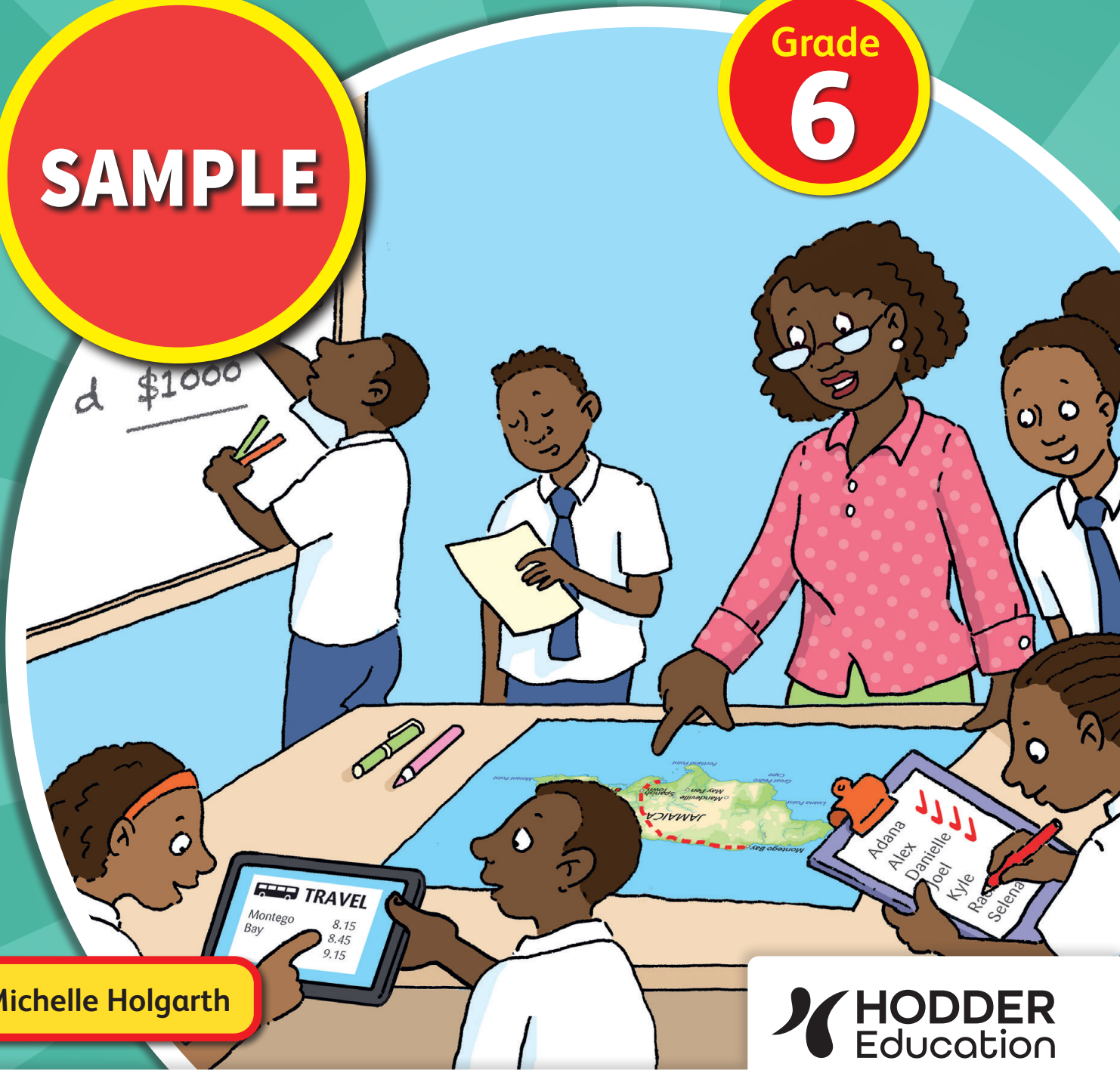
JAMAICA

Primary Mathematics

NSC Edition

SAMPLE

Grade 6



Michelle Holgarth

HODDER Education

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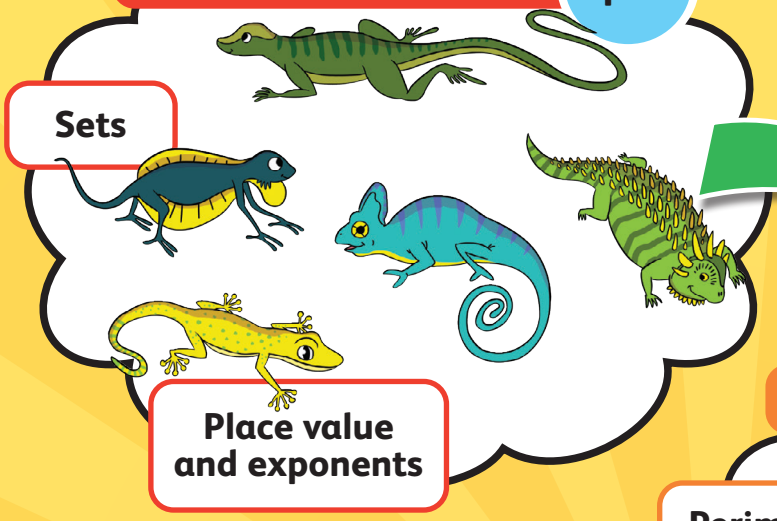

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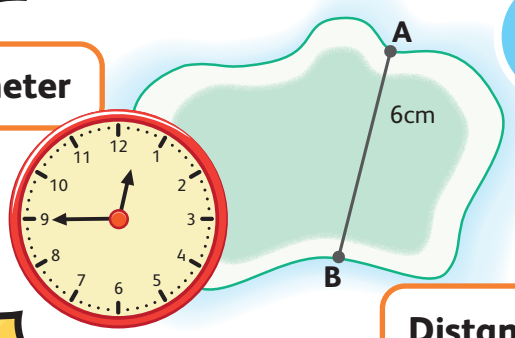

