Mathletics

Series C Student

# Geometry

My name _____

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First edition printed 2009 in Australia.

A catalogue record for this book is available from 3P Learning Ltd.

**ISBN** 978-1-921860-29-4

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# Series C – Geometry

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Series Author:

Rachel Flenley



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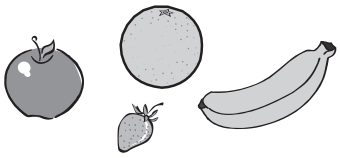
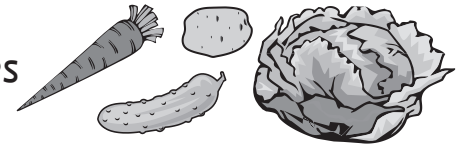
# 2D shape – sorting

How has this food been sorted? It has been sorted into 2 groups:



fruits

vegetables

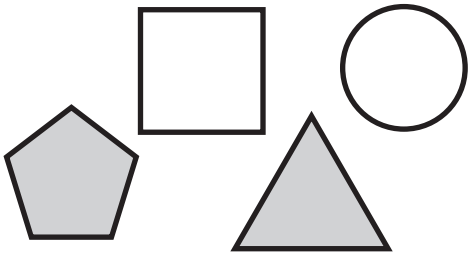


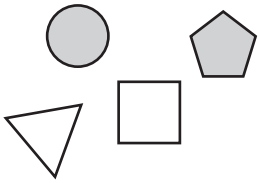
We could also sort them by colour, shape, size or whether we liked them or not. There are LOTS of ways to sort things.

**You will need:** a partner 2D shapes

## What to do:

**a** How do you think these shapes have been sorted?





They have been sorted ...

**b** What other ways could you sort them? Work with a partner and your pattern blocks to find some other ways. Record your ways here.

## What to do next:

Sort your pattern blocks following a secret rule. See if your partner can work out what your secret rule is.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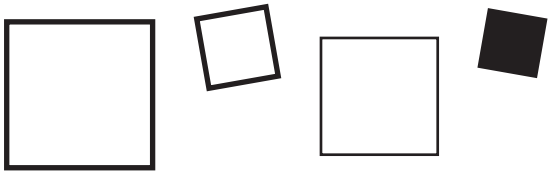
# 2D shape – sorting

Mathematicians sort and group shapes according to their **vertices**, **sides** and **lines**.

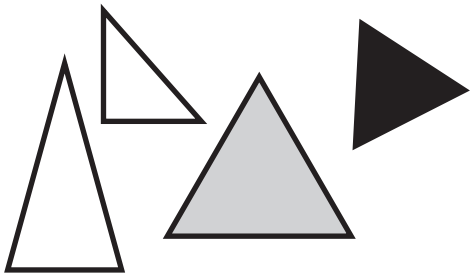


Let's look at these shapes.

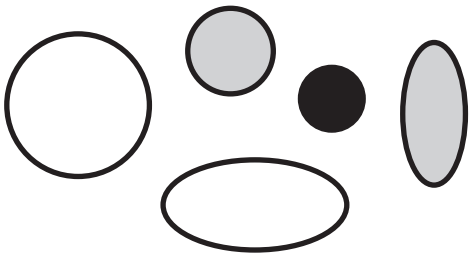
We say these are all **squares** because they all have 4 sides, which are all the same length. They each have 2 sets of parallel lines. They have 4 right angles. They are different colours and sizes and in different positions, but they are still squares.

There are different rules for different shapes.

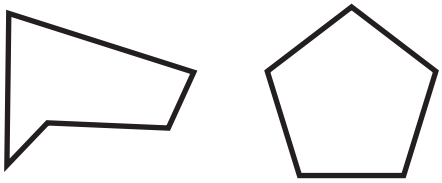
**1** Are these all triangles? Explain your thinking.



**2** Are these all circles? Explain your thinking.



**3** Are these both pentagons? Explain your thinking.

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# 2D shape – 4-sided shapes

Here are two 4-sided shapes.

A rectangle is a 4-sided shape with two pairs of sides the same length.

This is a special type of rectangle because all 4 sides are the same length. We call it a square.

**You will need:** a partner 2D shapes

## What to do:

Find a square and a rectangle. Look closely at the sides, angles and lines to work out what is **the same** and what is **different** about these 2 shapes. Record them here.

| Same | Different |
| --- | --- |
| • they have 2 sets of parallel lines | |

## What to do next:

Look through your 2D shapes. What other 4-sided shapes can you find? Trace or draw them here.

Look closely at the lines, vertices and sides to work out how they are the same as squares and rectangles and how they are different. Talk it through with your partner.


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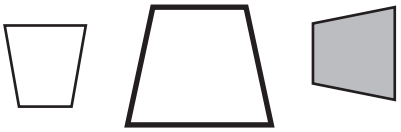
# 2D shape – 4-sided shapes

Here are 2 other kinds of 4-sided shapes.

These are **rhombuses**.

These are **trapeziums**.



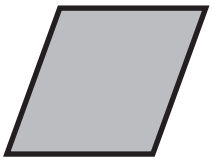
We know these shapes have 4 sides. Let's look closely at the lines and vertices to find out more about them.

**You will need:** a partner rhombus and trapezium blocks

## What to do:

Work with your partner to help these shapes answer some questions. Look at the shape blocks to help.

**a**



Do I have any sets of parallel lines? If so, how many? ☐

Are ALL my sides the same lengths? ☐

Do I have any square vertices? ☐

Is there anything else you notice about me?

**b**

Do I have any sets of parallel lines? If so, how many? ☐

Are ALL my lines the same lengths? ☐

Do I have any square vertices? ☐

Is there anything else you notice about me?



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# 2D shape – 4-sided shapes

**1** Draw a square, a rectangle, a trapezium and a rhombus. Label them.

**2** Now draw them again, but turn them around and make them a different size. Label them.


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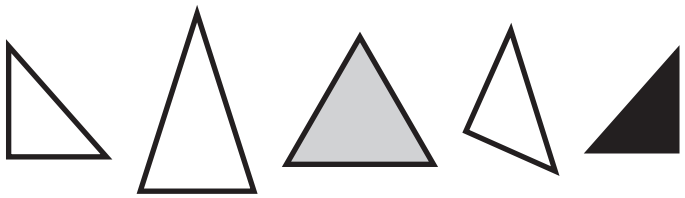
# 2D shape – triangles

Triangles can be different shapes and sizes.

Some have a square vertex. Some have all sides the same length.

Some have 2 sides the same length. Some have no sides the same length.

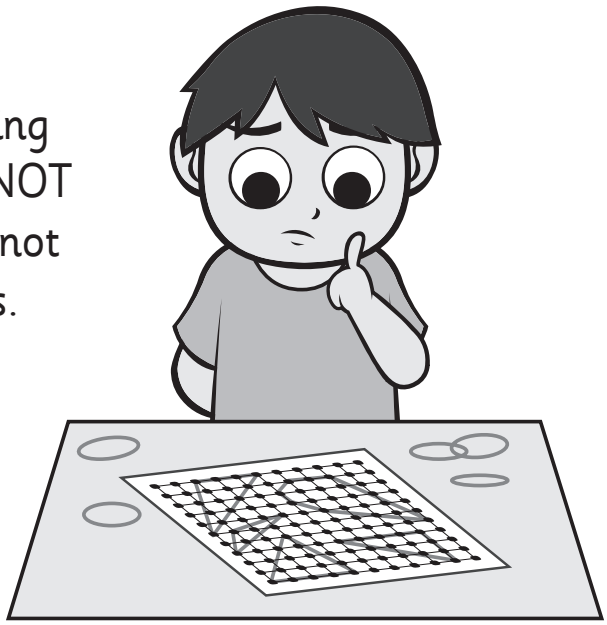
What makes them all triangles is the fact they have 3 sides and 3 vertices.



**You will need:** a partner a geoboard rubber bands

## What to do:

On your geoboard make 4 different looking or sized triangles and one shape that is NOT a triangle. Ask your partner to spot the 'not triangle'. Can you trick them? Swap roles. Play a few times.



## What to do next:

Take turns directing each other to make different kinds of triangles.

'Make me a triangle with a square vertex.' 'Make me a triangle with 2 long sides and 1 short side.'

Check that you can make it yourself before you ask your partner to make it.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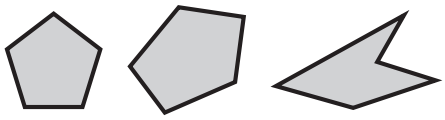
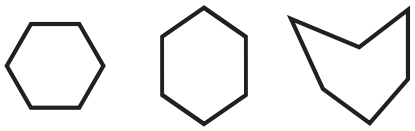
# 2D shape – 5- and 6-sided shapes

5-sided shapes are called pentagons.
They always have 5 sides and 5 vertices.



6-sided shapes are called hexagons.
They always have 6 sides and 6 vertices.



If their sides are all the same length, they are called **regular**.

If their sides are NOT all the same length, they are called **irregular**.

**1** Draw 2 different pentagons. Make 1 regular and 1 irregular.

**2** Draw 2 different hexagons. Make 1 regular and 1 irregular.

**3** **a** Use a ruler and a pencil to join the dots on this regular pentagon.

**b** How many triangles have you made?

6 • 1

3 •

• 4

5 •

• 2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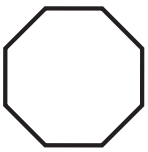
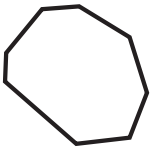
# 2D shape – 8-sided shapes

8-sided polygons and called **octagons**. They have 8 sides and 8 vertices.

