square number**. The factor you multiplied is the **square root**.

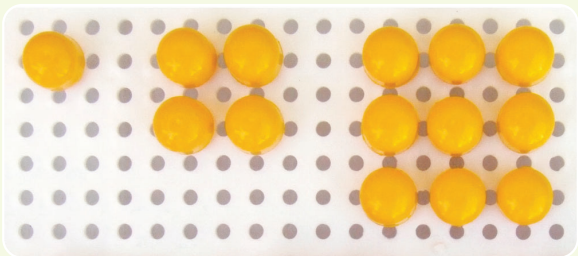
$1 \times 1 = 1$ 1 is the square root of 1

$2 \times 2 = 4$ 2 is the square root of 4

$3 \times 3 = 9$ 3 is the square root of 9

Key words

even odd
square number
square root



1 Draw the next two shapes in the pattern of square numbers.

2 Copy and complete the table on the right about the pattern of square numbers.

3 What makes the pattern of square numbers different from the increasing patterns you have already worked with?

4 Continue the sequence of square numbers up to twelve terms.



Term	How many pegs?
1	1
2	4
3	9
4	
5	

- 5 a** Look at the pattern of even numbers. Use it to complete the rule:
The unit digit of an even number is always one of these numbers:
____, ____, ____, ____ or ____.
- b** Look at the pattern of odd numbers. Use it to complete the rule:
The unit digit of an even number is always one of these numbers:
____, ____, ____, ____ or ____.
- 6** Predict whether the answer will be odd or even for each of the following operations. Write the reason for your prediction. Then use a calculator to test out three or more examples. Were you right? Why?
- a** Add an even number to an even number.
 - b** Subtract an odd number from an odd number.
 - c** Subtract an even number from an odd number.
 - d** Add an odd number to an odd number.
 - e** Add three odd numbers together.

Multiplication patterns

Key maths idea

×	1	2	3	4	5	6	7	8	9	10	11	12
1	1	2	3	4	5	6	7	8	9	10	11	12
2	2	4	6	8	10	12	14	16	18	20	22	24
3	3	6	9	12	15	18	21	24	27	30	33	36
4	4	8	12	16	20	24	28	32	36	40	44	48
5	5	10	15	20	25	30	35	40	45	50	55	60
6	6	12	18	24	30	36	42	48	54	60	66	72
7	7	14	21	28	35	42	49	56	63	70	77	84
8	8	16	24	32	40	48	56	64	72	80	88	96
9	9	18	27	36	45	54	63	72	81	90	99	108
10	10	20	30	40	50	60	70	80	90	100	110	120
11	11	22	33	44	55	66	77	88	99	110	121	132
12	12	24	36	48	60	72	84	96	108	120	132	144

This is a multiplication chart. It shows the times tables up to 12×12 . You can find many number patterns in the chart. For example, multiples in the 5 times table have a repeating pattern. 5 times table:
5, 10, 15, 20, 25, 30, 35 ...
Pattern in the last digits:
5, 0, 5, 0, 5, 0, 5 ...



Mental maths

Hint

Look for digits that repeat, especially in the tens and ones places.

Hint

To 'double' means to multiply by 2. To 'half' means to divide by 2.

- 1 What pattern do you notice:
 - a as you go along the rows from left to right?
 - b as you go down the columns from top to bottom?
 - 2 Is it possible that any of the numbers in the grid are primes? Tell your partner your reason for your ideas.
 - 3 What patterns do you notice in:

a multiples of 3, 6 and 9?	b multiples of 5 and 10?
c multiples of 2, 4 and 8?	d multiples of 11?
 - 4 If you chose any number in the chart, how would you check whether it is a square number?
 - 5 Choose a number in the 1 times table. Double it. What do you notice about the position of the double:
 - a if you look for it in the same row, but in a different column?
 - b if you look for it in the same column, but in a different row?

Try it with another number in the 1 times table. What is the same, and what is different? Why?
 - 6 Now repeat question 5 with the 2 times table. What do you notice?
-
- 1 True or false? Use the multiplication grid to help you explain your answer.
 - a All multiples of 10 are also multiples of 5.
 - b A multiple of an even number must always be an even number.
 - c A multiple of an odd number must always be an odd number.
 - d The product of an odd and an even number must be an odd number.
 - 2 Work out the missing terms in these number sequences.
 - a ____, ____, 30, 36, ____, ____, 54, 60
 - b ____, ____, 110, 99, ____, 77, ____, ____
 - c 21, 24, 27, ____, ____, ____
 - d 90, ____, ____, 63, ____, 45, 36
 - 3 In each of the following sequences, one of the terms is incorrect. Identify the mistakes and write the correct number sequence.
 - a 10, 15, 15, 25, 30, 35, 40
 - b 56, 63, 72, 80, 88, 96
 - c 24, 48, 70, 84, 108, 132
 - 4 These patterns use doubling or halving. Write D for doubling or H for halving, and work out the next three terms in each sequence.

a 2, 4, 8, 16, ...	b 50, 100, 200, ...	c 160, 80, 40, ...	d 12, 24, 48, ...
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Key maths idea

Number patterns can help you. When you need to add, subtract, multiply or divide, you can look for **compatible numbers**. Some people also call these 'friendly numbers'. They are pairs of numbers that are easy to work with, for example:

- pairs of numbers that add up to 10, 20 or 100
- multiples of 5 or 10.