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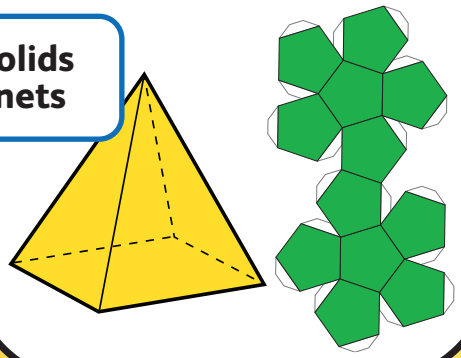

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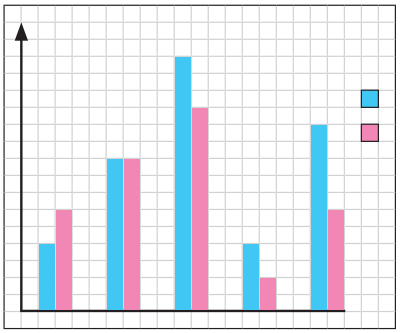

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Chapter 1 Sets

In this chapter you will explore this focus question:

What special symbols and language do we use when working with sets?

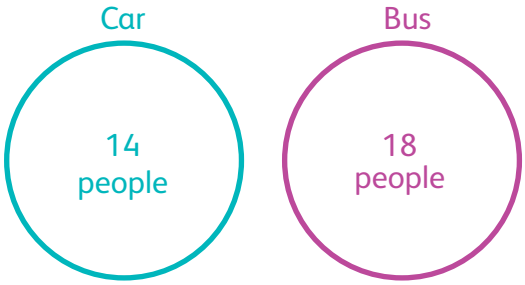
To answer this question, you will:

- identify the members of a set
- associate the members of a set with the properties of the set
- distinguish between equal and equivalent sets
- distinguish between finite and infinite sets
- list the members in the intersection or union of two sets
- draw Venn diagrams to show the intersection of two sets
- know and use the symbols for set notation.

Starting point

1 Shawnae asked people whether they travelled by car or by bus to get to work.

She drew this diagram to show what she found out.



Discuss these questions with a partner.

a What information does this diagram give you?

b How is the information shown?

c Ms Byers walks to work. She doesn't use the car or the bus. How could you show this information on the diagram?

d Mr Johnston uses his car to go to work on Monday, Wednesday and Friday but he uses the bus on Tuesday and Thursday. How could you change the diagram to include 5 people who use both types of transport?

e Nobody uses the train to travel to work. How would you show this on a Venn diagram? Why?

2 A set is a collection of things that have something in common.

Look at the pictures. What do each of these sets have in common?

Set A

Set B

Set C

In maths we use special symbols and notation for sets. We can write set C like this:

C = {soccer ball, football, basketball}

C is the name of the set. It is usually a capital letter.

All the members or elements of the set are listed or described inside the brackets.

We use curly brackets { } called braces to contain the set.

3 Look at these sets:

a {1, 3, 5, 7, …}

How would you describe this set? What do you think the three dots mean?

b {0, 1, 2, 3, …, 18, 19, 20}

How would you describe this set?

This time the three dots are in a different place. What do you think this means in this set?

c {a, e, i, o, u}

How would you describe this set?

d { }

How would you describe this set? Why?

e Create your own set and write it in curly brackets. Challenge a partner to describe your set.

Members of sets

Key maths idea

A **set** is a well-defined collection or group. How would you define this set?

The set of vowels in our alphabet can be written as
Vowels = {a, e, i, o, u}

The set of vowels has five members or elements.

The five **elements** or **members** are written as a list inside **curly brackets (braces)**, each separated by a comma. This is called **set notation**.

We use the **symbol** ∈ to show that an item is a member or element of a set.

Example a ∈ {a, e, i, o, u}

Key words

- set
- element
- member
- curly brackets (braces)
- set notation
- symbol
- universal set
- null set (empty set)

To show that an item is not a member or element of a set we cross through the element symbol like this: ∉

Example b ∉ {a, e, i, o, u}

The set of vowels is part of the larger set of letters of the alphabet. We can say that the alphabet is the **universal** (largest) **set** in this example. The universal set contains all the possible members you may use in a particular problem. We use the letter U to represent the universal set.

A set that has no members is called an **empty set** or **null set**. This is shown using the symbol ∅ or { } .

The set of town names in Jamaica that contain only vowels would be an example of an empty set.

Remember these important symbols:

∈ member of a set

∉ not a member of a set

∪ universal set

∅ or { } null set or empty set

1 Use set notation to list the members of these sets:

a five subjects you study

b three animals that can swim

c letters in your name.

2 How many members are in each of these sets?

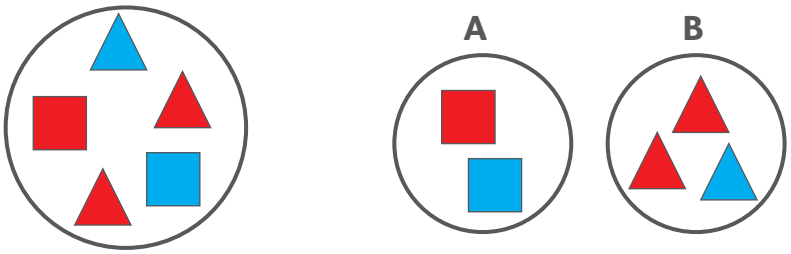
a odd numbers between 1 and 10

b months of the year

c letters of the alphabet

d integers between 4 and 6

3 Daniel has this universal set of shapes.



He puts them into sets A and B.

a Copy and complete these set notations:

A = { …

B = { …

b How could you reorganise the shapes to make two different sets? Use set notation to list the members of these new sets.