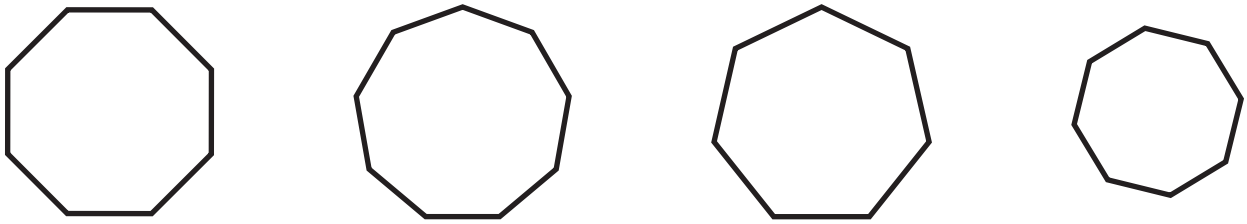
If all the sides are the same length, then they are **regular**;



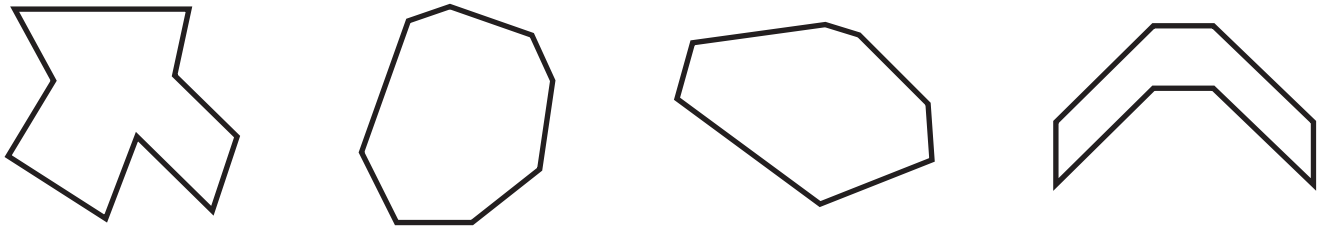
if not, then they are **irregular**.



**1** Circle the regular octagons.



**2** Circle the irregular octagons.



**3** Draw two octagons – one regular and one irregular.



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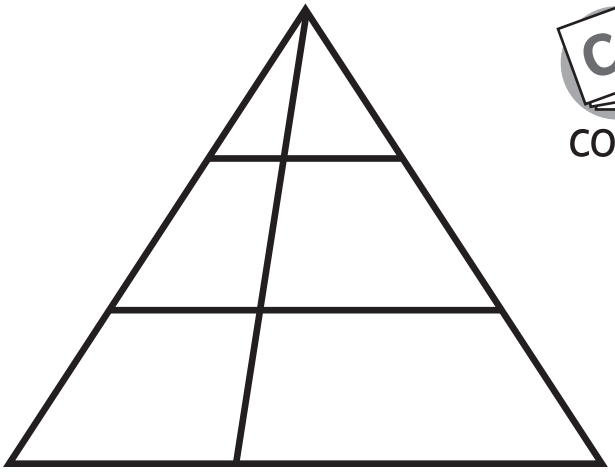
# 2D shape – explore

**1** How many triangles can you find?

Compare your answer with that of a partner. Do you both agree?



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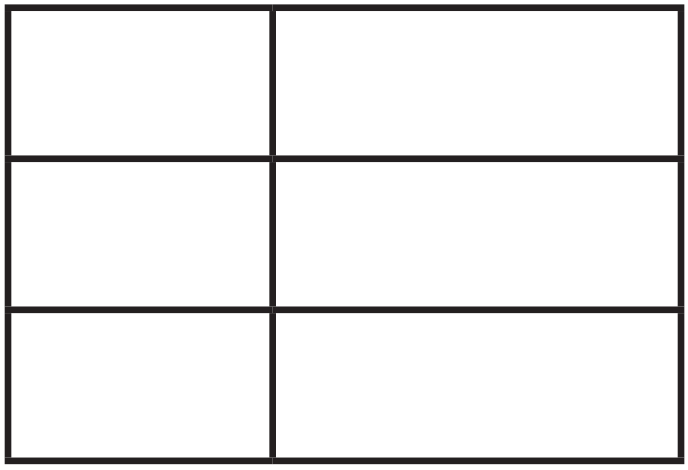
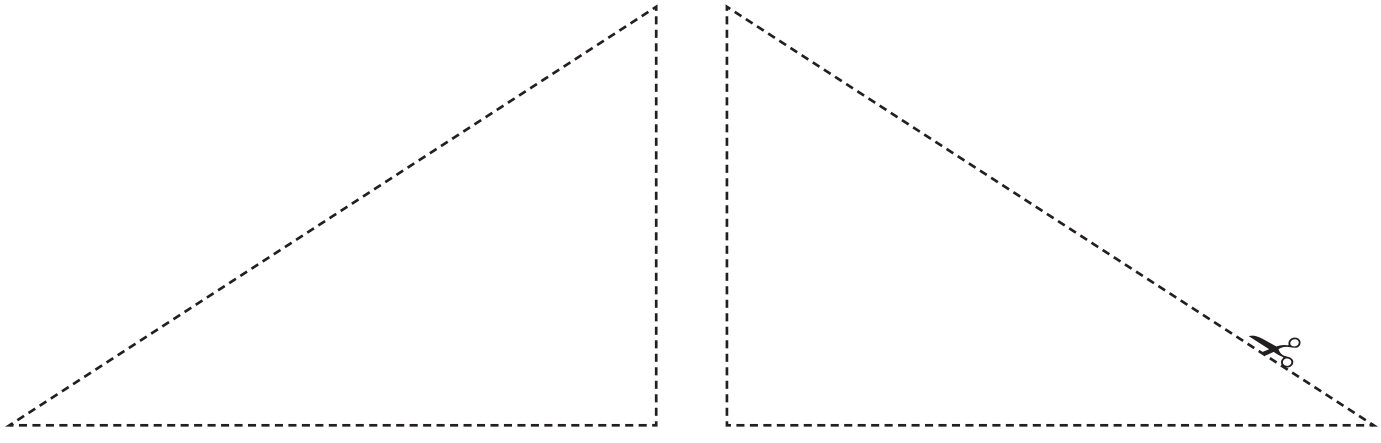
**2** How many rectangles can you find?

Compare your answer with that of a partner. Do you both agree?



**3** Cut out the triangles below. What different shapes can you make by joining them in different ways? Remember you can make irregular shapes. Record the different shapes you make in your maths book.

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# 2D shape – explore

**You will need:** 3 partners, a bag, 2D shapes

## What to do:

You are going to take turns working out what a shape is that you can feel but not see.

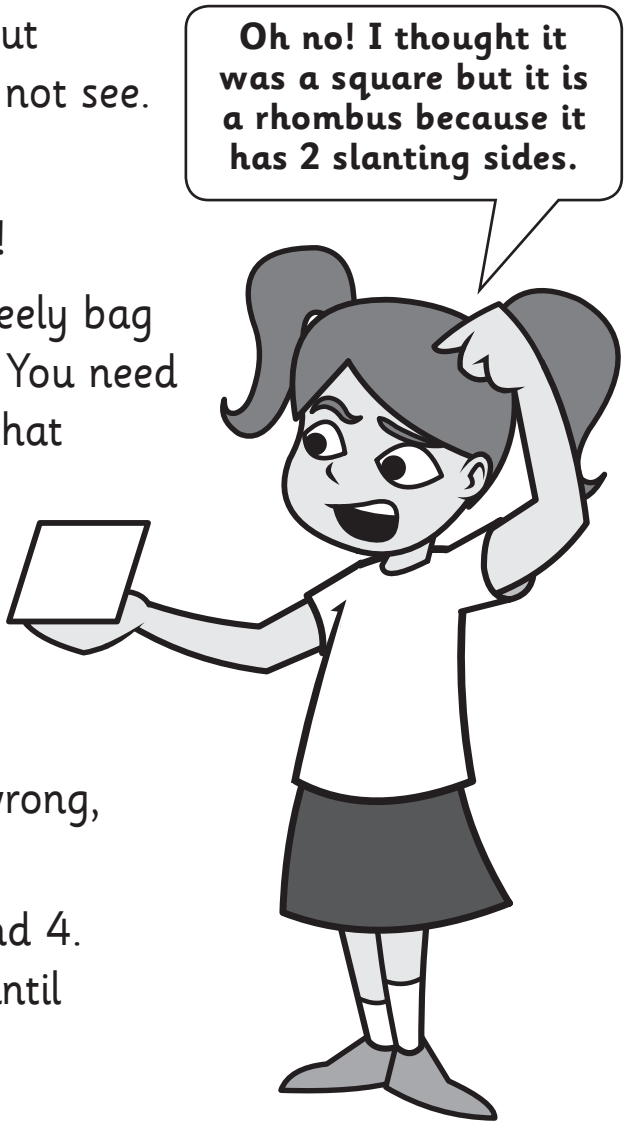
Put 1 shape into the bag at a time.

Don't let the first player see what it is!

Player 1, you need to reach into the feely bag and see if you can identify the shape. You need to name it AND say why you know what it is. For example, you might say 'This is a triangle – I know that because I can feel 3 sides and 3 vertices.'

Pull the shape out. If you are right, you keep the shape. If you just name it but don't describe it, or if you are wrong, the shape goes back in the bag.

Player 2 has a turn, then Players 3 and 4. Play until all the shapes are gone or until 1 player has 5 shapes.




## What to do next:

Put all the shapes into the bag. Take turns directing each other to pull out a particular shape – 'Pull out a rhombus, please.'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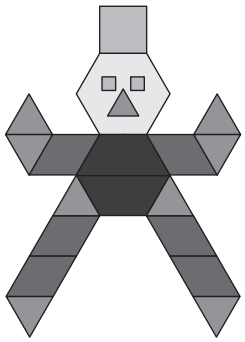
# 2D shape – tessellation

When we fit pattern blocks together like this, we are **tessellating**. When we tessellate, the shapes fit together without any spaces or overlapping.

We often **flip**, **slide** and **turn** shapes when we tessellate.



**You will need:** a partner or work by yourself pattern blocks

## What to do:

Create a pattern or picture with pattern blocks. You could create a robot, person, butterfly or flower.

What different 2D shapes did you use? Record them here.

## What to do next:

Experiment with the pattern blocks to answer these questions.

Remember, you may need to flip, slide or turn the blocks.