Key words

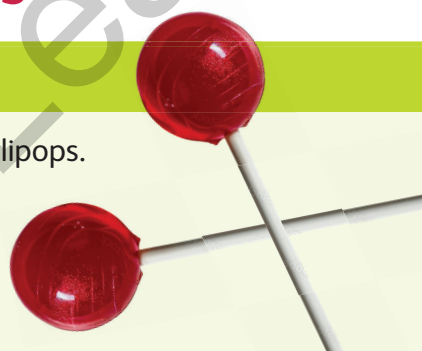
compatible numbers

- Write five different sums that add up to 10.
 - Use your answer to question **a** to help you write five sums that add up to 100, and five more that add up to 1000.
- Use your answers from question 1. Work out the missing numbers.
 - $35 + \underline{\quad} = 100$
 - $100 - \underline{\quad} = 23$
 - $\underline{\quad} + 79 = 100$
 - $100 = \underline{\quad} - 90$

Using patterns to solve problems

Key maths idea

Karimah is having a party. She wants to give each child 2 lollipops. There will be 12 children at the party. How many lollipops must she get? Look at how these two students solved the problem.



Adara

Number of children	1	2	3	4	5
Number of lollipops	2	4	6	8	10

The first term is 2. The rule is add 2. To find the 12th term, I keep adding 2. 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24. Karimah must get 24 lollipops.

Jenny

1 child	2 lollipops
2 children	4 lollipops
3 children	6 lollipops

I can see that the number of lollipops is double the number of children. Double 12 = 24. She must get 24 lollipops.

- 1 Karimah wants to make sure that there are 3 patties for each child at the party.
 - a What number pattern can she use to work out how many patties to buy?
 - b Patties come in boxes of 10. How many boxes should Karimah buy? Show your working.
- 2 Adara says that if a pattern rule is 'add zero', this is the same as a pattern rule of 'multiply by 1'.
 - a Test out Adara's rule. Does it work? Why?
 - b What happens if the term-to-term rule is 'subtract zero'?
- 3 Jenny says that if the pattern rule is 'multiply by zero', then you always get the same repeating pattern, no matter the starting term. Test out Jenny's idea. Does it work? Why?
- 4 Tricia is building a pattern using toothpicks. She uses three toothpicks for the first shape, five toothpicks for the second shape and seven toothpicks for the third shape.
 - a What rule does her pattern follow?
 - b How many toothpicks would she need for the eighth shape in the pattern? Show how you work it out.
 - c Draw a set of shapes that would follow this pattern rule.
 - d Compare your work with a partner. What similarities and differences do you notice?

Finding an unknown

Key maths idea



Example 1

Look at this number sentence:

$$3 + \text{★} = 10$$

Think: 'three plus something equals ten'

You know that $7 + 3 = 10$.

$$\text{So } \text{★} = 7$$

The star is like a question mark or an answer box. It represents an amount or value we do not know yet, which we want to find out. We call it an **unknown**.

Example 2

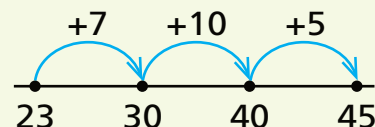
$$23 + \square = 45$$

Look at how these different students worked out the unknown.

Ashanti used a **bar model** to show the problem as a picture.

45	
23	?

Randy thought about jumps on a **number line**. He started at 23. He used **compatible numbers** to get to 45.



$$7 + 10 + 5 = 22$$

This helps you to understand the **number facts** you can use to solve it:

$$23 + \square = 45$$

$$45 - \square = 23$$

$$45 - 23 = \square$$

$$45$$

$$-23$$

$$\hline 22$$

$$\text{So } 23 + 22 = 45$$

Key words

unknown
bar model
number line
compatible numbers
number facts

- Work out the unknown in each number sentence. Explain how you worked it out, or show your working.

a $\square + 20 = 50$	b $2 \times \square = 100$	c $\square - 25 = 340$	d double $\square = 1000$
e $\square \div 3 = 6$	f $700 - \square = 200$	g $50 + \square = 90$	h $20 \div \square = 4$
- Dinesh tells Zaida he will sell twice as many raffle tickets as she does.
 - If Zaida sells 18 tickets, how many must Dinesh sell?
 - If Zaida sells 35 tickets, how many must Dinesh sell?
 - Explain the procedure you can use to work out how many tickets Dinesh must sell if you know how many Zaida sold.
- For each of the following sentences, the result is 100. Write a number sentence for each. Use a box, shape or letter to represent the unknown number. Then work out the unknown.

a I choose a number and double it.	b I choose a number and add 35.
c I choose a number and divide it by 10.	d I choose a number and subtract 80.

Problem solving



Use what you know about different types of numbers, number facts or compatible numbers. Solve these problems.

- Use the digits 3, 4, 5 and 6. Copy and complete the addition sum using all four digits each time to make:

- the smallest possible sum
- the greatest possible sum.

$$\begin{array}{r} \square \square \\ + \square \square \\ \hline \end{array}$$

- Work out the missing digit for each box.

$$\begin{array}{r} \text{a} \quad 41\square \\ - \square 10 \\ \hline 102 \end{array}$$

$$\begin{array}{r} \text{b} \quad \square 20 \\ - 31\square \\ \hline 201 \end{array}$$

$$\begin{array}{r} \text{c} \quad \square 45 \\ - 6\square 3 \\ \hline 62 \end{array}$$

Hint

Think about what you would need to trade from the next column.

What did you learn?

Look back at the work you did in this chapter. Rate your progress.

1 = I cannot do this. 2 = I need more practice. 3 = I understand it and feel confident.