4 Copy and complete these set notations using the symbol ∈ or ∉.

a 1 ☐ {odd integers}

b November ☐ {days of the week}

c F ☐ {consonants of the alphabet}

d ☐☐ {▲, ■, ▬, ●}

Equal and equivalent sets

Key maths idea

Equal sets have the exact same members or elements. The order of the members does not matter as long as the members are exactly the same.

Example

{◆, ★, ●} = {★, ●, ◆}

{◆, ★, ●} ≠ {★, ●, ■}

{2, 4, 6, 8} = {8, 6, 4, 2}

Equivalent sets have the same number of members.

The members of each set do not need to be the same.

This symbol shows that sets are equivalent: ⟷

This symbol shows that sets are not equivalent: ⟷ (with a slash)

Example

{◆, ★, ●} ⟷ {A, B, C}

{★, ▲, ■} ⟷ {Q, R, S, T}

Key words

equal sets

equivalent sets

1 Choose the pairs of sets that are equal to set A.

A = {★, ◆, ■, X, ●}

B = {■, X, ●, ★, ◆}

C = {★, ●, ■, X, ■}

D = {■, ★, X, ●, X}

E = {■, X, ★, ●}

F = {X, ★, ◆, ●, ■}

G = {■, ●, ★}

2 Copy and fill in the symbol ⟷ or ⟷ (with a slash) between the pairs of sets.

a {6, 3, 2, 1} ☐ { △, ○, □, ⬠, ☆ }

b {◆, ◆, ◆} ☐ {C, +, ÷}

c {=, >, √, π} ☐ $\{\frac{1}{2}, \frac{1}{3}, \frac{3}{4}, \frac{3}{7}\}$

d {A, B, C} ☐ {?, !, ;}

e {  ,  ,  ,  ,  } ☐ {  ,  ,  ,  ,  }

f {factors of 9} ☐ {factors of 8}

Remember: equivalent sets have the same number of members. The members do not need to be the same.

3 Draw four equivalent sets with five members.

Finite and infinite sets

Key maths idea

A set with limited members is called a **finite set**.

Example

Set B = {Nathaniel, Jada, Joshua}

Set B has three members. These are the members limited to this set.

In some sets, you may notice three little dots. These are called ellipsis and this means 'continue on'. The next set contains the first few prime numbers, but they go on infinitely. We draw three dots at the end of the set to show this.

This is an example of an **infinite set**:

{2, 3, 5, 7, 11, 13, 17, …}

Now look at this set:

{7, 14, 21, …, 84}

This set shows multiples of 7, up to 12 × 7. The ellipsis in this set shows that there are more multiples of 7 between 21 and 84, but these are not listed. This is a finite set.

Key words
finite set
infinite set

1 Describe each set and say if it is finite or infinite.

- **a** {5, 10, 15, 20, 25, 30}
- **b** {0, 1, 2, 3, …}
- **c** {5, 6, 7, 8, …, 44, 45, 46}
- **d** {…, −2, −1, 0, 1, 2, …}
- **e** {3, 6, 9, …, 33, 36}

2 Write finite or infinite set for each of the following sets:

- **a** days of the week
- **b** hours in a day
- **c** multiples of 6
- **d** the set of all integers.

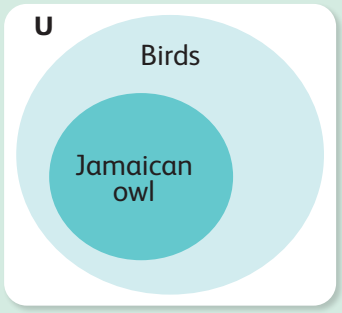
3 Write each of these sets in set notation. If the set is infinite, list at least five members before using the ellipsis.

- **a** the set of factors of 24
- **b** the set of multiples of 9
- **c** the set of prime numbers to 31
- **d** the set of even numbers greater than 40
- **e** the set of positive integers with 2 in the ones place

Subsets

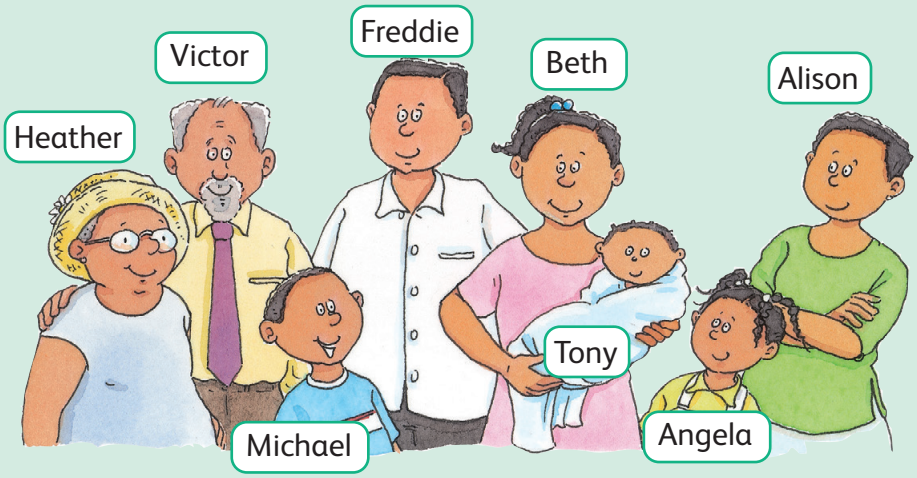
Key maths idea

Sets can be further organised into smaller sets.
When you put the members of a set into smaller sets, these smaller sets are called **subsets**.