Can we tessellate if we **only** use:

**a** squares? _____

**b** rhombuses? _____

**c** trapeziums? _____

**d** triangles? _____

**e** pentagons? _____

**f** hexagons? _____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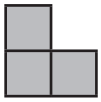
# 2D shape – tessellation

**You will need:** a partner or work by yourself scissors

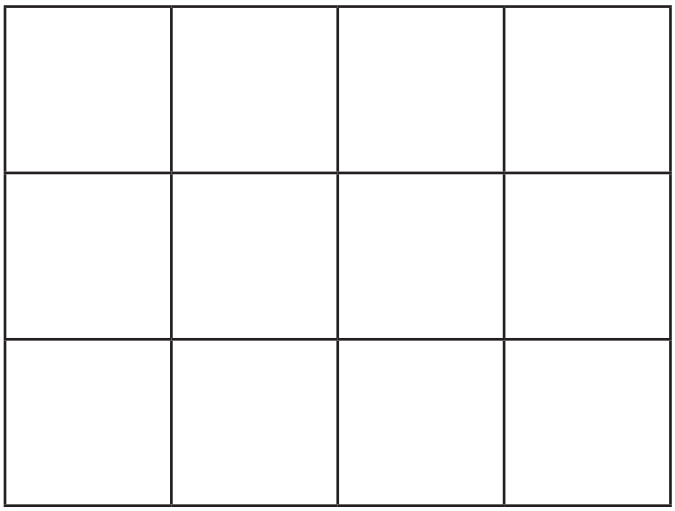
copy

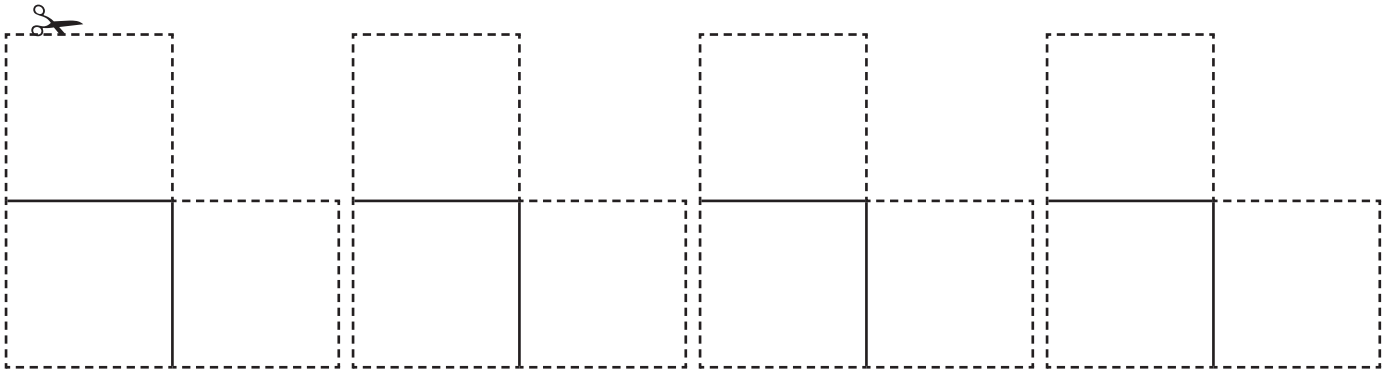
## What to do:

This is a triomino.  It is 3 squares in an L shape.

**a** Colour each triomino below a different colour and cut them out. Make sure you keep each triomino whole!

**b** Can you fill the grid with the triominoes? You will need to flip, slide and turn them to make them fit.







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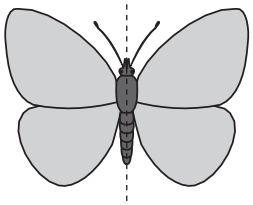
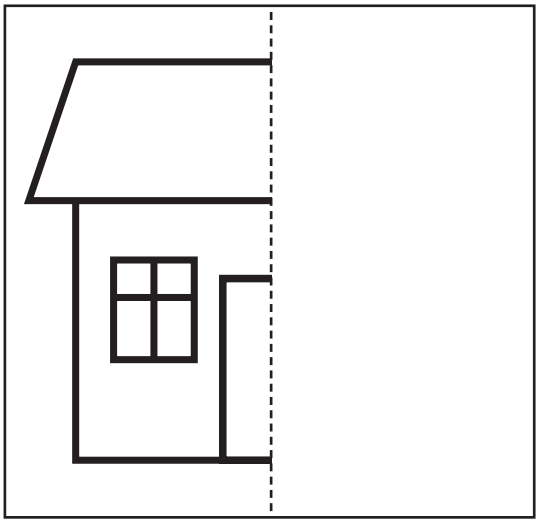
# 2D shape – symmetry

This picture of a butterfly is symmetrical. If we fold it along the dotted line, both sides match exactly.

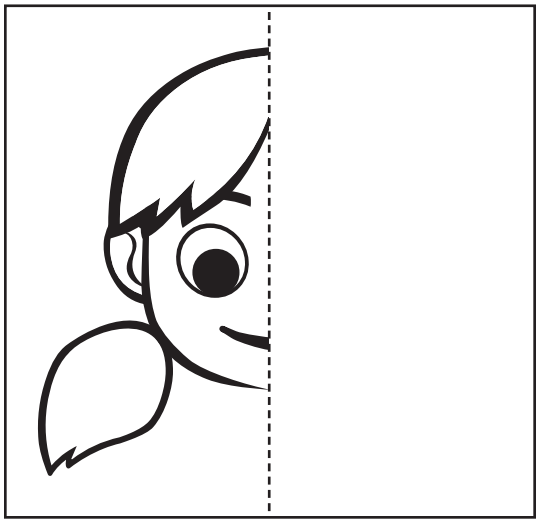


**1** Draw the other side of the pictures to make them symmetrical. Colour them symmetrically.

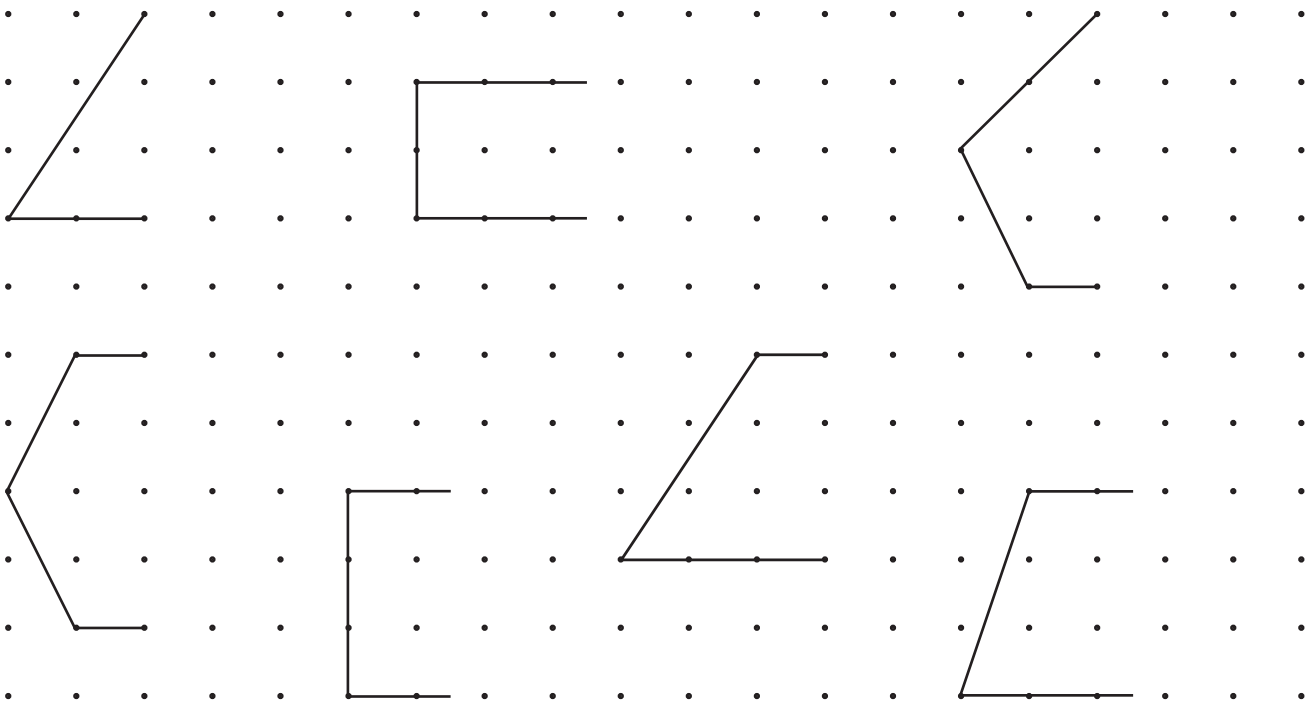
**a**



**b**



**2** Draw the other side of the shape. Label each shape.

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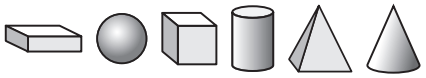
# 3D shape – faces, edges and vertices

The flat surfaces of 3D objects or 3D shapes are called **faces**.

Faces can be flat or curved (as on a sphere).

This cylinder has three faces.

Two are flat and one is curved.

**You will need:** a partner  these 3D shapes

## What to do:

Choose a 3D shape and then give it to your partner to hold for you.

Close your eyes and imagine its faces. How many are there? What shapes are they? Are they curved or flat?

Keep your eyes closed and ask your partner to pass you that 3D shape. Feel its faces. Now tell your partner about the faces. They will record the information for you. Swap roles and play until the faces of all the 3D shapes have been described.

| | | |
|---|---|---|
| | | |
| | | |



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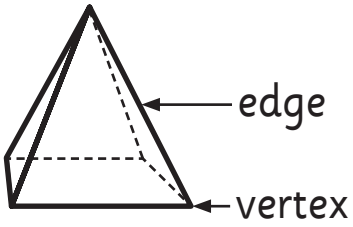
# 3D shape – faces, edges and vertices

**Edges** are formed when 2 **faces** meet.
**Vertices** are formed when 2 or more edges meet.
This square pyramid has 5 **faces**.
It has 8 **edges** and 5 **vertices**.

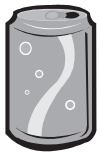



**You will need:** a partner classroom objects

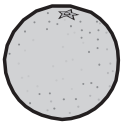
## What to do:

Your task is to investigate the faces, edges and vertices of some common classroom or household objects. Record the number of each to finish the fact files.

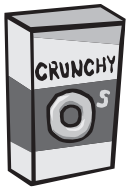
_____ faces
_____ edges
_____ vertices



_____ faces
_____ edges
_____ vertices



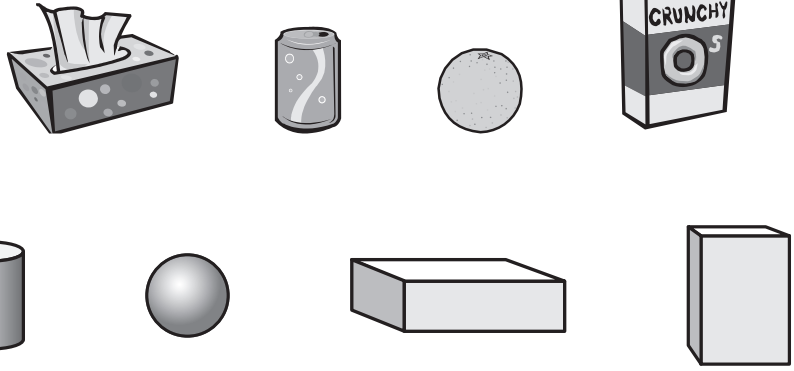
_____ face
_____ edges
_____ vertices




_____ faces
_____ edges
_____ vertices

## What to do next:

Draw lines to join the objects with their matching 3D shapes on the right.