Can you:

- describe a number pattern, giving the first term and the pattern rule?
- work out whether a pattern is repeating, increasing or decreasing, and explain why?
- work out the missing terms in a sequence?
- create repeating, increasing and decreasing number patterns of your own?
- describe patterns in different kinds of numbers, including even, odd and square numbers?
- describe patterns that appear in a list of multiples?
- use patterns to solve problems?
- find unknowns in number sentences?

Number patterns and number relationships review

Key terms and concepts

1 Write the word that correctly completes each statement.

term

increasing

sequence

core

element

repeating

rule

decreasing

- a** A list of numbers in a particular order is known as a ____.
- b** In the pattern 4, 8, 12, 16, 20, ... the ____ is add four.
- c** In the pattern above, 4 is the first ____ or ____.
- d** This is an example of a ____ pattern: 5, 6, 5, 6, 5, 6. The ____ is 5, 6.
- e** The first term of a pattern is 100, and the rule is subtract 3. It is a ____ pattern.
- f** Adding or multiplying usually results in an ____ pattern.

Quick check

1 Give an example of:

- a** an increasing pattern
- b** a decreasing pattern
- c** a repeating pattern.

2 Choose one of the multiplication tables. Write the first six multiples in a table. Then complete the statement of the pattern rule:

Start at ____ and ____ ____ to get to the next term.

- a** 10
- b** 1000
- c** 100 000

3 Write the first ten square numbers.

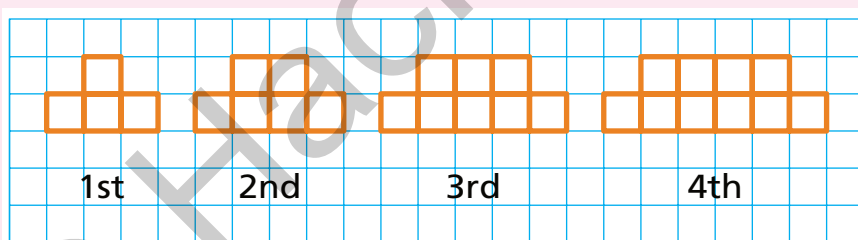
4 Work out the value of the unknown in each equation.

- a** $\square \times 10 = 800$
- b** $700 - \square = 20$
- c** $180 + \square = 180$

Challenge and investigate

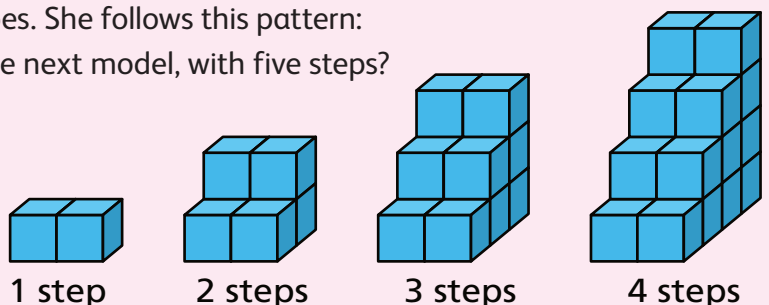
1 In a pattern, the first term is 25, the fifth term is 225 and the fourth term is 175. Write the first ten terms in the pattern.

2 The first four elements of a pattern are shown here:



- a** State the pattern rule.
- b** How many squares will make up the tenth element of this pattern?

3 Lara is building model stairs out of toy cubes. She follows this pattern: How many cubes will Lara need to build the next model, with five steps? Show how you work it out.



Strand number	Standard 4 Outcomes	Standard 5 Outcomes	Coverage
NUMBER – Numbers to 1 000 000			
Number concepts, place value and rounding			
1	1. Recognize, represent, model, compare and order numbers up to 1 000 000 with reference to place value		Chapter 1
2	Demonstrate an understanding of different types of numbers		Chapter 1
3	Develop an understanding of rounding to thousands		Chapter 1
Number patterns			
4	Recognize and explore number patterns up to thousands		Chapter 2
5	Develop an understanding of different types of numbers by exploring their patterns		Chapter 2
6	Develop an understanding that pattern recognition can aid in problem solving		Chapter 2, Chapter 12
Number relationships			
7	Solve problems involving number sentences with one unknown		Chapter 2, Chapter 12
Whole number (operations)			
8	Solve problems using whole numbers involving the four operations		Chapter 3, Chapter 12
9	Demonstrate an understanding of algorithms, mental strategies and estimation strategies.		Chapter 3
Fractions			
10	Develop and apply procedures to solve problems involving fractions and the four operations		Chapter 6, Chapter 12
		1. Develop and apply procedures to add and subtract fractions and mixed numbers to solve problems.	Chapter 14
		2. Develop and apply procedures to multiply a fraction by a whole number and multiply fractions and mixed numbers and to solve problems.	Chapter 14
		3. Develop and apply procedures to divide whole numbers by fractions, fractions by whole numbers and fractions to solve problems.	Chapter 14
Decimals			
11	Demonstrate an understanding of decimals up to hundredths		Chapter 7
12	Develop an understanding of the comparison of decimals		Chapter 7
13	Develop an understanding of rounding to whole numbers and tenths		Chapter 7
14	Develop and apply procedures to solve problems involving the addition and subtraction of decimals		Chapter 7, Chapter 15
15	Develop estimation skills		Chapter 7
		4. Develop and apply the procedures to multiply decimals by whole numbers and decimals (limited to tenths by tenths) and to divide a decimal by a whole number (up to hundredths) to solve problems.	Chapter 15, Chapter 18

