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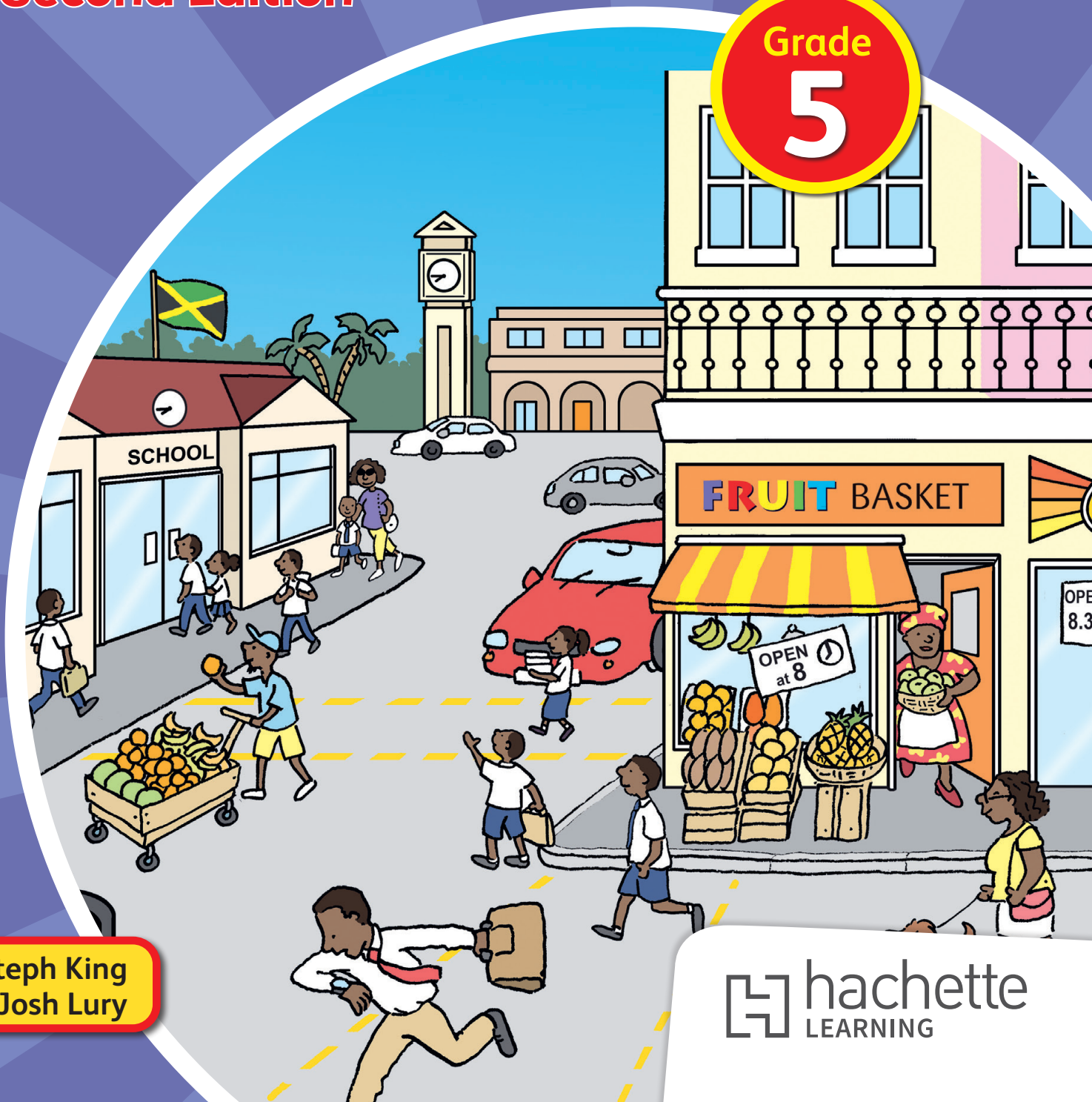
SAMPLE

NSC Edition

Primary Mathematics

Second Edition

Grade 5



Steph King
Josh Lury

hachette LEARNING

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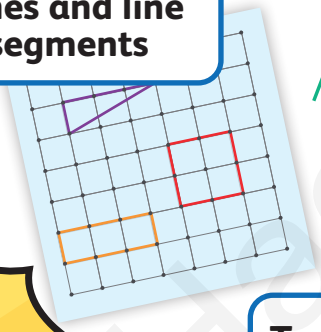