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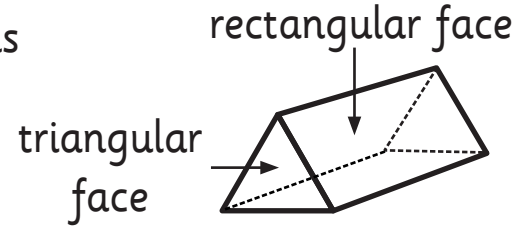
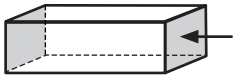
# 3D shape – prisms

Prisms have 2 **identical end faces**. All the other faces are always **rectangles**. Prisms are named according to their end faces.

The end faces of this prism are triangles so we call it a **triangular prism**.

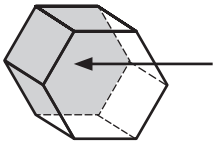



**1** Look at the end faces of these 3D shapes. Choose words from the box to finish the statements.

**a** 

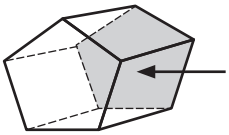
My end faces are _____.

I am a _____ prism.

**b** 

My end faces are _____.

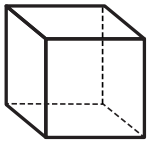
I am a _____ prism.

**c** 

My end faces are _____.

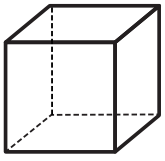
I am a _____ prism.

hexagons
hexagonal
pentagons
pentagonal
rectangles
rectangular



This shape can be called a rectangular prism even though its faces are square. Do you know why?
It's because squares are actually part of the rectangle family.

**2** Let's look at this shape some more.



**a** We sometimes call it another name.

Do you know what it is? ___u___e

**b** What are some real life objects shaped like it?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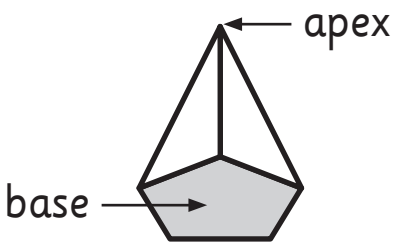
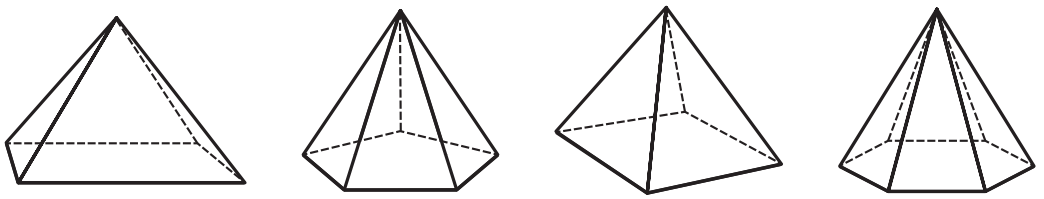
# 3D shape – pyramids

Pyramids have one base. The **base** always has straight sides.
The other faces are always **triangles**.
The triangular faces meet at a point called the **apex** (a special type of vertex).
Pyramids are named after their bases.
This is a **pentagonal pyramid**.

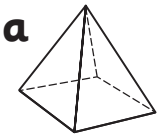



**1** Match the pyramids to their labels.

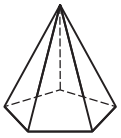


| hexagonal pyramid | square pyramid | pentagonal pyramid | rectangular pyramid |
|---|---|---|---|

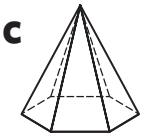
**2** Use real 3D shapes to help you finish the fact stories, or can you find a rule to help you?

**a** 

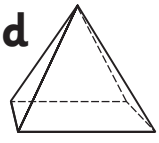
A square pyramid has a square base which has _____ sides.
It has _____ triangular faces.

**b** 

A pentagonal pyramid has a _____ base which has _____ sides.
It has _____ triangular faces.

**c** 

A hexagonal pyramid has a _____ base which has _____ sides.
It has _____ triangular faces.

**d** 

A rectangular pyramid has a _____ base which has _____ sides.
It has _____ triangular faces.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# 3D shape – pyramids

**You will need:** scissors

copy

## What to do:

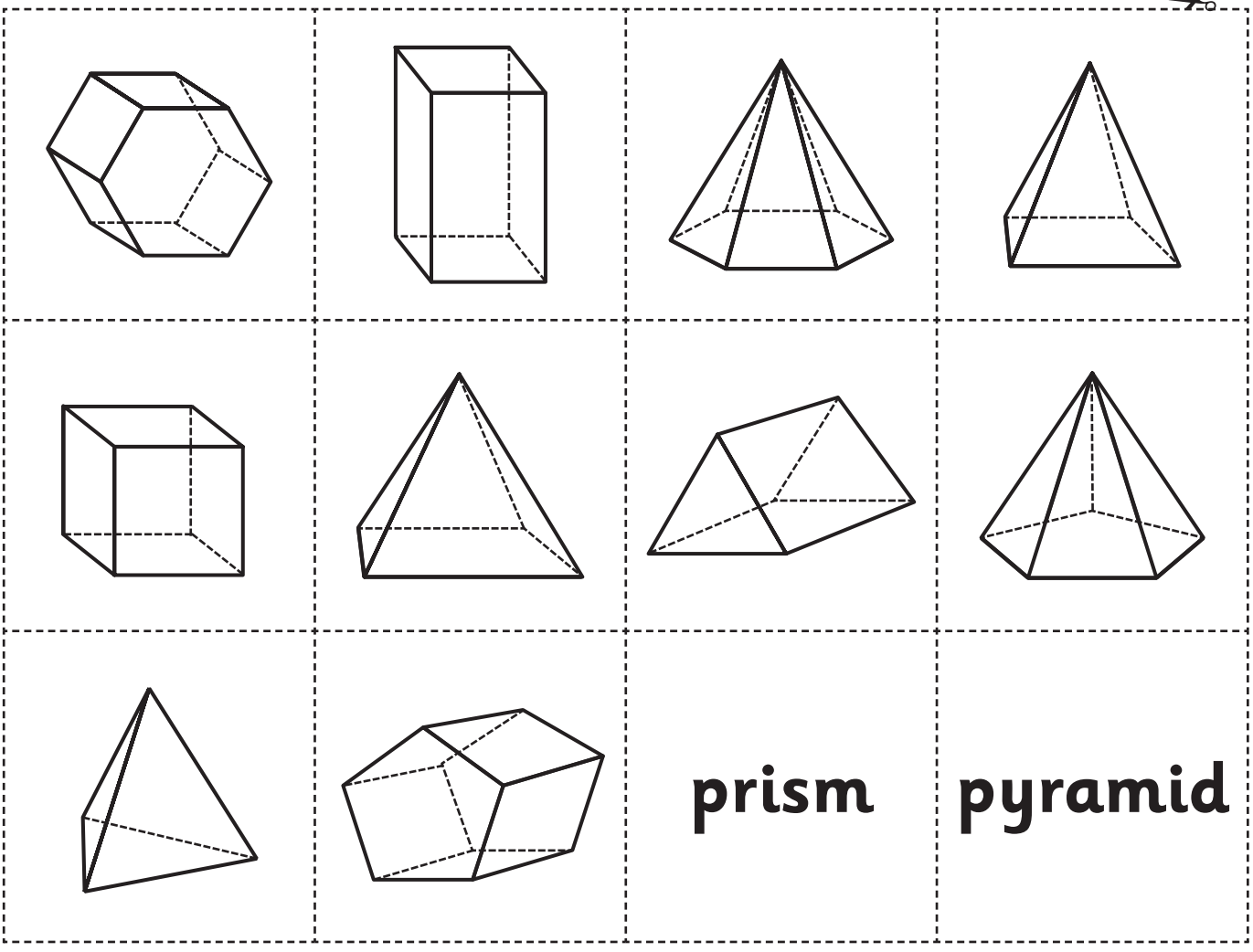
Cut out the 3D shape cards and put them in a pile, face down. Cut out the labels and put them side by side, face up.

Turn over the 3D shape cards one at a time and put them under the right label. You can play this by yourself or you can race against other people. Get somebody to check. How did you go?

Now, can you do it even faster?

## What to do next:

Combine your 3D shape cards with those of a partner and play Snap!





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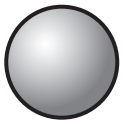
# 3D shape – spheres, cylinders and cones

This is a ...

cylinder

cone



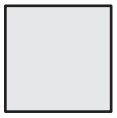
sphere

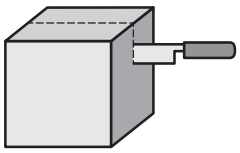
**1** What is the **same** about these 3 3D shapes?

**2** What is the **different** about these 3 3D shapes?

A **cross-section** is what you see when you slice right through something.

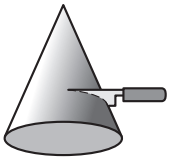
The cross-section of a cube would look like this.



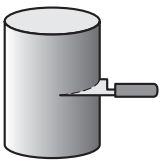


**3** Draw the shape you would see if you cut these cross-sections.

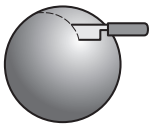
**a**



**b**



**c**



Do your answers surprise you?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# 3D shape – explore

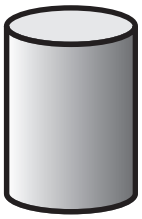
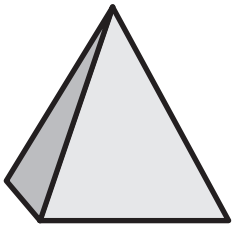
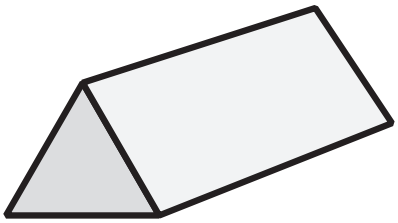
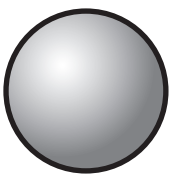
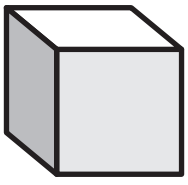
**You will need:** scissors glue stick

C copy

## What to do:

Cut out the descriptions and the 3D shapes and match them. You can use real 3D shapes to help you make your decisions. When you are sure you are right, stick them in your maths book.