		Percent	
		5. Demonstrate an understanding of percent concretely, pictorially and symbolically	Chapter 18
		6. Demonstrate an understanding of the relationships between fractions and percents.	Chapter 18
		7. Apply understanding of fractions, decimals and percents to solve problems.	Chapter 18
Problem solving			
16	Solve multi-step problems involving whole numbers, fractions and decimals using algorithms, mental strategies and other problem solving strategies		Chapter 12
17	Solve problems involving direct proportion		Chapter 12
		8. Create and solve one-step and multi-step problems involving whole numbers, fractions, mixed numbers, decimal, percents including money using algorithms, mental strategies and other problem solving strategies	Chapter 12, Chapter 18
		9. Solve problems involving unequal sharing.	Chapter 12, Chapter 18
Language (of number)			
18	Communicate effectively using vocabulary associated with number	10. Communicate effectively using vocabulary associated with number	throughout all Number chapters
GEOMETRY – Solids and plane shapes			
1	Demonstrate an understanding of the relationship between standard units and their sub-parts to solve practical problems involving linear measure		Chapter 5
2	Solve problems involving linear measure		Chapter 5, Chapter 16
		1. Describe solids in terms of their properties.	Chapter 16
		2. Classify and determine the properties of quadrilaterals.	Chapter 16
		3. Solve problems involving solids and plane shapes.	Chapter 5, Chapter 16
Angles			
3	Demonstrate an understanding of angles		Chapter 4
4	Demonstrate an understanding of the different types of triangles based on properties of sides and angles		Chapter 5
Language (of geometry)			
5	Communicate effectively using vocabulary associated with geometry	4. Communicate effectively using vocabulary associated with geometry	throughout all Geometry chapters
MEASUREMENT – Linear measure			
1	Demonstrate an understanding of the relationship between standard units and their sub-parts to solve practical problems involving linear measure		Chapter 8, Chapter 11
2	Demonstrate appropriate techniques when measuring		Chapter 8, Chapter 11
3	Solve problems involving linear measure		Chapter 8, Chapter 11, Chapter 12
		Linear: Perimeter	
		1. Develop and use proficiently the formulae to calculate perimeter of squares and rectangles in problem solving.	Chapter 17

Mass/weight			
4	Demonstrate an understanding of the relationship between standard units and their sub-parts to solve problems involving mass/weight		Chapter 8
		2. Apply algebraic reasoning to calculate unknown values involving mass/weight.	Chapter 13
		3. Solve problems involving mass/weight.	Chapter 13
Time			
5	Accurately read and record time to the minute and solve practical problems involving time		Chapter 8
6	Develop an understanding of time schedules		Chapter 8
		4. Solve problems involving time	Chapter 8, Chapter 12
Capacity and volume			
7	Demonstrate an understanding of the concept of volume		Chapter 10
8	Understand that volume can be quantified		Chapter 10
9	Understand conservation of volume		Chapter 10
10	Understand that capacity and volume are related		Chapter 10
11	Solve problems involving capacity and volume		Chapter 10, Chapter 20
		5. Develop and use proficiently the formula to calculate volume of cubes and cuboids in problem solving.	Chapter 20
		6. Solve problems involving volume and capacity.	Chapter 10, Chapter 20
Area			
12	Demonstrate an understanding of area of regular and irregular plane shapes		Chapter 11, Chapter 17
		7. Develop and use proficiently formula to calculate area in problem solving.	Chapter 17
Language (of measure)			
13	Communicate effectively using vocabulary associated with measurement	8. Communicate effectively using vocabulary associated with measurement.	throughout all Number chapters
STATISTICS			
1	Design survey(s) to solve problem(s) that involve the use of statistical data	1. Design survey(s) to solve problem(s) that involves the use of statistical data.	Chapter 9, Chapter 19
2	Gather, classify, organise and display data using tables, tally charts and graphs (pictographs, block graphs and bar graphs) and interpret results	2. Gather, classify, organize and display using tables, tally charts and graphs (pictographs, block graphs and bar graphs) and interpret results.	Chapter 9, Chapter 19
3	Describe methods and analyse results and make decisions	3. Describe methods and analyse results and make decision	Chapter 9, Chapter 19
4	Communicate findings and decisions made using vocabulary associated with statistics	4. Communicate findings and decisions made using vocabulary associated with statistics	Chapter 9, Chapter 19
5	Demonstrate an understanding of mode	5. Demonstrate an understanding of mode and mean.	Chapter 9 (mode); Chapter 19 (mean)