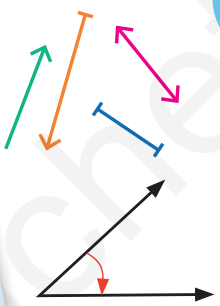

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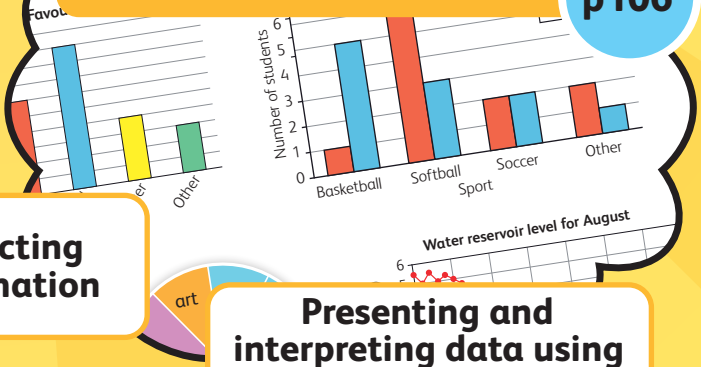

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Unit 1: Number

Chapter 1 Sets

In this chapter you will explore this focus question:

In what ways are sets represented?

To answer this question, you will:

- describe a set and differentiate between the set of real numbers
- describe a set as being finite, infinite or an empty set (null set)
- differentiate between sets of counting numbers, whole numbers, odd numbers, even numbers, prime numbers, composite numbers and fractional numbers.

Starting point

1 **a** Describe the objects in this group. What do they have in common? What is different about each object?

b Discuss with a partner how you could sort these objects into smaller groups. For example, you could sort them by colour. Think of two other ways you could sort them, and which would belong in each group.

2

2	9	15	30	12	10	17	27	5	7	22	25

Some children are grouping these numbers in different ways.

a Marva says: 'The numbers that belong in my set are 2, 5, 7 and 9.' What do the numbers in Marva's group have in common?

b Amy says: 'The numbers that belong in my set are 7, 17 and 27.' Describe Amy's set. List some other 2-digit numbers that could belong to this group.

c What other groups can you make from the set above? Describe them to a friend.

3 Tania also chooses a group of numbers. Each number can only be divided by 1 and the number itself. Explore Tania's idea. Which numbers did she choose?

You can use cubes or bottle tops to help you with dividing different numbers.

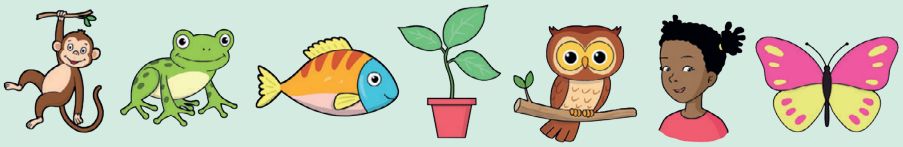
What is a set?

Key maths idea

A **set** is a collection or group of items that have a common attribute.

We can also say that the **members** (**elements**, or items) of a set share characteristics.

Example



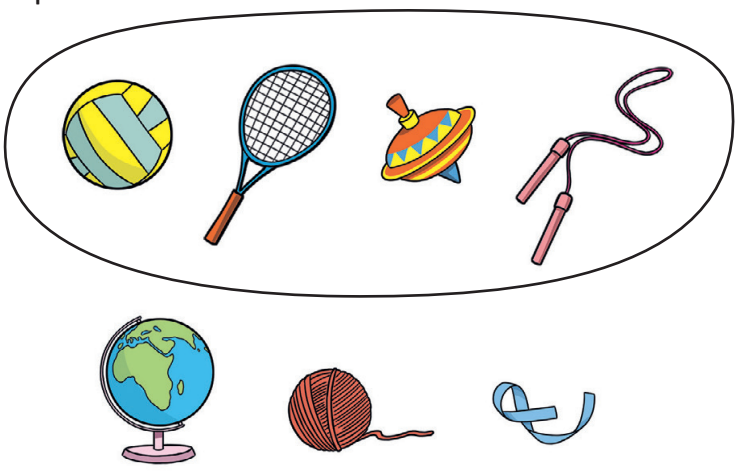
There are seven members or elements in this set. All the members share the same attribute: they are living things.
We use a capital letter to name a set.
Let's use the letter L to name this set of living things.
We write the elements of the set in curly brackets (called braces), like this:
L = {monkey, frog, fish, owl, plant, person, butterfly}

An **empty set** has no members. It is also called the **null set**.
If set A is the set of living things that do not grow then it is a null set.
We write this null set as set A = { } or ∅

Key words

set
member
element
empty set
null set

1 Look at the objects that have been grouped in a set.



a Write a sentence to describe the set. Think about the attributes (or characteristics) all members of the set share.

b Use curly brackets (braces) to list the members of the set.

c How can you group the objects in the picture in a different way to make another set? Describe your new set and list the members.