Owls are a particular type of bird, so every owl is also a bird. We can express this in the language of sets by saying that the set of owls is a subset of the set of birds.
{owls } ⊂ {birds} because every owl is a bird.

The symbol ⊂ means 'is a subset of'.



{Michael, Angela, Tony} ⊂ {Heather, Victor, Freddie, Beth, Alison, Michael, Angela, Tony}

This means that the set of the children is a subset of Angela's family.

If Set A = {1, 2, 3, 4, 5}, then sets {1, 2, 3}, {3, 4} and {1} are all subsets of Set A.

We can show subsets in set notation: {1, 2, 3} ⊂ {1, 2, 3, 4, 5}

We say this aloud as 'the set 1, 2, 3 is a subset of the set 1, 2, 3, 4, 5'.

{6} is not a subset of {1, 2, 3, 4, 5} because 6 is not in the parent (main) set.

In set notation, we write: {6} ⊄ {1, 2, 3, 4, 5}

We say this aloud as 'the set 6 is not a subset of the set 1, 2, 3, 4, 5'.

Key word
subset

1 Write down whether each statement is true or false:

a {Wednesday, Thursday} ⊂ {days of the week}

b {multiples of 4} ⊂ {even numbers}

c {  } ⊂ {things to wear}

d {vowels} ⊂ {consonants}

2 Rewrite in set notation.

a All squares are rectangles.

b Not all rectangles are rhombuses.

c A = {2, 3, 4, 5, 6, 7}
B = {2, 4, 7, 8}
C = {2, 4}

3 Copy and complete. Use the symbol ⊂ or ⊄ to make the statements true.

a B _____ A

b C _____ A

c B _____ C

d C _____ B

4 Make four possible subsets of the set of polygons.

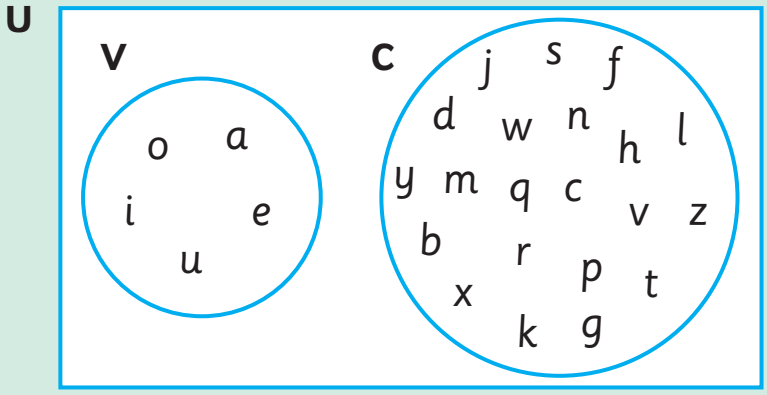
5 **a** List five members of the set of sports in set notation.

b Give three subsets of the set of sports in set notation.

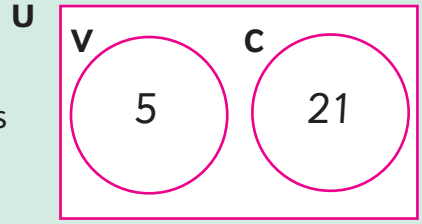
Venn diagrams

Key maths idea

A **Venn diagram** uses circles in a frame to show sets and the relationships between them. For example, if U = {the 26 letters of the alphabet}, V = {vowels} and C = {consonants}, the Venn diagram could look like this:



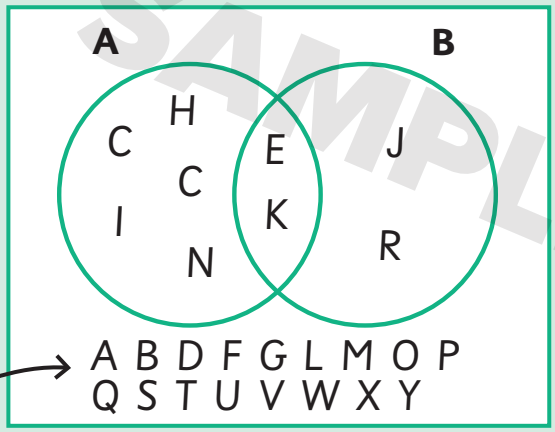
Sometimes Venn diagrams show the number of members in each set without listing them all. This Venn diagram shows the same sets as the previous one, but it uses the number of members of each set rather than the letters.



Key word
Venn diagram

If the members of the sets are shared, then the circles overlap.
The shared members are written in the overlapping section.
This Venn diagram shows:
U = {26 letters of the alphabet}
A = {letters in the word CHICKEN}
B = {letters in the word JERK}

E and K are members of set A and set B.

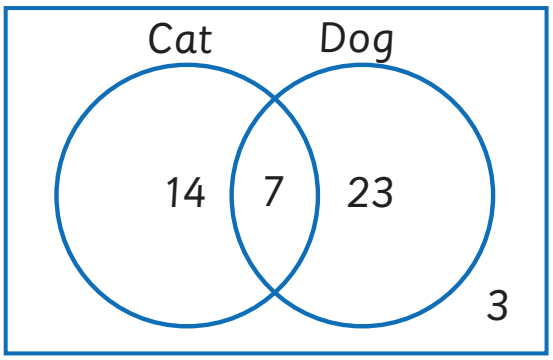


These letters are not found in set A or set B, but they are in the universal set U.