Outcome number	Assessment framework outcome	Skill set	Where students will deal with this
NUMBER CONCEPTS PLACE VALUE AND ROUNDING			
1	Represent any number up to one million using numerals or word names	Knowing	Chapter 1
2	Represent a number up to one million concretely, pictorially, symbolically using multiple models and connect to numerals and number names	Knowing	Chapter 1
3	State the value or place value of a digit in any whole number up to one million	Knowing	Chapter 1, Chapter 2
4	Sequence number names and numerals	Knowing	Chapter 1
5	Compare whole numbers to one million and use the symbols > or < to show the relationship between them	Applying	Chapter 1, Chapter 2
6	Order a given set of numbers in ascending or descending order and explain the order by making references to place value	Applying	Chapter 1, Chapter 2
7	Identify the missing numbers in an ordered sequence or on a number line	Knowing	Chapter 2, Chapter 18
8	Express a whole number up to one million using expanded notation	Knowing	Chapter 1, Chapter 3
9	Write the numeral represented by a given expanded notation	Knowing	Chapter 1
10	Round whole numbers to the nearest thousand	Knowing	Chapter 1, Chapter 3
11	Differentiate between factors and multiples and prime and composite numbers and identify square numbers	Applying	Chapter 1, Chapter 2
12	Calculate the square of a number up to the square of 12	Knowing	Chapter 2
13	List square numbers up to 144	Knowing	Chapter 2
14	Identify coins, bills, their value and the value of a set of coins/bills (up to 100 cents and \$100)	Knowing	fully covered at earlier standards
15	Determine the possible combinations of coins/bills, which are equal to given amounts (up to 100 cents and \$100)	Knowing	Chapter 3, Chapter 12, Chapter 18
WHOLE NUMBER (OPERATIONS) ADDITION, SUBTRACTION, MULTIPLICATION, DIVISION			
16	Solve problems involving addition (up to 4-digit numbers with sum less than 10 000) and up to 4 addends and subtraction (with minuend up to 4 digits)	Applying	Chapter 3, Chapter 12, Chapter 13
17	Solve one-step addition and subtraction problems involving whole numbers and money including bills, best buy, profit and loss, using dollars only and cents only	Applying	Chapter 3, Chapter 12, Chapter 18
18	Solve multi-step addition and subtraction problems involving whole numbers and money including bills, best buy, profit and loss, using dollars only and cents only	Reasoning	Chapter 3, Chapter 12, Chapter 15, Chapter 18
19	Solve real-life problems involving addition and subtraction	Reasoning	Chapter 3, Chapter 12, Chapter 15, Chapter 18
20	Explain or demonstrate how an answer was obtained when solving problems involving addition, subtraction or both	Reasoning	Chapter 12, Chapter 18
21	Multiply two-, three- and four-digit numbers by one- or two-digit multipliers	Knowing	Chapter 3
22	Divide two-, three- and four-digit numbers by one- or two-digit divisors with and without remainder	Knowing	Chapter 3
23	Solve real-life problems involving multiplication and division	Reasoning	Chapter 3, Chapter 12, Chapter 15, Chapter 18
24	Solve one-step multiplication and division problems (including problems involving the unitary method) involving whole numbers and money (including bills, best buy, profit and loss, rate (weekly, hourly, daily, monthly, yearly and by the minute - using dollars only and cents only)	Reasoning	Chapter 3, Chapter 12, Chapter 15, Chapter 18
25	Solve multi-step multiplication and division problems (including problems involving the unitary method) involving whole numbers and money (including bills, best buy, profit and loss, rate (weekly, hourly, daily, monthly, yearly and by the minute - using dollars only and cents only)	Reasoning	Chapter 3, Chapter 12, Chapter 15, Chapter 18

26	Explain through the use of words and diagrams the procedures involving multiplication using whole numbers	Reasoning	Chapter 3
27	Explain through the use of words and diagrams the procedures involving division using whole numbers	Reasoning	Chapter 3
28	Explain or demonstrate how an answer was obtained when solving problems involving multiplication, division, or both	Reasoning	Chapter 3, Chapter 12, Chapter 15, Chapter 18
29	Interpret the remainder in relation to the context of the word problem	Reasoning	Chapter 3, Chapter 12
30	Solve one-step word problems involving any one of the four basic operations on whole numbers	Applying	Chapter 3, Chapter 8, Chapter 10, Chapter 11, Chapter 12
31	Solve multi-step word problems involving any combination of the four basic operations on whole numbers	Reasoning	Chapter 3, Chapter 8, Chapter 10, Chapter 11, Chapter 12
32	Use estimation strategies in problem solving contexts with whole numbers	Reasoning	Chapter 3, all problem solving exercises
33	Use estimation skills to check solutions to problems and determine reasonableness of answer	Reasoning	Chapter 3, Chapter 12, all problem solving exercises
NUMBER PATTERNS			
34	Explore repeating, increasing and decreasing patterns	Reasoning	Chapter 2, Chapter 6, Chapter 18
35	Describe and extend whole number patterns involving the four operations	Reasoning	Chapter 2, various problem solving activities
36	Describe and extend patterns involving fractions, by using the pattern rule	Reasoning	Chapter 6, Chapter 12, Chapter 14
37	Explore patterns involving square numbers up to 144 and square roots up to 12	Reasoning	Chapter 2, Chapter 12
38	Insert missing elements in number patterns and explain reasoning	Reasoning	Chapter 2, Chapter 12, Chapter 13, Chapter 18
39	Use a pattern rule to determine missing elements for a given pattern and to extend or predict subsequent elements in patterns	Reasoning	Chapter 2, various problem solving activities
40	Recognize when an error occurs in a pattern and explain what is wrong	Reasoning	Chapter 2, various problem solving activities
41	Solve problems involving the use of number patterns	Reasoning	Chapter 2, Chapter 12
NUMBER RELATIONSHIPS			
42	Explore algebraic thinking (number patterns and number relationships)	Reasoning	Chapter 2
43	Solve problems involving number sentences with one unknown number represented by a symbol and explain reasoning	Reasoning	Chapter 2, Chapter 12, Chapter 13
FRACTIONS			
44	Represent a fraction using pictorial and symbolic representations	Applying	Chapter 6, Chapter 14, Chapter 18
45	Recognize and generate equivalent fractions using a variety of models	Applying	Chapter 6, Chapter 14, Chapter 18
46	Create equivalent fractions using the rule	Knowing	Chapter 6, Chapter 14, Chapter 18
47	Reduce a fraction to the lowest equivalent form	Knowing	Chapter 6, Chapter 14, Chapter 18
48	Order proper fractions with unlike denominators using equivalent forms	Reasoning	Chapter 6, Chapter 14, Chapter 18
49	Demonstrate an understanding of proper fractions, improper fractions and mixed numbers	Reasoning	Chapter 6, Chapter 14, Chapter 18
50	Express improper fractions as mixed numbers	Knowing	Chapter 6, Chapter 14
51	Express mixed numbers as improper fractions	Knowing	Chapter 6, Chapter 14
52	Place a given set of fractions, including mixed numbers and improper fractions, on a number line and explain strategies used to determine position	Reasoning	Chapter 6, Chapter 14, Chapter 18
53	Add and subtract fractions involving same denominator	Knowing	Chapter 6, Chapter 14
54	Add a fraction to a whole number	Applying	Chapter 6, Chapter 14
55	Add and subtract fractions involving one denominator as a multiple of the other	Knowing	Chapter 6, Chapter 14