2 Tamika groups some numbers in a set.
{0, 2, 4, 6, 8}

a How can you describe this set?

b Use curly brackets and create your own set of numbers. Challenge a friend to describe your set.

3 Look at these sets.

Set A	Set B	Set C	Set D
Days of the week	Five polygons	Continents of the world	Four fractions that are equivalent to one-half

a Name and list the members of each set. Remember to use curly brackets.

b Which sets have the same number of members?

4 Choose objects from the classroom to match each description of a set. Remember to name and list the elements of each set.

a colour is blue

b used for maths lessons

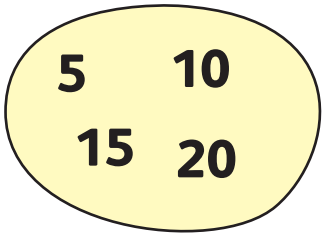
c used for writing

d longer than 15 cm

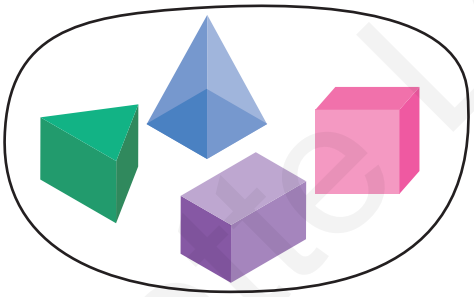
e have a curved surface

5 Here are some more sets. What attribute do the members of each set share?

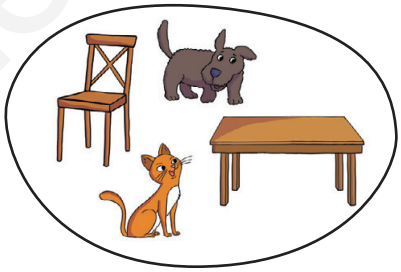
V



W



X



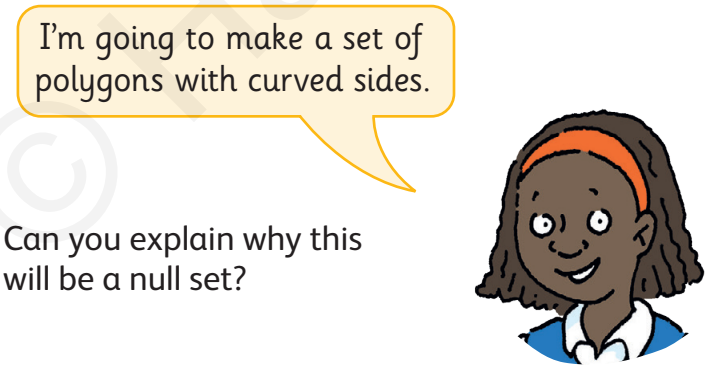
6 Think back to the objects you chose for the sets in question 4. Can you use some of the objects to create a new set, Z?

a Photograph, sketch or list the elements in your new set Z.

b Ask a friend to describe the set by identifying the common attribute.

Z

7



Can you explain why this will be a null set?

Finite and infinite sets

Key maths idea

A set that has a limited or countable number of elements is called a **finite set**. For example, if set C is the set of colours in the Jamaican flag, then set C = {black, gold, green}.

This set is a finite set because it is possible to count how many elements or members it has.

When a finite set has a greater number of elements, we can use three dots (…) to show that the set continues in the same way, rather than listing them all.

For example, the set of counting numbers up to 50 = {1, 2, 3, …, 50}.

When a set has an endless number of elements, we call it an **infinite set**.

We can use the three dots to show that the set continues without end.

Examples

The set of **even** numbers = {2, 4, 6, 8, …}.

The set of **odd** numbers = {1, 3, 5, 7, …}.