Label each 3D shape. You score 5 points for each 3D shape that is correctly matched and named.

| | | |
|---|---|---|
| I have 6 faces. They are all rectangles. I am a kind of prism. | I am a prism. My 2 end faces are triangles. My other faces are rectangles. | I am a prism. I have 6 square faces. |
| I have 1 square base. I have 4 triangular faces that meet in an apex. | I can roll. I have 1 curved surface. | I can roll. 2 of my faces are circles. Cans are my shape. |
|  |  |  |
|  | |  |



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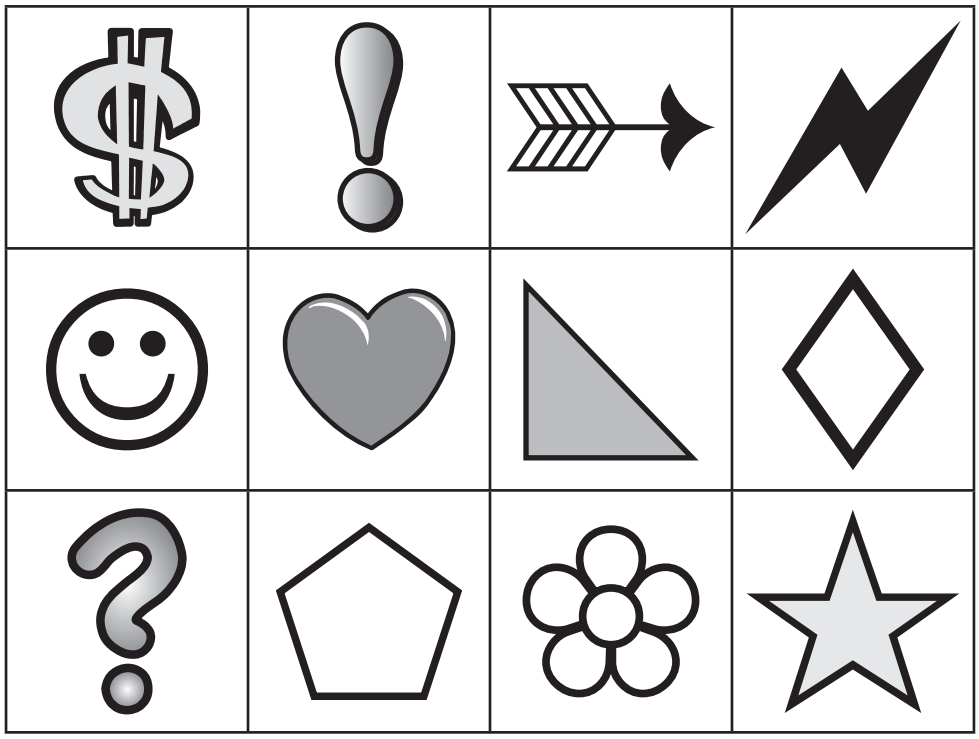
# Position – describing position



**1** Look at the grid. Draw the figure that is:

**a** next to

**b** under

**c** above

**d** between and

**e** below

**f** next to

**2** If you are the where would you say the:

**a** is? It is _____ me.

**b** is? It is _____ me.

**c** is? It is _____ me.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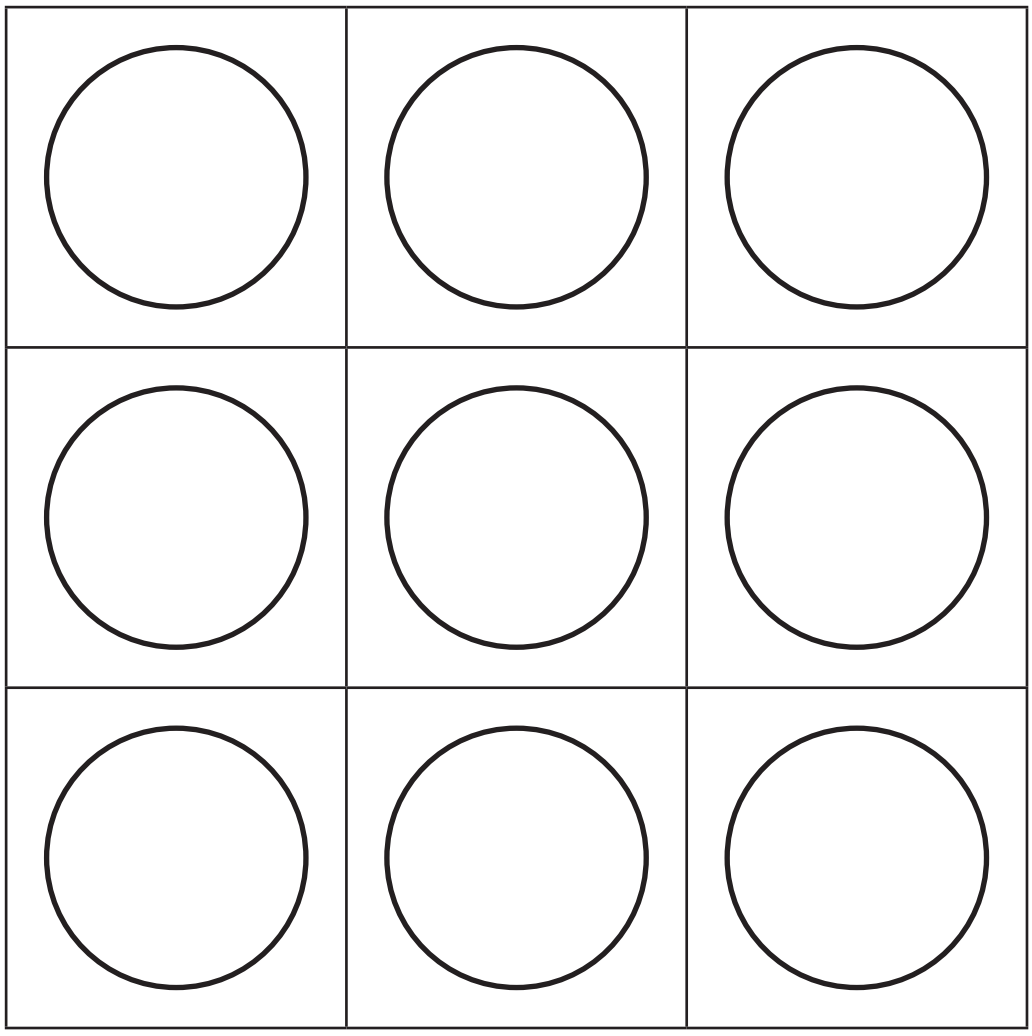
# Position – describing position

**You will need:** coloured pencils counters

## What to do:

Use the clues to colour the circles. You may want to experiment with coloured counters before you colour.



- orange is between red and blue
- green is below red
- black is to the left of both yellow and green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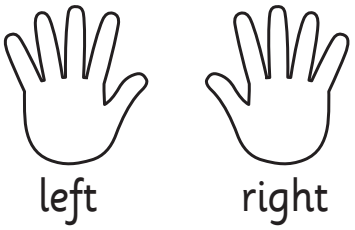
# Position – describing position