56	Subtract a fraction from a whole number	Applying	Chapter 6, Chapter 14
57	Add or subtract two fractions (including whole/mixed numbers)	Applying	Chapter 6, Chapter 14
58	Calculate fractions of a collection or set	Knowing	Chapter 6, Chapter 14
59	Calculate the whole given a part as a unit fraction	Knowing	Chapter 6, Chapter 14
60	Multiply fractions by whole numbers	Applying	Chapter 6, Chapter 14
61	Solve problems involving the multiplication of a fraction by a whole number	Reasoning	Chapter 6, Chapter 12, Chapter 14, Chapter 18
62	Solve problems involving the multiplication of a fraction by a fraction	Reasoning	Chapter 14, Chapter 18
63	Solve problems involving the multiplication of a fraction by mixed numbers	Reasoning	Chapter 14, Chapter 18
64	Divide a whole number by a fraction	Applying	Chapter 6, Chapter 14
65	Divide a fraction by a whole number	Applying	Chapter 14
66	Divide a fraction by a fraction	Applying	Chapter 14
67	Solve problems involving the division of a whole number by a fraction, a fraction by a whole number and a fraction by a fraction	Reasoning	Chapter 14, Chapter 18
68	Solve one-step problems involving fractions	Applying	Chapter 6, Chapter 12, Chapter 14, Chapter 18
69	Solve multi-step problems involving fractions	Reasoning	Chapter 6, Chapter 12, Chapter 14, Chapter 18
70	Solve real-life problems involving fractions and using the algorithms developed	Reasoning	Chapter 6, Chapter 12, Chapter 14, Chapter 18
DECIMALS			
71	Use decimal notation as another form of writing base ten fractions (tenths, hundredths)	Knowing	Chapter 7, Chapter 15
72	Express decimals as common fractions	Knowing	Chapter 7, Chapter 15
73	Record money values using decimals	Knowing	Chapter 7, Chapter 12, Chapter 15
74	State the place value of digits in decimal fractions up to hundredth	Knowing	Chapter 7
75	Explore the place value of decimals to hundredths including expanded notation	Applying	Chapter 7
76	State the value of digits in decimal fractions up to hundredths	Knowing	Chapter 7
77	Express decimal fractions using expanded notation	Knowing	Chapter 7, Chapter 15
78	Convert expanded notation to decimal fractions	Knowing	Chapter 7
79	Compare and order decimals up to hundredths	Applying	Chapter 7
80	Arrange decimal fractions in ascending and descending order (up to hundredths)	Knowing	Chapter 7
81	Round decimals to the nearest whole number and tenths	Knowing	Chapter 7
82	Develop an understanding of the algorithm for addition and subtraction of decimals	Applying	Chapter 7, Chapter 12, Chapter 15
83	Solve problems involving the multiplication of a decimal by a whole number	Applying	Chapter 7, Chapter 15
84	Solve problems involving the multiplication of tenths by tenths	Applying	Chapter 15, Chapter 18
85	Solve problems involving the division of a decimal fraction by a whole number (dividend up to 2 decimal places)	Reasoning	Chapter 15, Chapter 18
86	Use a number of strategies to solve routine and non-routine problems involving decimals	Reasoning	Chapter 7, Chapter 12, Chapter 15
87	Solve real-world problems involving the addition and subtraction of decimals to hundredths using the algorithm	Reasoning	Chapter 7, Chapter 12, Chapter 15
88	Solve one-step and multi-step problems involving decimals (including money transactions, bills, best buy, profit and loss) using the four operations	Reasoning	Chapter 7, Chapter 12, Chapter 15