Key words

finite set
infinite set
even
odd
whole numbers
counting numbers

The three dots are called an ellipsis.

1 Say whether these sets are infinite or finite. If they are finite, list the members:

- **a** the set of **whole numbers**
- **b** the set of even numbers between 60 and 70
- **c** the set of **counting numbers**
- **d** the set of 2-digit multiples of 5
- **e** the set of objects on your table
- **f** the set of stars in the universe
- **g** the set of months in the year.

Remember to use an ellipsis to show when a set continues on.

2 Describe each set and say whether it is finite or infinite.

- **a** {3, 6, 9, 12, 15, 18, …}
- **b** {1, 3, 5, 7, 9, …, 99}
- **c** {0, –1, –2, –3, –4, –5, …}
- **d** {Asia, Africa, North America, South America, Antarctica, Europe, Australia}

3 Work with a partner to create three finite sets and three infinite sets. Name and list the elements of each set.

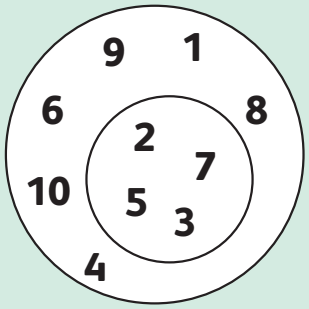
Subsets

Key maths idea

Sometimes we sort the elements of a set into further sets. These are **subsets** of the main set. The diagram shows the main set of animals inside the larger circle. Animals with a backbone (vertebrates) make a subset of the main set.

Let's think about a set of numbers.

The main set is all the counting numbers from 1 to 10.



You will learn more about prime numbers in Chapter 3.

The set of **prime numbers** is a subset of the main set, so we can say that {2, 3, 5, 7} is a subset of {1, 2, 3, …, 10} because 2, 3, 5 and 7 are still part of the counting numbers from 1 to 10.

{11, 13, 17} is a set of prime numbers, but it is not a subset of {1, 2, 3, …, 10}.

Can you explain why?

2 is a prime number, because $2 \div 2 = 1$ and $2 \div 1 = 2$. It cannot be divided by any other number without leaving a remainder.

4, 6 and 8 are not prime numbers.

They are **composite numbers**, because they can be divided by more than two numbers.

Key words

subset

prime numbers

composite numbers

Why has an ellipsis been used for the main set? Is this set finite or infinite?

Remember that a prime number can only be divided by itself and 1.
So, only two division sentences can be made.

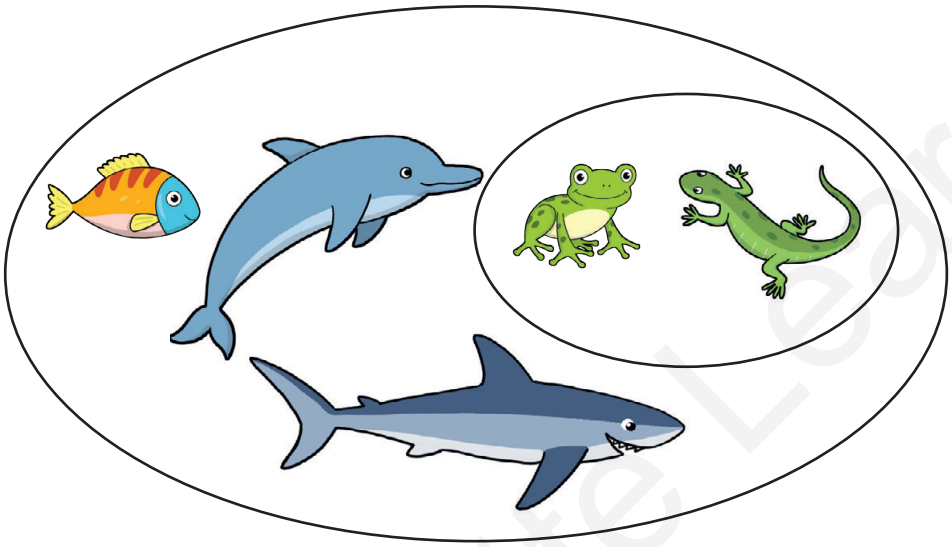
Can you explain why the number 1 is not a prime number or a composite number?

1 Use the main set of animals on the previous page and list the animals that belong to these subsets:

- **a** can live in water
- **b** can fly
- **c** have no backbone (are invertebrates).
- **d** Choose one of these three subsets and draw it as part of the main set.