1 If U = {whole numbers from 1 to 50}, draw Venn diagrams to show these sets:

	Set A	Set B
a	Numbers from 1 to 10	Prime numbers
b	Odd numbers from 2 to 20	Composite numbers
c	Numbers from 1 to 20	Factors of 25
d	Prime numbers between 5 and 50	Multiples of 5
e	Multiples of 10	Multiples of 20

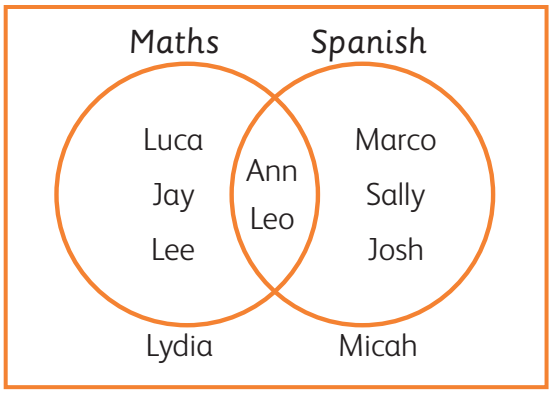
2 Leroy asked people whether they liked cats or dogs. He drew this Venn diagram.



Discuss these questions with a partner.

- **a** How many people liked both cats and dogs?
- **b** How many people didn't like cats or dogs?
- **c** How many people liked cats?
- **d** How many people liked dogs?
- **e** What is the universal set in this example? How many members are in the universal set?

3 Look at this Venn diagram.



- **a** How many members does the universal set contain?
- **b** Describe the set of students who go to maths lessons after school.
- **c** How many students have both maths and Spanish lessons after school?
- **d** Use set notation to list the members of the set 'Does not do maths or Spanish lessons after school.'

Intersection and union of sets

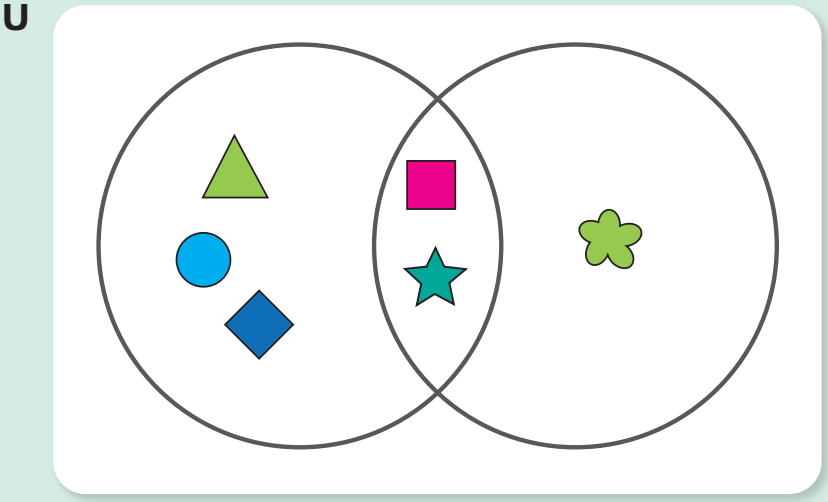
Key maths idea

The **intersection** of two sets is the set of members that both sets have in common. The symbol for intersection is ∩.

Example

{ ■, ▲, ●, ★, ◆ } ∩ { ■, ★, ✿ } = { ■, ★ }

The intersection of two or more sets is shown on a Venn diagram by overlapping the circles.



The **union** of two sets is the combined members of both sets. Each member is listed once only.
The symbol for union is ∪.

Example

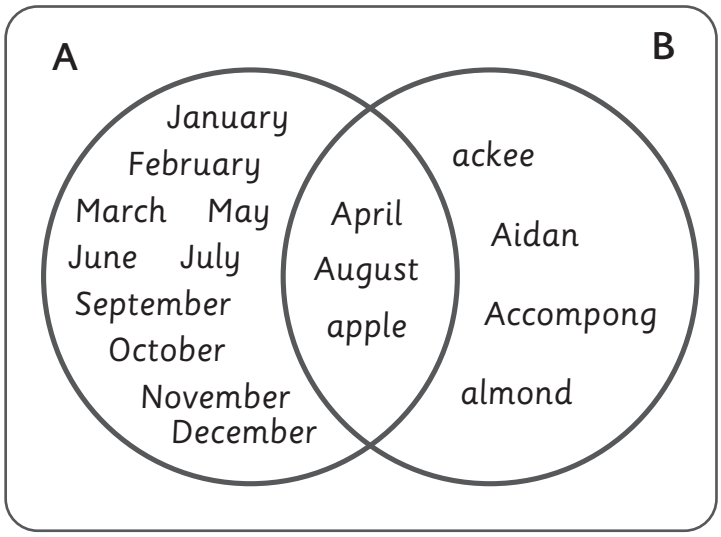
{ ■, ▲, ●, ◣ } ∪ { ◆, ◣, ★, ● } =
{ ■, ▲, ●, ◣, ◆, ★ }

Key words

intersection
union

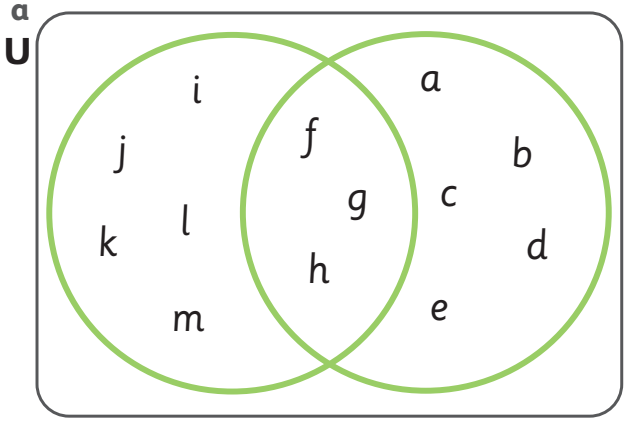
1 Look at the Venn diagram.