PERCENT			
89	Calculate simple percent of quantities e.g. 10% of \$200 = 110 of \$200 = \$20	Knowing	Chapter 18
90	Express a quantity as a percentage of another	Applying	Chapter 18
91	Express a percent (e.g. 50%, 25%, 20% and 10%) as a fraction (e.g. 12, 14, 15, and 110)	Knowing	Chapter 18
92	Express a percent (e.g. 50%, 25%, 20% and 10%) as a decimal (e.g. 0.5, 0.25, 0.2 and 0.1)	Knowing	Chapter 18
93	Order fractions, decimals and percents	Applying	Chapter 18
94	Solve one-step problems involving percent	Applying	Chapter 18
95	Solve multi-step problems involving percent	Reasoning	Chapter 18
PROBLEM SOLVING			
96	Solve real-life, one-step problems involving whole numbers, (including profit and loss, best buy, discount, savings, salaries, wages, loans, simple interest, VAT)	Applying	Chapter 12, Chapter 18
97	Solve real-life, multi-step problems involving whole numbers, (including profit and loss, best buy, discount, savings, salaries, wages, loans, simple interest, VAT)	Reasoning	Chapter 12, Chapter 18
98	Solve problems involving direct proportions	Reasoning	Chapter 12, Chapter 20
99	Solve problems involving unequal sharing (not including the use of ratio)	Reasoning	Chapter 12
SOLIDS AND PLANE SHAPES			
100	Recognize and name solids from pictorial representations	Knowing	Chapter 5, Chapter 16
101	Draw the faces of solids and explore their properties	Applying	Chapter 5, Chapter 16
102	Describe the properties of solids in relation to number and types of faces, edges and vertices	Knowing	Chapter 5, Chapter 16
103	Name the solids with uniform cross-sections	Knowing	Chapter 16
104	Solve problems involving solids	Reasoning	Chapter 12, Chapter 16
105	Identify and list the properties of solids including cross-sections, base, height and angles	Applying	Chapter 5, Chapter 16
106	Recognize and name plane shapes from pictorial representations	Knowing	Chapter 5, Chapter 16
107	Classify solids and plane shapes and give reasons for their classification	Applying	Chapter 5, Chapter 16
108	Solve problems involving plane shapes	Reasoning	Chapter 5, Chapter 11, Chapter 12, Chapter 16
109	Construct and draw regular and irregular polygons given their properties using the principles of parallel and perpendicular lines, angles and number of sides	Applying	Chapter 5, Chapter 16
110	Differentiate between regular and irregular polygons (triangles, quadrilaterals, pentagons, hexagons, octagons)	Knowing	Chapter 5, Chapter 16
111	Describe the properties of specific quadrilaterals (rectangle, square, trapezium, parallelogram and rhombus)	Knowing	Chapter 16
112	Classify and compare quadrilaterals according to their attributes (no. of sides and angles, no. of equal sides, no. of pairs of parallel sides, no. of perpendicular sides)	Applying	Chapter 16
113	Solve problems involving solids and plane shapes	Reasoning	Chapter 5, Chapter 11, Chapter 12, Chapter 16
114	Classify triangles (same, similar or different) based on properties of sides and angles	Applying	Chapter 5
115	Identify and name triangles as scalene, right angled, isosceles and equilateral	Knowing	Chapter 5
116	Compare and describe the properties of the sides and angles of the scalene, right angled, isosceles and equilateral triangles	Applying	Chapter 5

GEOMETRICAL PATTERNS				
117	Name a repeating pattern containing three to five elements in its core (name as 'number' pattern e.g. 'three' pattern or using a letter code e.g. ABCABC)	Knowing	Chapter 2	
118	Distinguish between repeating and non-repeating patterns in a given set involving solids or plane shapes by identifying the part that repeats or errors	Applying	Chapter 2, Chapter 5	
119	Recognize and complete patterns using solids or plane shapes (repeating – 3 to 5 elements, growing or increasing and decreasing)	Reasoning	Chapter 2, Chapter 5	
120	Describe a given pattern (repeating, increasing or decreasing) determine the pattern rule and extend the pattern using pictorial representation	Reasoning	Chapter 2, Chapter 5	
121	Insert the missing elements in given patterns and explain the reasoning	Reasoning	Chapter 2, Chapter 5	
SYMMETRY				
122	Determine whether plane shapes, letters and numerals are symmetrical	Knowing	Chapter 16	
123	Complete a symmetrical shape given half of the shape and a line of symmetry	Applying	Chapter 16	
124	Determine the number of lines of symmetry in plane shapes – (regular, irregular and curved) and in numerals and letters	Applying	Chapter 16	
125	Solve problems involving line symmetry	Reasoning	Chapter 16	
ANGLES				
126	Describe an amount of turn (e.g. whole turn, three quarter turn, half turn or quarter turn)	Knowing	Chapter 4, Chapter 16	
127	Describe an angle as a measure of turn and name the quarter turn as a right angle or the angle formed when perpendicular lines meet	Knowing	Chapter 4, Chapter 16	
128	Identify angles on faces of solids or plane shapes that are right angles, greater than right angles or smaller than right angles	Applying	Chapter 4, Chapter 16	
129	Investigate angles (right angles, angles greater than and smaller than right angles) in regular and irregular polygons and faces of solids	Applying	Chapter 4, Chapter 16	
130	Draw shapes with angles of various sizes and describe the angles	Reasoning	Chapter 4, Chapter 16	
AREA				
131	Select and use the most appropriate standard unit for measuring various lengths/distances	Knowing	Chapter 8, Chapter 11, Chapter 17	
132	Measure lengths in millimetres	Applying	Chapter 8	
133	Measure lengths using combinations of millimetres, centimetres and metres	Applying	Chapter 8	
134	Convert linear measure from one form to the other: mm to cm and vice versa; cm to m and vice versa; km to m and vice versa	Knowing	Chapter 8	
135	Apply decimal knowledge to record measurements. e.g. $123\text{ cm} = 1.23\text{ m}$	Applying	Chapter 8, Chapter 12, Chapter 15	
136	Solve computational problems involving the metre and the centimetre by using the relationship between them	Reasoning	Chapter 8, Chapter 11	
137	Solve problems involving length	Reasoning	Chapter 8, Chapter 11	
138	Develop and use formulae for finding the perimeter of squares and rectangles	Reasoning	Chapter 11	
139	Write and explain the formulae for finding the perimeter of any given rectangle and square	Reasoning	Chapter 11	
140	Calculate and compare perimeters of squares and rectangles	Applying	Chapter 8, Chapter 11	
141	Construct or draw two or more rectangles for a given perimeter in a problem-solving context	Reasoning	Chapter 8, Chapter 11, Chapter 12, Chapter 17	
142	Find the perimeters of simple composite figures that may be dissected into rectangles and squares	Applying	Chapter 11	
143	Solve problems in real-life contexts involving perimeter	Reasoning	Chapter 11, Chapter 12, Chapter 17	
144	Solve problems involving perimeter of compound shapes	Reasoning	Chapter 11, Chapter 12, Chapter 17	