2 Look at this diagram.

- **a** Describe and list the members of the main set.
- **b** Describe the subset. List the members as: { } is a subset of { }.



The symbol ⊂ also means 'is a subset of'.

3 Work with a partner. Collect at least 6 different objects from the classroom for a main set. Some of the objects will need to make up a subset so think about common attributes. Represent your sets. For example, you can use a piece of paper for the main set and a loop of string or draw a hoop to show the subset. Invite other students from your class to describe your sets.

The symbol ⊄ also means 'is not a subset of'.

4 True or false? Copy the statements that are true. Correct the statements that are false by writing 'is not a subset of'.

- **a**  ⊂ {types of transport}
- **b**  ⊂ {vertebrates}
- **c** {12, 15, 18} ⊂ {0, 2, 4, 6, … 20}
- **d** {prime numbers} ⊂ {composite numbers}
- **e** {multiples of 8} ⊂ {multiples of 4}

You may find it useful to organise your results in a table.

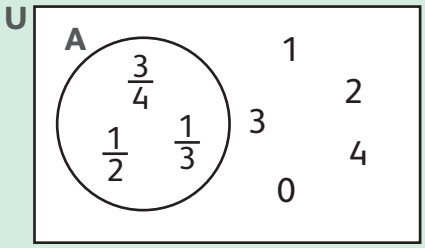
5 Subsets can have 0 or more elements. How many different subsets of set F can you find? List them.

F = {apple, banana, cherry}

Venn diagrams

Key maths idea

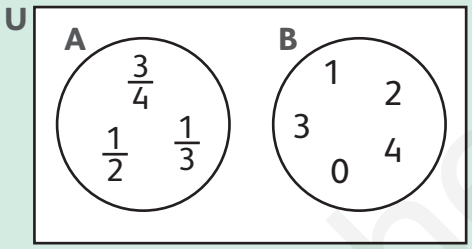
We can use a **Venn diagram** to display different types of sets. The members of each set are chosen by **collecting** or **grouping** items according to their specific characteristics.



The **universal set** is the set of all the elements we are talking about in a specific case, so all the numbers inside the rectangle make up the universal set. We use the symbol U for the universal set. The elements in the hoop make up a set within the universal set.

The elements in set A are all fractional numbers!

This Venn diagram has been drawn a little differently. It shows the numbers as two sets, A and B.



The elements in set B are all whole numbers!

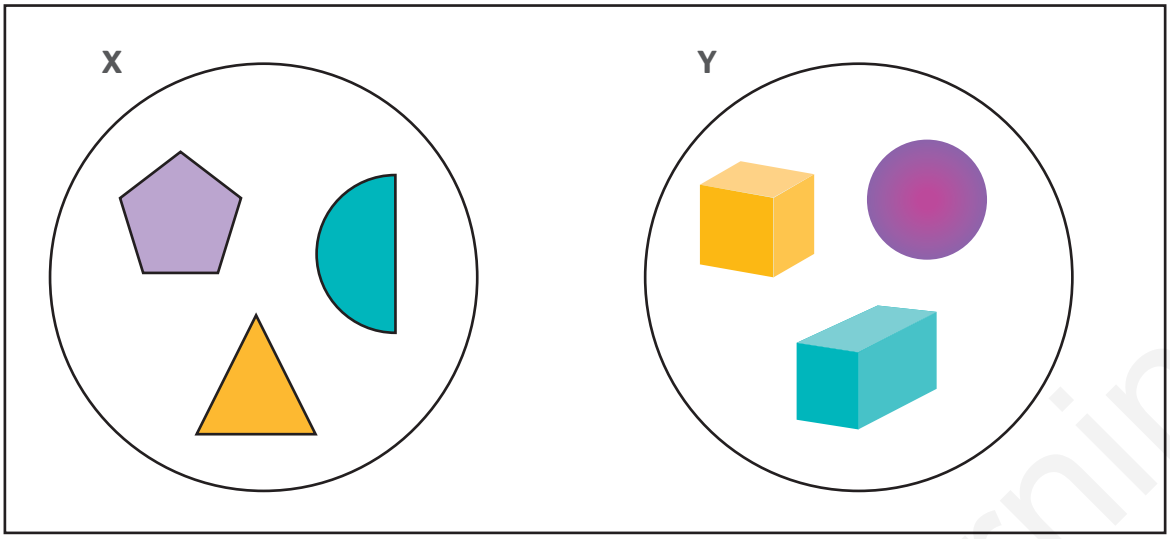
We call these **disjoint sets** because they share no common elements.