- **a** Use set notation to write the intersection of sets A and B.
- **b** Name some more members that could be in set B.
- **c** What could you name set A?
- **d** What could you name set B?
- **e** Where would you place the word 'soursop' in this Venn diagram?

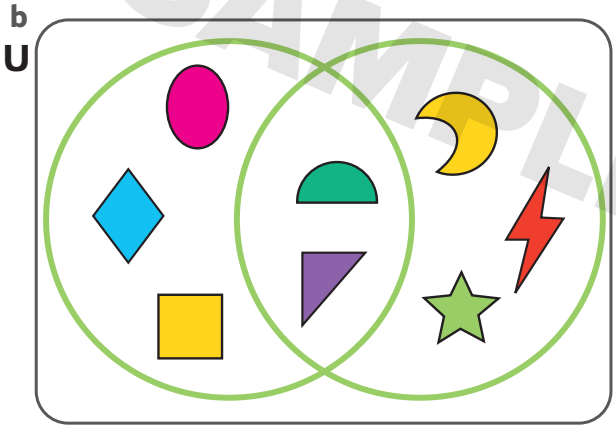


2 Write the union and intersection of the sets shown in the Venn diagrams below.

a



b



3 Copy and complete these statements. Represent them in a Venn diagram.

a {1, 2, 3, 4, 5, 6} ∩ {2, 4, 6, 8, 10} =

b {1, 2, 4 ,7, 11, 16, 21} ∩ {whole numbers from 0 to 15} =

c {a, b, c, d, e, f, g} ∩ {b, e, l, v, w} =

d {even numbers between 3 and 11} ∩ {prime numbers between 1 and 10} =

4 Copy and complete.

a {1, 4, 9, 16, 25} ∪ {4, 8, 10, 12, 14, 16} =

b {Liam, Kyle, Amelia, Ariana} ∪ {Liam, Amelia, Ashley} =

c {80, 90, 100} ∪ {88, 89, 90, 91, 92} =

5 Copy and complete the statements (use the symbol ∩ or ∪).

a {days of the week} ☐ {weekend days} = {Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday}

b {1, 2, 3, 4, 5, 6} ☐ {2, 4, 6, 8, 10} = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}

c {2, 3, 4} ☐ {1, 2, 3, 4, 5, 6} = {2, 3, 4}

6 You have these sets:
U = {whole numbers less than 20}
A = {square numbers less than 20}
B = {even numbers less than 20}
C = {odd numbers less than 20}

a Draw a Venn diagram to show sets A and C.

b Draw a different Venn diagram to show sets B and C.

c What is A ∩ B?

d List the members of A ∪ B.

e Draw a Venn diagram to show the relationship between sets A and B.

Disjoint sets

Key maths idea

Key word
disjoint sets

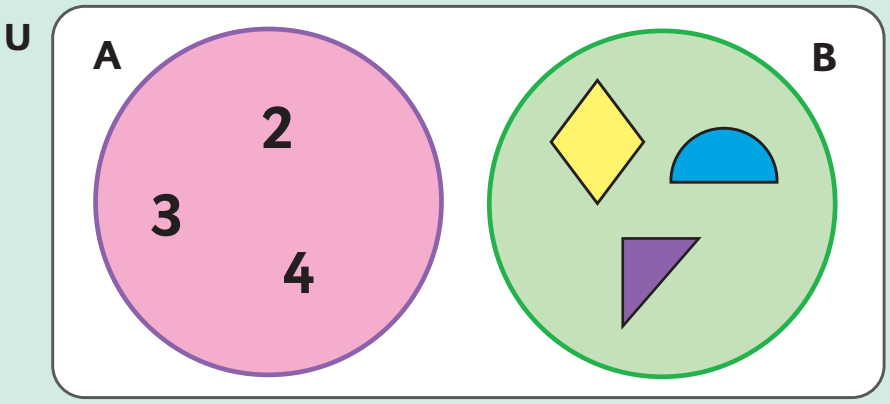
Set A and set B are equivalent sets because they have the same number of members. But they have no common members.

A = {2, 3, 4}

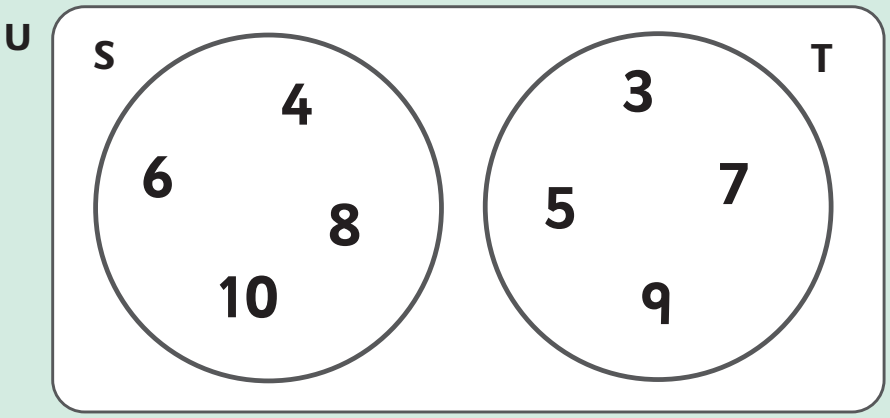
B = { ◇, ◤, ◡ }

Two sets that have no common members are called **disjoint sets**.

We can show this in a Venn diagram:



The sets S = {4, 6, 8, 10} and T = {3, 5, 7, 9} are disjoint. They have no common members.



Compare the sets in each pair and say whether they are disjoint or not.