VOLUME AND CAPACITY			
145	Select the appropriate unit of measure when measuring surfaces of varying sizes and explain the suitability of the unit	Knowing	Chapter 11, Chapter 17
146	Draw different shapes of a given area on grids	Reasoning	Chapter 11, Chapter 17
147	Calculate area of plane shapes drawn on a grid with unit squares	Applying	Chapter 11, Chapter 17
148	Compare and order area of surfaces and explain reasoning using appropriate vocabulary	Reasoning	Chapter 11, Chapter 17
149	Approximate the area of surfaces to the nearest square metre or square centimetre	Reasoning	Chapter 11, Chapter 17
150	Develop and use formulae to calculate the area of squares and rectangles	Reasoning	Chapter 11, Chapter 17
151	Write and explain the formulae for finding the area of squares and rectangles	Reasoning	Chapter 11, Chapter 17
152	Calculate the areas of compound shapes that may be dissected into rectangles and squares	Applying	Chapter 11, Chapter 17
153	Solve problems involving area	Reasoning	Chapter 11, Chapter 12, Chapter 17
154	Solve problems in real-life contexts involving area	Reasoning	Chapter 11, Chapter 12, Chapter 17
155	Solve problems involving area and perimeter of plane shapes	Reasoning	Chapter 11, Chapter 12, Chapter 17
MASS			
156	State the relationship between the litre and millilitre and convert from litre to millilitre	Knowing	Chapter 10, Chapter 20
157	Identify the cubic centimetre and cubic metre (cm^3 and m^3) as the standard units for measuring volume	Knowing	Chapter 10, Chapter 20
158	State the relationship between the metric units of volume and capacity (e.g. $1\text{L} = 1000\text{ cm}^3$)	Knowing	Chapter 10
159	Measure the volume of boxes by stacking and packing cubic blocks into them and counting to determine the volume	Reasoning	Chapter 10, Chapter 20
160	Calculate the volume of cubes and cuboids	Applying	Chapter 10, Chapter 20
161	Solve problems involving capacity, number and money	Reasoning	Chapter 10, Chapter 12, Chapter 18, Chapter 20
162	Solve problems involving volume and/or capacity	Reasoning	Chapter 10, Chapter 20
MASS			
163	Determine the most appropriate standard unit for measuring mass/weight	Knowing	Chapter 8
164	Convert kilograms to grams	Knowing	Chapter 8
165	Measure and compare the masses/weights of objects in kilograms and grams using a set of scales.	Knowing	Chapter 8
166	Solve problems involving different units of mass/weight (e.g. Find the total mass/weight of three items weighing 50g, 750g and 2.5kg)	Reasoning	Chapter 8, Chapter 13
167	Calculate unknown mass/weight on a balance (including the use of algebraic reasoning)	Reasoning	Chapter 8, Chapter 13
168	Solve computational and real-life problems involving grams and kilograms	Reasoning	Chapter 8, Chapter 13
169	Solve real-life problems involving mass/weight, number and money	Reasoning	Chapter 8, Chapter 12, Chapter 13
TIME			
170	Tell time in five-minute intervals using the digital and analog clocks	Knowing	Chapter 8
171	State the time after given intervals on analog and digital clocks	Knowing	Chapter 8
172	Match times shown on standard digital clocks, 24-hour digital clocks and analog clocks to the minute, and record the time	Knowing	Chapter 8
173	Relate seconds to minutes, minutes to hours, hours to days, days to weeks, days/weeks to months and months to years and use the relationships to solve problems	Applying	Chapter 8
174	Convert hours to minutes	Knowing	Chapter 8
175	Calculate the duration of events using starting and finishing times (elapsed time)	Applying	Chapter 8, Chapter 12

176	Interpret simple time schedules (e.g. the calendar)	Knowing	Chapter 8
177	Solve computational and real-life problems involving hours and minutes	Reasoning	Chapter 8
178	Solve problems involving time and other related concepts (using proportional reasoning)	Reasoning	Chapter 8, Chapter 12
STATISTICS			
179	Represent data using tally charts, frequency tables and graphs (pictographs, block graphs, bar graphs) using various scale factors	Applying	Chapter 9, Chapter 19
180	Interpret the findings displayed in the tables, charts (including tally charts, no pie charts) and graphs (pictographs, block graphs, bar graphs)	Reasoning	Chapter 9, Chapter 19
181	Determine a suitable scale for data and record the scale in a key	Reasoning	Chapter 9, Chapter 19
182	Use analysed data to solve problems, draw conclusions and make decisions	Reasoning	Chapter 9, Chapter 19
183	Communicate findings and decisions made using appropriate vocabulary associated with statistics	Reasoning	Chapter 9, Chapter 19
184	Evaluate decisions made based on analysis of data represented in tables, charts and graphs	Reasoning	Chapter 9, Chapter 19
185	Determine the mode of a given set of data	Knowing	Chapter 9
186	Explore the concept of mean using various activities related to equal sharing or distribution	Reasoning	Chapter 19
187	Determine and use the rule for calculating the mean of a given set of data	Applying	Chapter 19
188	Calculate the mean of a given set of data	Knowing	Chapter 19
189	Solve problems involving mean/average	Reasoning	Chapter 19

SmartMaths Standards 4 and 5

SAMPLE

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