Key words
Venn diagram
collecting
grouping
universal set
disjoint sets

1 Draw Venn diagrams to show the following:

	Universal set	Set
a	Days of the week	Weekend days
b	Months of the year	Months with 30 days
c	Numbers from 1 to 10	Composite numbers
d	Prime numbers from 1 to 10	Odd numbers
e	2-digit multiples of 5	Multiples of 10
f	$0, \frac{1}{5}, \frac{1}{4}, \frac{1}{3}, \frac{1}{2}, 1$	Fractional numbers

2 Look at this Venn diagram.



a Explain why sets X and Y are disjoint sets.

b List the members of each set.
X = Y =

c How many members are in the universal set?

d Choose another member of your own for each set.

3 Look at this universal set of living things:

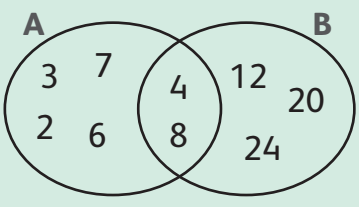
U = {beetle, elephant, bird, crocodile, bee, snail, shark}
Draw a Venn diagram to show these disjoint sets: V, the set of vertebrates and W, the set of invertebrates.

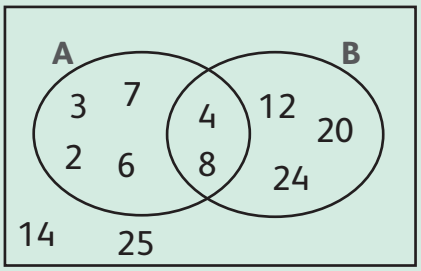
Intersection of sets

Key maths idea

When some members of one set are also members of another, we can overlap the sets and show the **intersection** of the sets.

Example
The members of the intersecting set have both characteristics of set A and set B as they are single-digit numbers and multiples of four. We say these are **jointed sets** because they do share common elements.

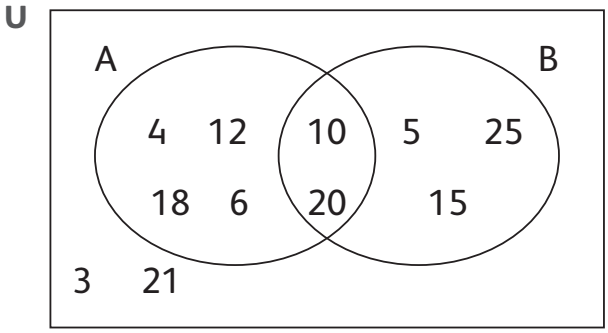




Key words
intersection
jointed sets

Can you explain why 14 and 25 are members of the universal set but not members of set A or set B?

1 Look at this Venn diagram.



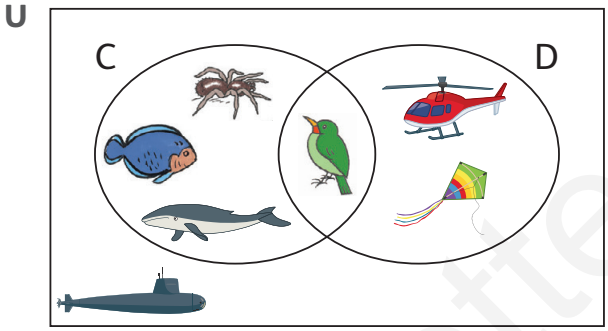
a List the members of set A. Remember to use curly brackets. A =

b List the members of set B. B =

c List the members of the intersecting set.

d Explain why these are members of both sets A and B.

2 Here is another Venn diagram.

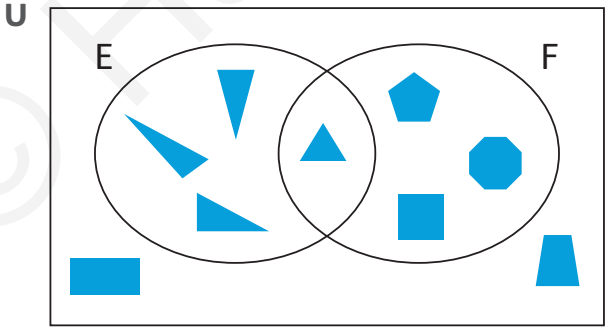


a List the members of the universal set. Remember to use curly brackets. U =

b What are the characteristics of the intersecting set?

c Why is the submarine outside the sets C and D?