1 A = {things we wear on our feet}; B = {running shoes}

2 C = {things we eat}; D = {running shoes}

3 E = {mango, pineapple, soursop}; F = {apple, banana, orange}

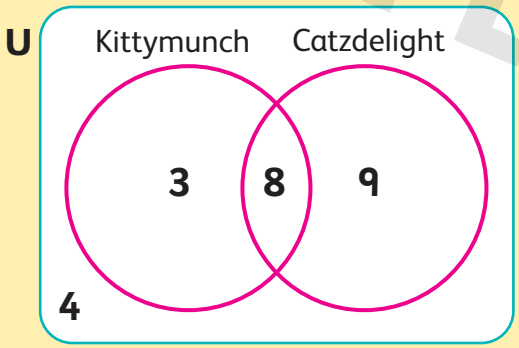
4 G = {Mara, Lisa, Jayden}; H = {Yohan, Elaine, Stacey}

5 I = {3, 6, 9, 12}; J = {2, 4, 8, 16}

Real-world maths: A cat food survey

VetCare Clinic in Mandeville did a survey to help them decide which cat food to buy to feed the animals in their hospital and boarding kennels.

1 The clinic tested two types of food (Kittymunch and Catzdelight) by feeding them to a set of 24 cats in their care. They drew this Venn diagram to show their results.



- **a** How many cats ate both types of food?
- **b** How many cats didn't eat either kind of food?
- **c** Which of these two cat foods would you recommend they buy? Why?
- **d** One of the vets says this is helpful, but that they need to try more options. Why do you think she said that?

2 The clinic director decided to do another test. She fed 25 cats in the boarding kennels Catzdelight and HappyCat. One cat didn't like either food. A quarter of the other cats liked both types of food, and two-thirds liked Catzdelight.

- **a** Use this information to draw a Venn diagram of these results.
- **b** How many cats only liked Catzdelight?

Maths detective: Things that belong together

Use the clues to help you solve each case.

Case 1

Look at the picture of items displayed at a grocery store.

Grocery stores use sets to organise and display items.

1 Make and name 5 different sets of items you can buy at the grocery store.

2 Describe each of the 5 sets.

3 How many members are in each of your 5 sets?

4 Name and list two sets that are equivalent and write down why they are equivalent.

5 Write down the union of your two equivalent sets. Remember to use set notation.

Case 2

In this part you have to complete a Venn diagram.

Look at the pictures. Then complete the Venn diagram, where:

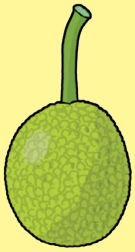
U = {fruits and vegetables}

C = {foods we eat raw}

D = {foods we eat cooked}


ackee


banana

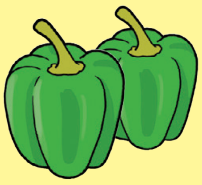

breadfruit


peas


cheese

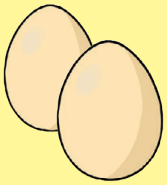

mango


apple


peppers


lettuce

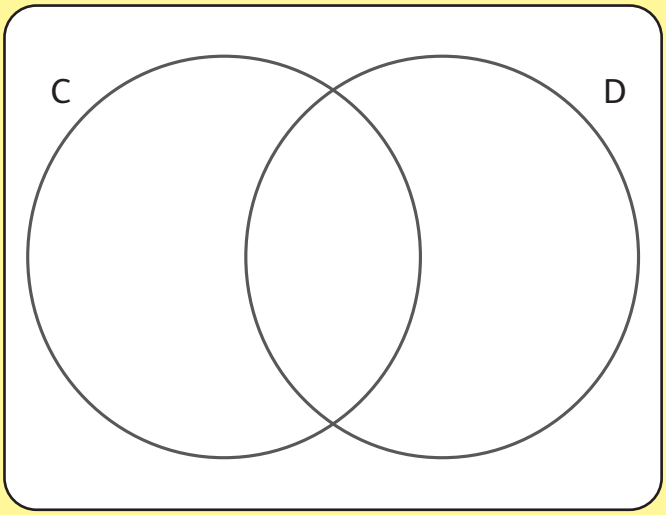

kallalloo


eggs


pineapple


coconut


yam



Case 3

Now use what you know about union and intersection to solve this case.

List the letters of the word CARNIVORE as set A.

List the letters of the word HERBIVORE as set B.

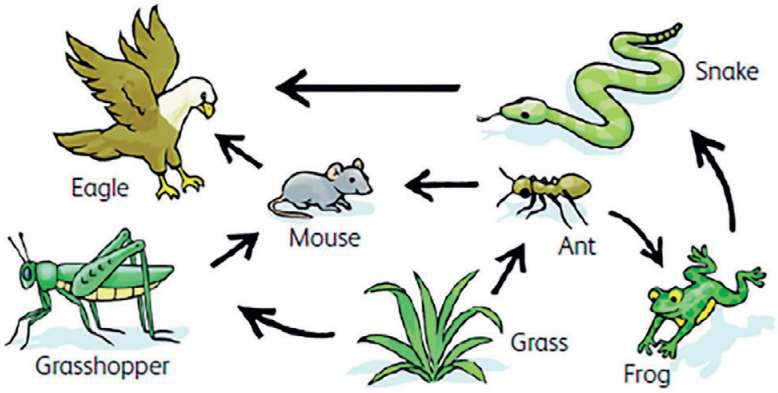
1. Represent set A and set B on a Venn diagram.
2. What is the intersection of A and B?
3. Use set notation to list A ∩ B.
4. Describe the members of the set of letter(s) common to both sets.
5. The members of set A and set B are combined. Write the set notation and list the members of the combined set.