**Left** and **right** are terms we often use when we are talking about position.




**1** Colour:

**a** the **left** hand blue

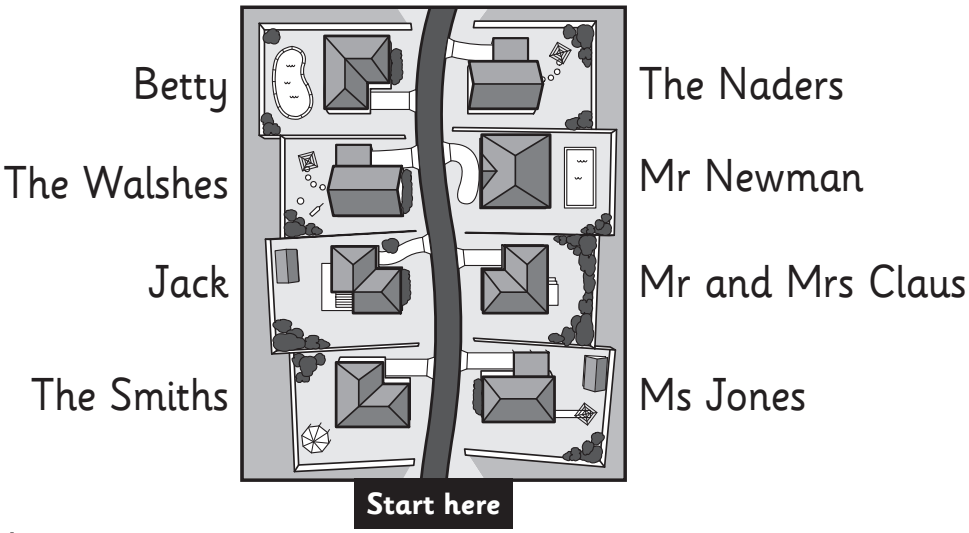
**b** the **right** hand green

**c** the **left** shoe yellow

**d** the **right** shoe orange

**e** the **right** flower pink

**f** the **left** flower purple




**2** Who lives at:

**a** the 2nd house on the right? _____

**b** the 3rd house on the left? _____

**c** the 1st house on the left? _____

**d** the 4th house on the right? _____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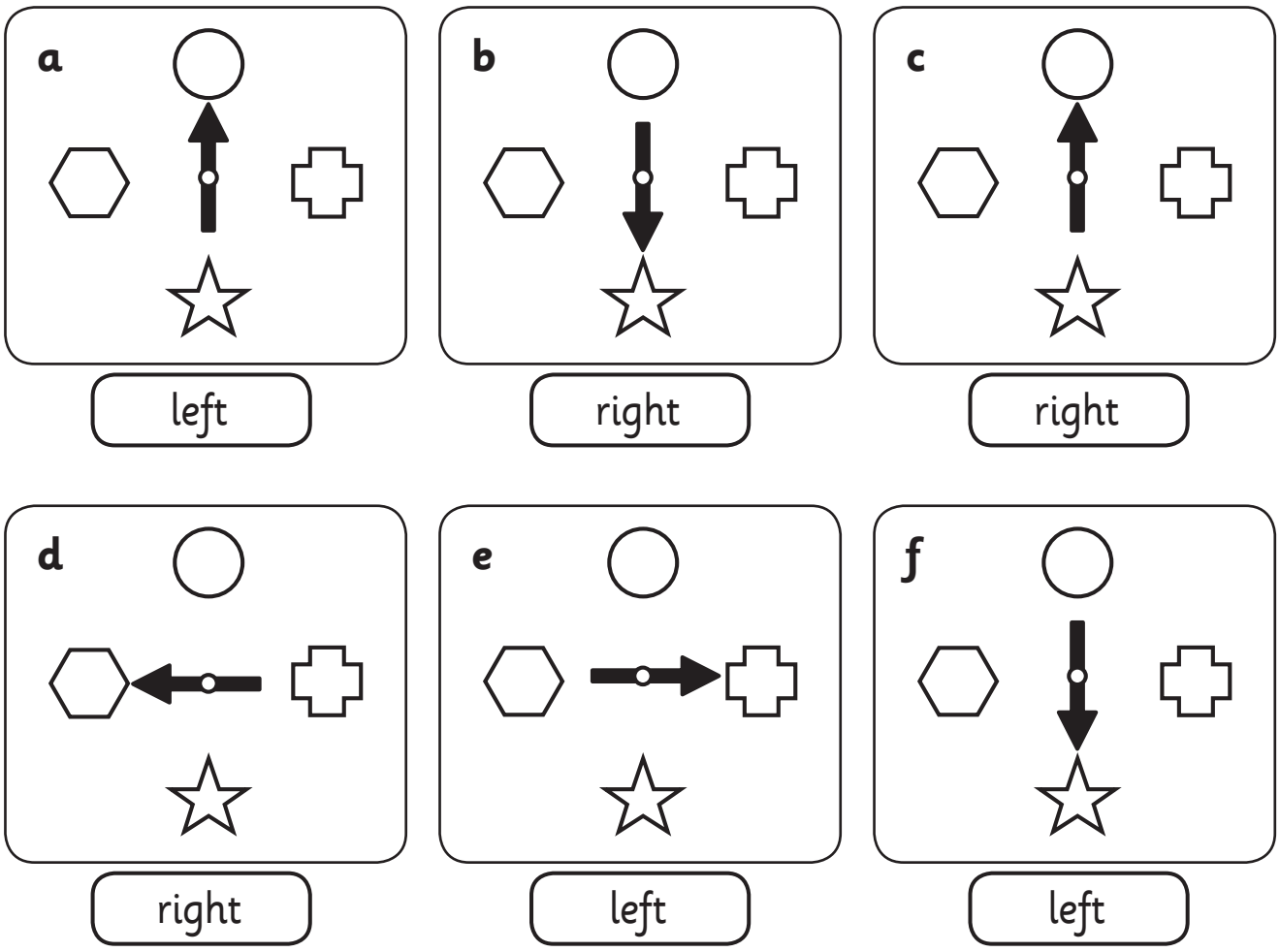
# Position – describing position

**1** You are facing the way the arrow points. Colour the shape the spinner would point to if it turned:




**2** To get from your classroom to the front office, how many left and right turns must you make? Close your eyes and picture the path. Record the turns you make in your head. Now test it out.

**3** Choose another start and end point and test it out. Record your turns and where you went.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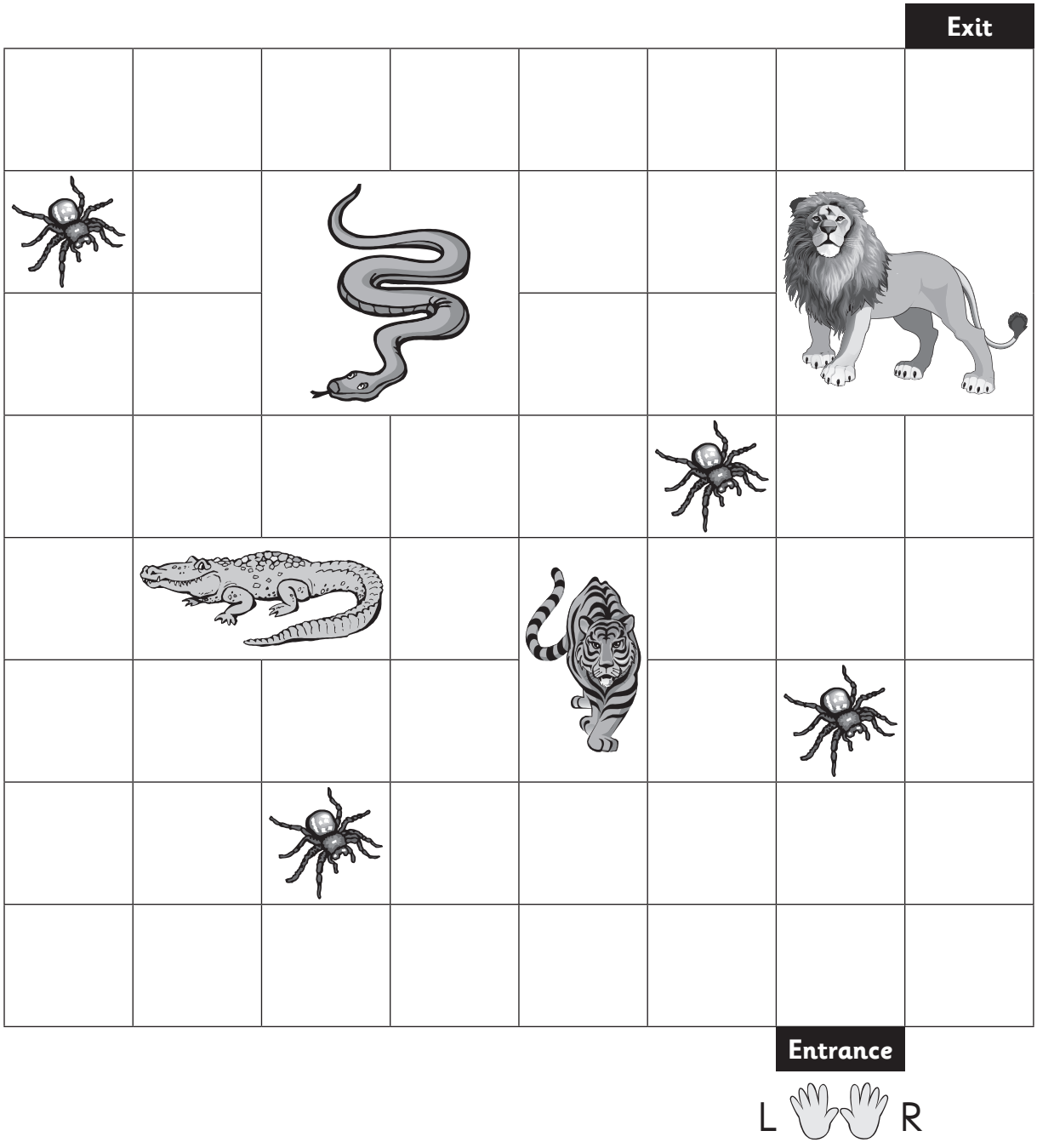
# Position – paths and directions

**1** Wally's class turn their classroom into a jungle for the school fete.

**a** Colour the path Wally takes to get through the jungle without bumping into anything scary.

| Up 2 | Left 3 | Up 3 | Right 1 | Up 3 | Right 3 |
|---|---|---|---|---|---|




**b** Find another path that Wally could take. Record it here.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# Position – paths and directions

**You will need:** a partner

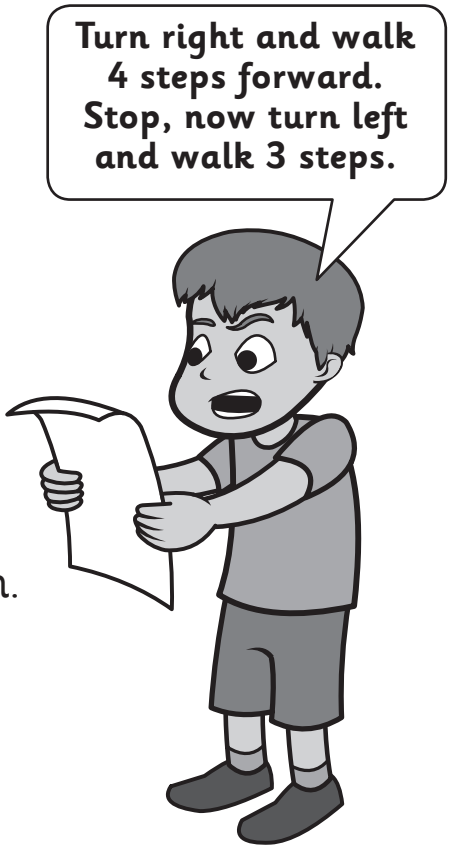
## What to do:

You are going to describe a path to your partner using terms such as **left**, **right** and **forward**.

Plan your path round the classroom or school. Once you are happy with it, write it below. Also write where your partner should end up on a secret scrap of paper.

Read your directions one by one to your partner or give them to him or her so they can read them.

When they have finished, check that they are where they are supposed to be. If not, walk the path again together and work out where things went wrong. Fix any incorrect directions.





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# Position – mapping

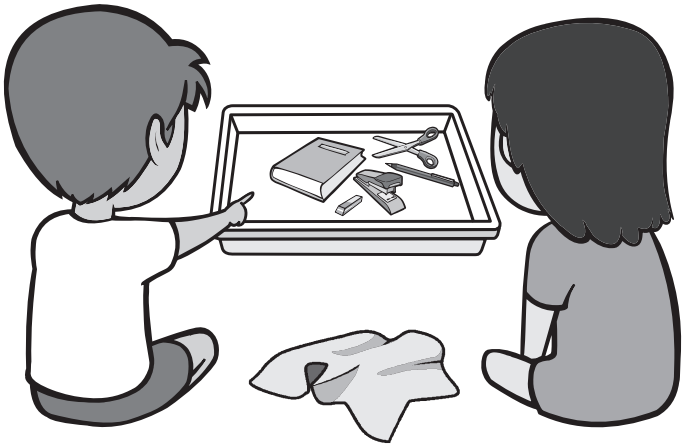
**You will need:** a partner, tray, tea towel, classroom objects

## What to do:

Decide who will go first. Choose 5 classroom objects to position on the tray. Cover the tray with the cloth. Uncover the tray for the count of 10 then re-cover.

Your partner then has to draw or write the objects in the correct position on one of the trays below.

Swap roles. Play 3 times each. If 5 objects are too easy for you, feel free to add a few more!



**Tray 1**

**Tray 2**

**Tray 3**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# Position – mapping

## What to do:

Map your classroom using the grid below to help you. Make sure you include the position of the doors, windows and your teacher's desk. Sketch everything in lightly.