3 Dana and Akiel have been thinking about this Venn diagram.
They write E ∩ F = {equilateral triangle}



a What do you think the symbol ∩ means?

b What are the two characteristics that the equilateral triangle has?

c Why are the rectangle and the trapezium outside the sets E and F?

4 Work with a partner. Use a set of small objects to create your own Venn diagram to show jointed sets. List the members of each set.

Challenge:

5 Dana and Akiel write down what they notice about another Venn diagram.

U = {months of the year}

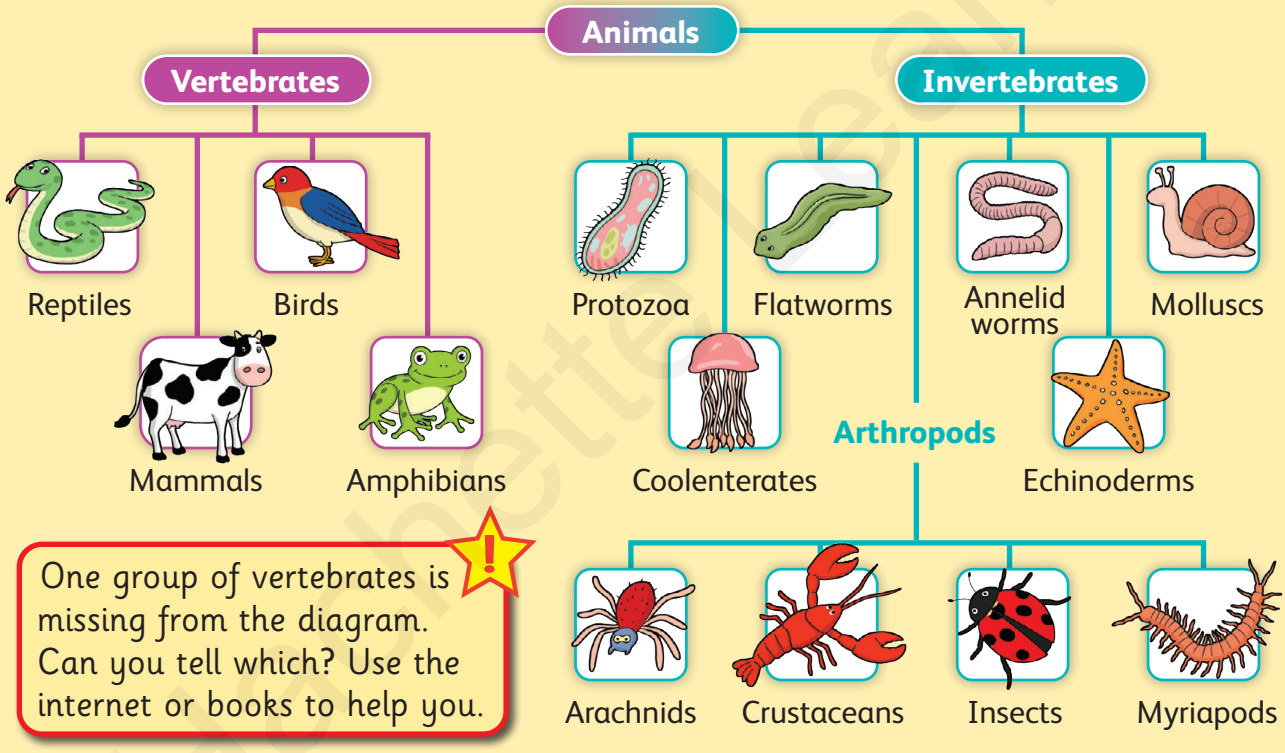
A = {months with 31 days}

B = {months that include the letter r in their names}

A ∩ B = {January, March, October, December}

Use the given information to draw the Venn diagram.

Real-world maths: Classifying animals



One group of vertebrates is missing from the diagram. Can you tell which? Use the internet or books to help you.

Animals can be grouped together by similar characteristics or attributes.

Discuss the classification of animals with a partner and talk about the following types of sets. You can research ideas in more depth using the internet:

a universal set

b set

c subsets

d disjoint sets

e jointed sets.

Sketch Venn diagrams to help you explain.