Case 4

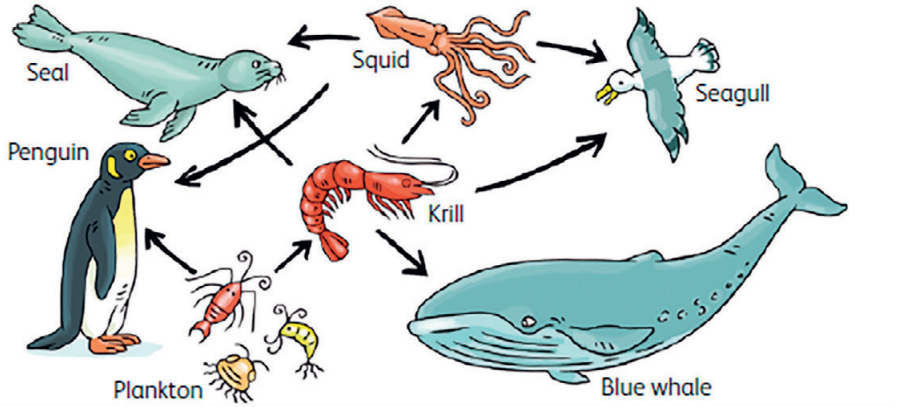
Some animals eat plants, some eat other animals (meat) and some eat both plants and other animals.

Here are two food webs showing what different types of animals eat. The arrows mean 'is eaten by'.

Food web A – Grassland



Food web B – Cold ocean



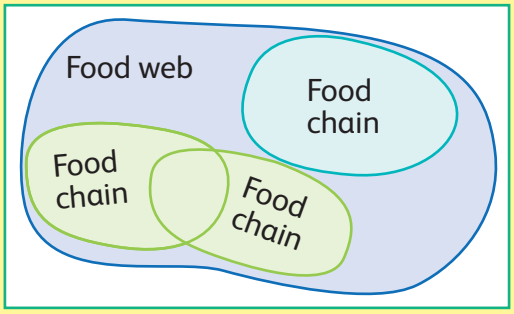
1 Answer these questions about the food webs.

- **a** How many of these animals only eat plants?
- **b** How many of these animals only eat other animals?
- **c** How many of these animals eat both plants and other animals?

2 Draw a Venn diagram to show this information. Use the number of members in each set.

Case 5

Ronnie was doing his Science homework and he found this Venn diagram on the internet.



1 What does this Venn diagram show?

2 Redraw the Venn diagram and fill in plants and animals that could fit into the different sets. Use a local environment that you have learned about.

What I have learned

Read the sentences. Copy them and fill in the missing words to summarise what you learned in this topic.

1 Two sets are _____ if they have the same number of members.

2 Two sets are _____ if they have no shared members.

3 If all the members can be counted or listed, the set is _____.

4 The _____ set is another name for the null set.

5 The _____ of two sets is the set of members common to both sets.

6 The _____ of two sets is the combined members of both sets with no members repeated.

7 A set is _____ if it has no last member.

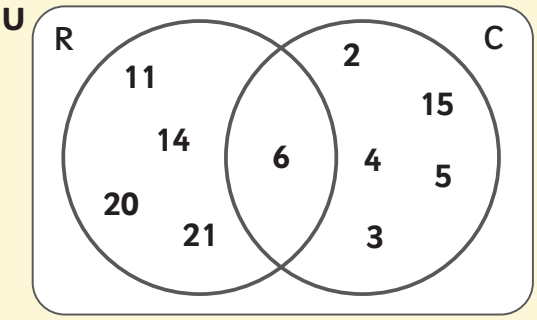
8 A _____ is a diagram that shows the relationship between sets.

Practice questions

1 Look at the Venn diagram.

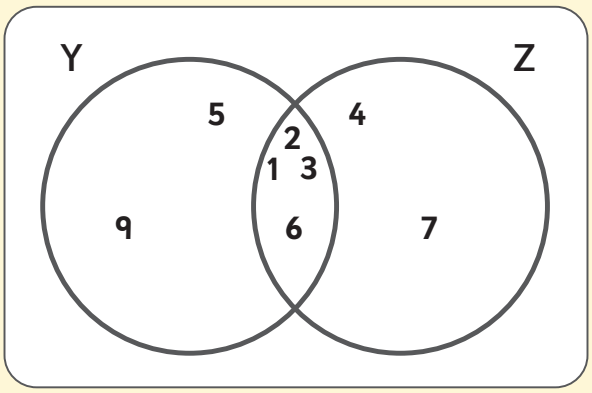
a How many members are in set R?

b What is R ∩ C? Use set notation to write the answer.



2 Use the given information to draw and label a Venn diagram.
U = {1, 2, 3, 4, …, 18, 19, 20}
A = {even numbers less than 20}
B = {the first five prime numbers}

3 Look at this Venn diagram.



a List the members of set Y.

b How many members are in the universal set?

c What are the members of Y ∩ Z?

d List the members of Y ∪ Z.

1 Self check

Check if you can do this: 	If you have difficulty, try this: 
1 Identify the members of a set, and associate the members of a set with the properties of the set.	Go to pages 9–10 and remind yourself what we mean by 'set', and 'elements' or 'members'. Remember that the properties of a set are the characteristics or criteria that determine whether something belongs in the set or not.
2 Distinguish between equal and equivalent sets.	Go to page 11 and remind yourself what we mean by these terms.
3 Distinguish between finite and infinite sets.	Go to page 12 and remind yourself what we mean by these terms.
4 List members of the intersection of two sets, and list members of the union of two sets.	Revise page 16. Remember that the intersection is where two sets overlap, and the union is where two sets are joined.
5 Draw Venn diagrams to show the intersection of two sets.	Revise pages 14–15 and practise drawing sets that have elements in common.
6 Use the symbols for set notation.	Revise all the symbols you used on pages 13–18.

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