## What to do:

Compare your map with someone else's. Do you agree on the positioning of objects? Make any changes you need to. Once you are happy with your map, colour and label the objects.


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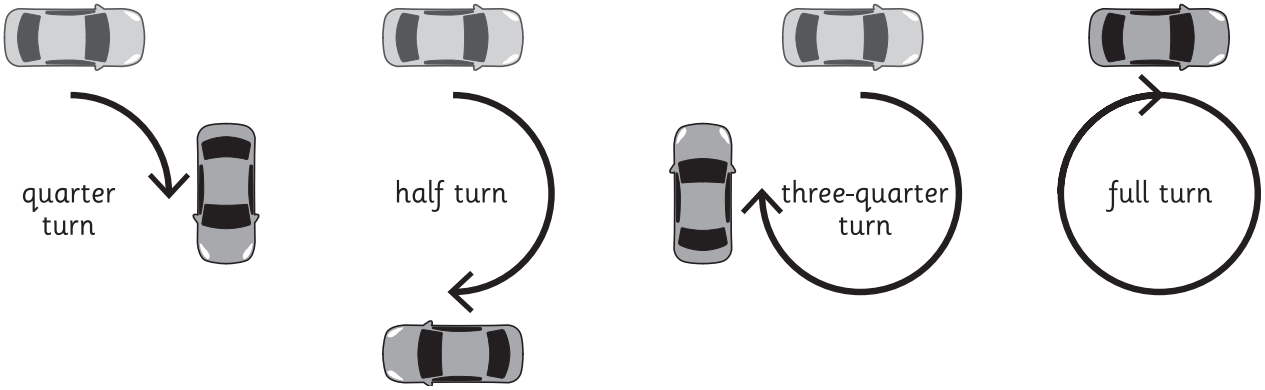
# Position – turns

We change our position if we make a turn. If we turn until we come back to the same position we have made a **full** turn. If we turn until we are facing in the opposite direction we have made a **half** turn. Half of a half turn is a **quarter** turn. Three-quarter turns make a **three-quarter** turn.

A car starts in this position:




**1** A car starts in this position:

What type of turn has it made to end up in the following end positions?

**a** ____

**b** ____

**c** ____

**d** ____

**2** A face starts in this position: Draw it after it has turned a ...

**a** half turn

**b** three-quarter turn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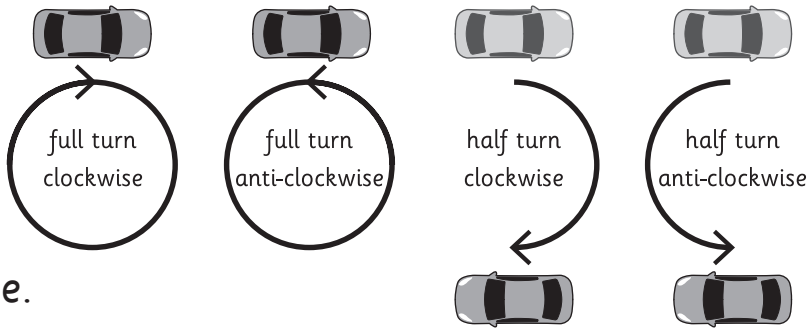
# Position – turns

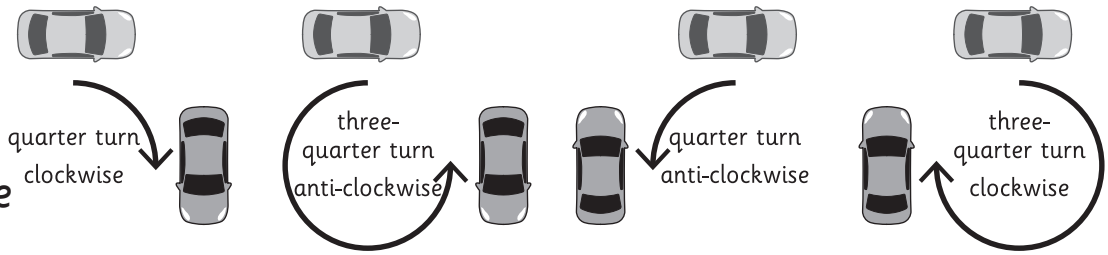
All the turns on the previous page are in a **clockwise** direction (the direction in which the hands of a clock turn).

Turns can also be made in the opposite, or **anti-clockwise** direction.

If something makes a full or half turn it makes no difference to its final position if the turn is clockwise or anti-clockwise.




A quarter turn clockwise is the same as a three-quarter turn anti-clockwise, and a quarter turn anti-clockwise is the same as a three-quarter turn clockwise.




**1** Are these turn clockwise or anti-clockwise?

The car starts in this position:

**a** three-quarter turn

**b** half turn

**c** quarter turn

**d** quarter turn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# Position – turns

**You will need:** partners

## What to do:

Choose a person to be the leader. The leader stands in front of the group, who also stand, and shouts 'turn' commands. He or she can us 'full turn', 'half turn', 'quarter turn' and 'three-quarter turn'. If a child makes a mistake they sit down until only one child remains. This child becomes the next leader.

The game can be made harder by shouting the commands faster and/or by using 'clockwise' and 'anti-clockwise' in the commands.

**You will need:** a partner

## What to do next:

Your partner will be a robot in this game. You are the controller. You decide on a place in the room that you want your robot to reach and give the robot commands to reach it, such as '3 steps forward', 'quarter turn clockwise', '2 steps forward', 'quarter turn anti-clockwise'. The robot has to follow the commands exactly, even if it means going wrong.

When the robot reaches the target, swap roles.

For a greater challenge, the controller can command two robots. They start at different places in the room, and the controller gives commands to the first one, and then the other, trying to make them meet somewhere in the middle.


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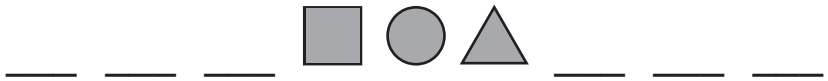
# Patterns and rules – repeating patterns

We are used to continuing repeated patterns.

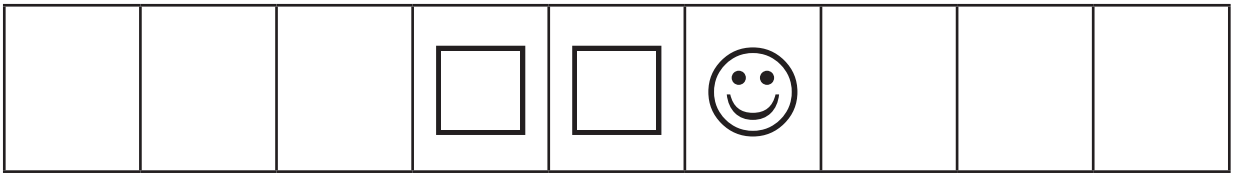
But what if the pattern rule is in the middle?



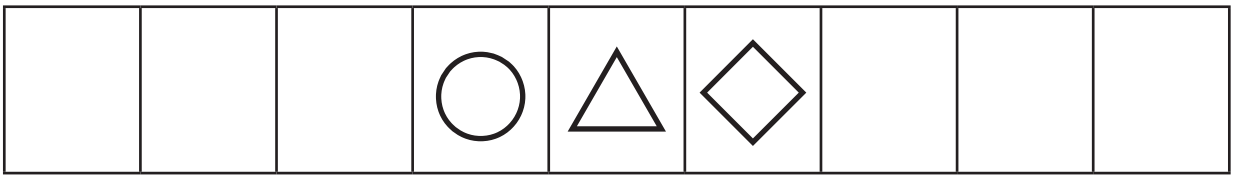
What strategies can you use to continue these patterns both ways?

**1** Continue these patterns both ways.

**a**



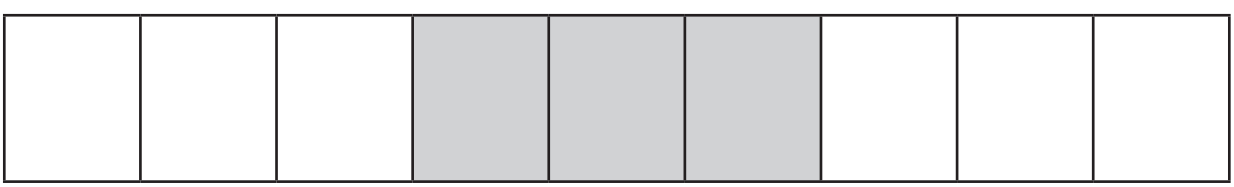
**b**



**2** Create your own pattern rules in the grey boxes. Swap with a partner and continue each other's patterns both ways.

**a**

**b**





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# Patterns and rules – repeating patterns

Patterns follow very strict rules. Look at this pattern.

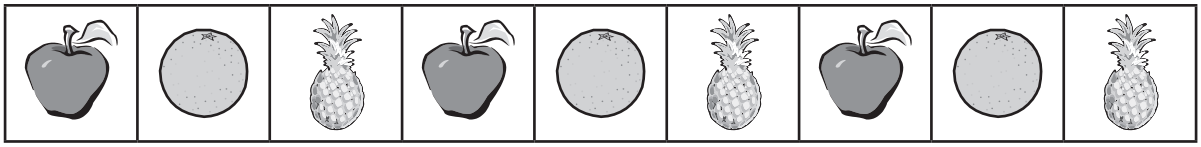
The rule is

circle triangle square

The pattern repeats this rule over and over.

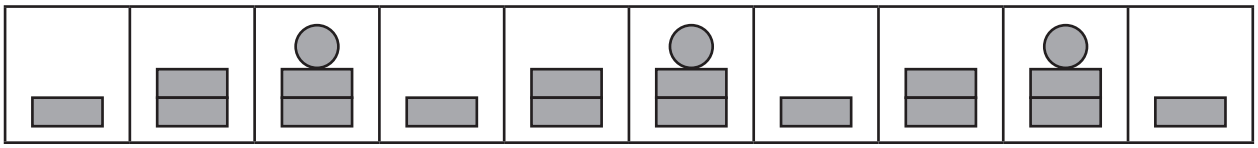
**1** Circle the rule in each repeating pattern. Record it below.

**a**



The rule is

**b**



The rule is

**2** Make up a rule and record it somewhere secret. Draw your rule (or make it with blocks) and repeat it over and over. Ask a partner to identify your pattern rule and record it here. Tick it if they were right.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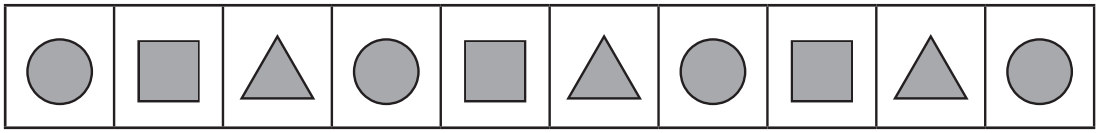
# Patterns and rules – repeating patterns

If there is no rule, it is NOT a pattern.