Taxonomists use classification for plants and animals to help them classify newly discovered plants or animals.

Find out more about John Venn, the creator of Venn diagrams.

Maths detective: Attributes of sets

Can you spot which members from the previous set need to be deleted each time to suit the attribute of the new set?

Set A = {0, 1, 2, 3, 4, 5, 6 }	- whole numbers
Set B = { ____ , ____ , ____ , ____ , ____ , ____ }	- counting numbers
Set C = { ____ , ____ , ____ }	- even numbers
Set D = { ____ , ____ }	- composite numbers
Set E = { ____ }	- common factor of 16 and 24

What I have learned

Copy and complete these sentences and definitions.

1 The members or elements of a set all ____ .

2 A set with no members is called a null set or an ____ set.

3 A set that has a limited or countable number of elements is called a ____ set.

4 A set with an endless number of elements is called an ____ set.

5 A subset is ____ .

6 The universal set is ____ .

7 Disjoint sets are sets that ____ .

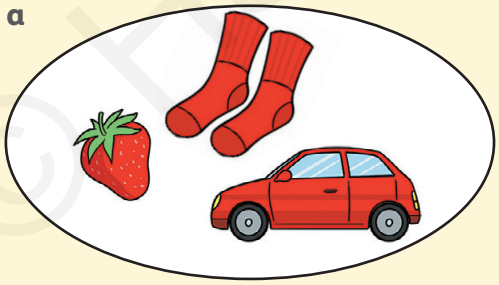
8 Jointed sets are sets that ____ .

9 The intersecting set is ____ .

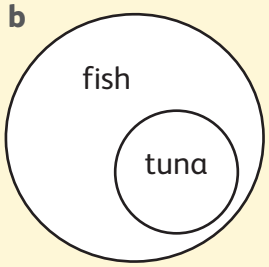
Practice questions

1 Use what you know about sets to describe what you see. Remember to think about the types of sets and the characteristics of the members.

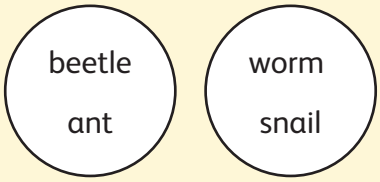
a



b



c



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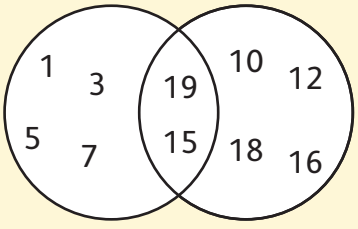


2 Look at this Venn diagram about pets.

a How many members are in the universal set?

b Use the Venn diagram to help write a sentence to describe what you know about:

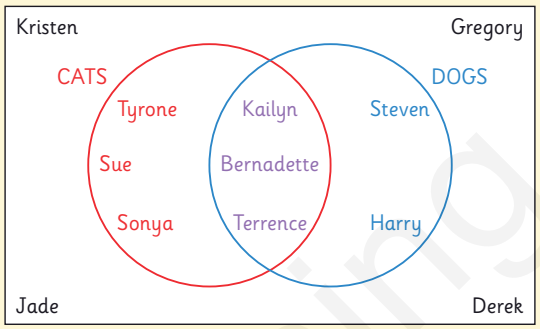
- Sue
- Terrence
- Harry
- Kristen

c Write the members of each set.

CATS =

DOGS =

CATS ∩ DOGS =



1 Self check

Check you can do this:	If you have difficulty, try this:
1 Identify and list members of a set, and describe common attributes.	Go back to pages 8–9. Look at some of the sets you described and how you decided what belonged in the set.
2 Create your own sets and describe the common attributes.	Make groups of objects or numbers and say what they have in common.
3 Describe a set as being finite, infinite or a null set.	Go back to pages page 10. Remember that finite numbers can be counted. If something is infinite it goes on forever so you cannot count it.
4 Talk about and represent different types of sets, for example, universal, subset and disjoint sets.	Go back to pages 13–14 and go over the definitions of the different types of sets.
5 Work with Venn diagrams, explain what each region represents and use symbols to describe sets, for example, U for the universal set.	Revise the activities from the section on pages 13–16.
6 Identify and compare sets of counting numbers, whole numbers, odd numbers, even numbers, prime numbers, composite numbers and fractional numbers.	Revise the work from the Maths detective section on page 17.

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Primary Mathematics

Grade 5

Second Edition

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