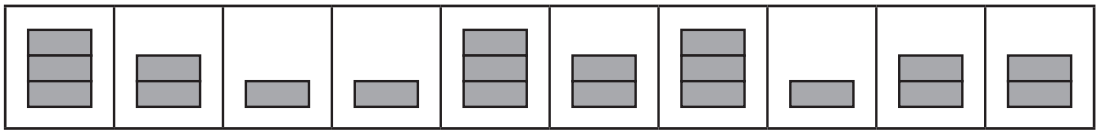
This is not a pattern, it is just a row of shapes.

**1** Look at these rows. Tick the ones that follow a pattern rule.

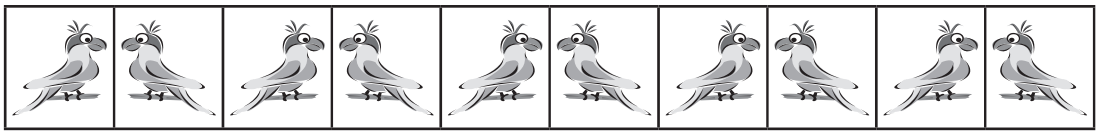
**a**



**b**



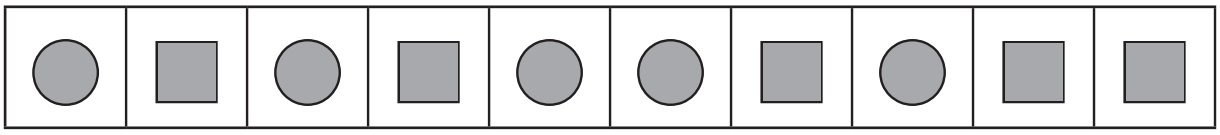
**c**



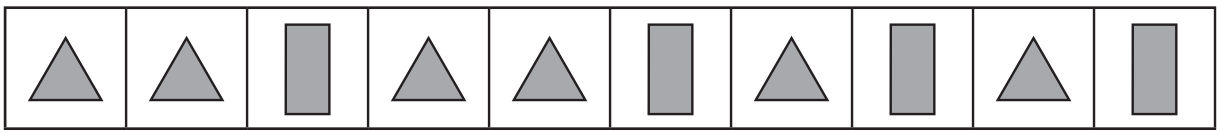
**2** Look at these rows. They started off as patterns but went a bit astray.

Circle the parts that don't follow the patterns and give the rows a good telling off. Tell them there are many rows that would like to be patterns and if they can't do it properly, you'll give the job to other rows.

**a**



**b**





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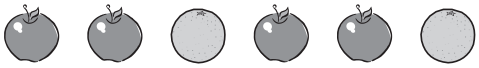
# Patterns and rules – translating patterns

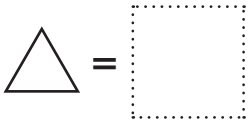
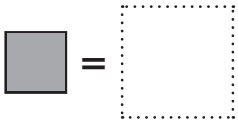
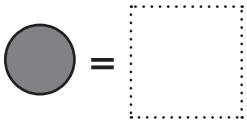
We can make patterns speak in different languages.
We call this **translating**.

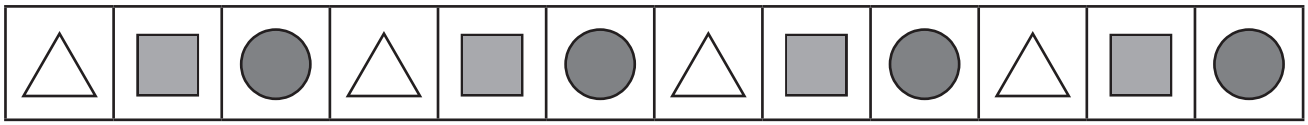
Say this pattern out loud.

We can change it to 

Say it out loud now.

**1** Look at this pattern. Translate it by changing each shape.

Plan it here:   



**2** **a** Think of a simple pattern rule you could make using 3 different pattern blocks.

Record it here.

**b** Make your rule with pattern blocks and repeat it 5 times.

**c** Ask a partner to translate your pattern using different pattern blocks.

**d** Record their translated rule here.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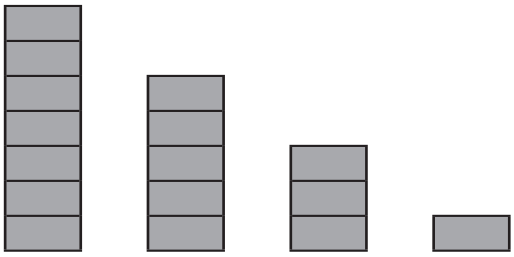
# Patterns and rules – growing patterns

Patterns can also shrink. Look at this pattern.




It follows a –2 rule.
In each stage we have
2 fewer blocks.

**You will need:** a partner counters

**What to do:**

Start with 10 counters. ○○○○○○○○○○

Take some away so there are only **7 left**. ○○○○○○○

Then take some more away so there are only **4 left**. ○○○○

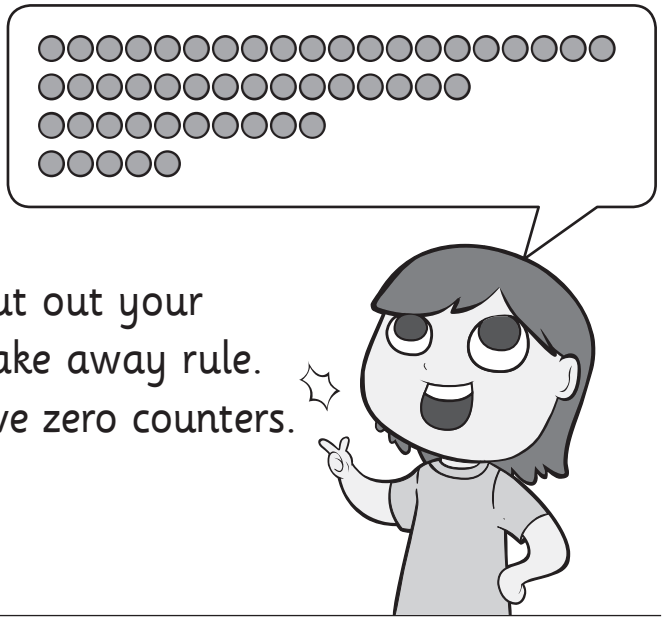
Now take some away so there is only **1 left**. ○

**a** How many counters are you taking away each time? _____

**b** What is the rule? _____

**What to do next:**

Think of a different take away rule. Write it somewhere secret. Don't let your partner see!




Put out 20 counters in a row. Then put out your next row of counters following your take away rule. Continue until your last row would have zero counters.

Guess each other's secret rule!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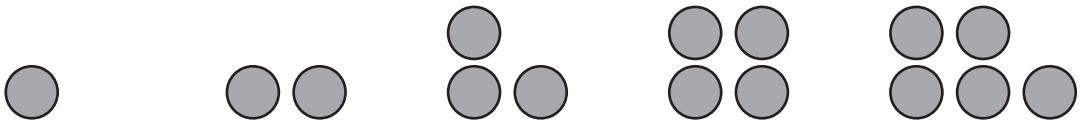
# Patterns and rules – growing patterns

Some patterns repeat. ♡♡♥♥♡♡♥♥

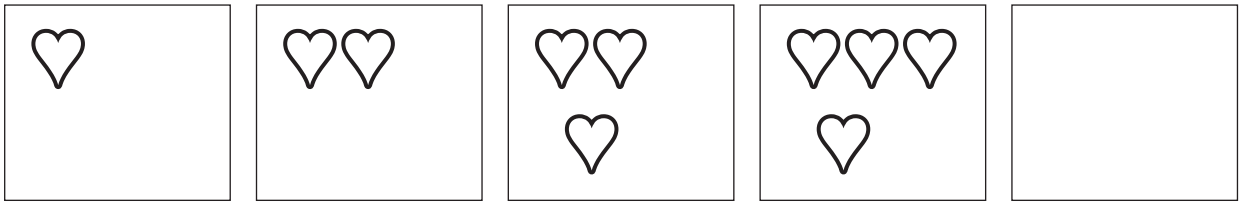
Some patterns grow. When they grow, they must still follow a rule.

The rule for this pattern is '+ 1 ●'



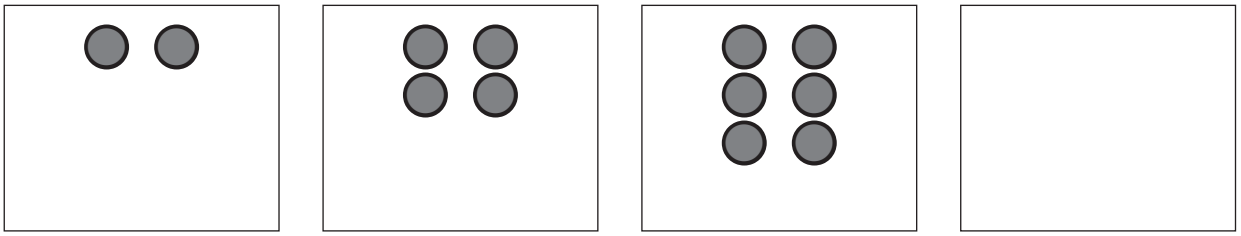
**1** Work out the rule and draw the next part of each pattern.

**a**



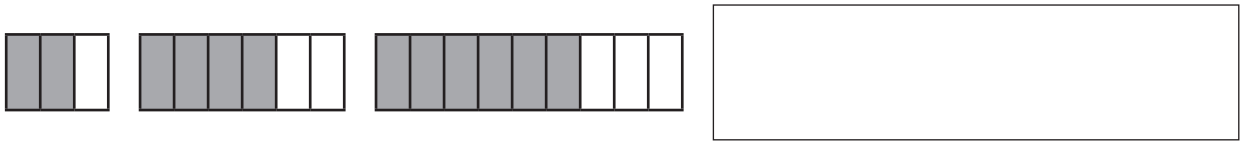
The rule is + _____

**b**



The rule is + _____

**c**



The rule is + ____ ▮ and + ____ ▯

**2** Make your own growing pattern with blocks. Record the rule and the first few parts of the pattern here.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