Mathletics

Series C Student

Space and Shape

My name

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Series C – Space and Shape

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Series Author:

Rachel Flenley

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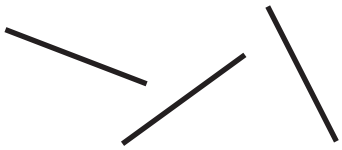
2D space – lines and angles

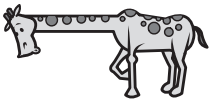
Vertical lines go straight up and down.

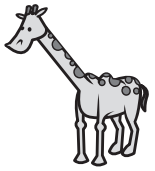
Horizontal lines go straight across.

Oblique lines go on a slant.



1 ✓ any vertical necks. ◯ any horizontal necks. ✗ any oblique necks.





2 How many lines are on these shapes?

a

vertical	0
horizontal	
oblique	

b

vertical	
horizontal	3
oblique	

c

vertical	
horizontal	
oblique	0

Shapes can be made up of straight lines, curves, or a mixture of both.

3 Draw a shape that is made up of:

a straight lines

b a curve

c a mixture of lines

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2D space – lines and angles

You will need: a partner or you can work alone

What to do:

a Look at these letters. Let's explore their shapes and the lines that make them.

A B C D E F G H I J K L M
N O P Q R S T U V W X Y Z

b These 2 letters belong together in a group. **P D**
Which other letters do you think belong in the same group?
Record them and explain to your partner why.

c These 2 letters belong together in a group. **T Y**
Which other letters belong in the group?
Record them and explain to your partner why.

d These letters form a group. **A Q R N M V W X**
Can you see why? Record your thinking here.

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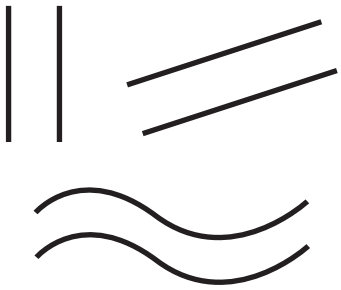
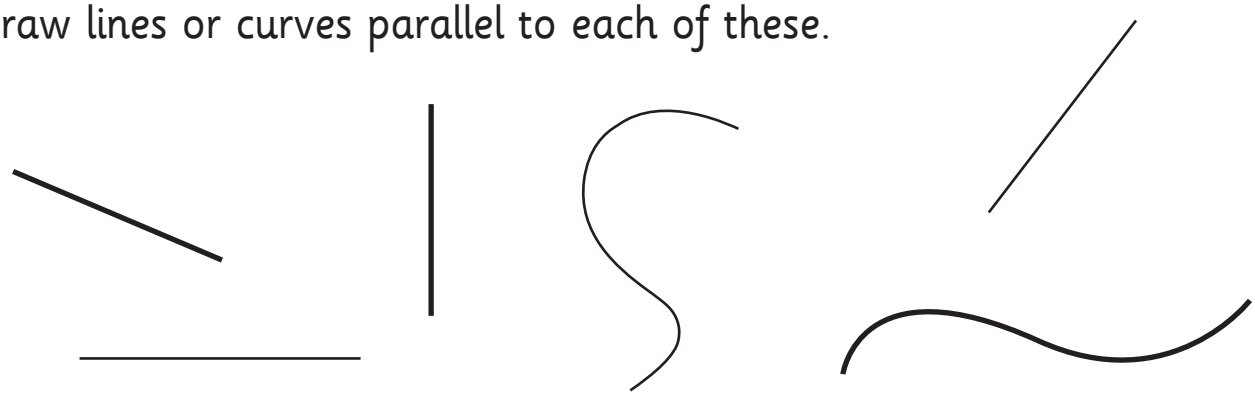
2D space – lines and angles

Parallel lines are always the same distance from each other and can never meet. They can be any length and go in any direction.

Curves can also run parallel to each other.

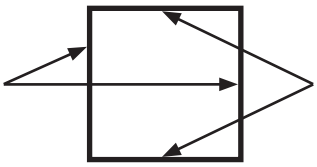


1 Draw lines or curves parallel to each of these.



Shapes can have parallel lines.

Look at this **square**.



A square has 2 sets of parallel lines.

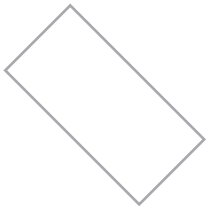
2 Trace any parallel lines in matching colours. Finish the statements.

a

A square has 2 sets of parallel lines.

b

A triangle has _____ sets of parallel lines.

c 

A rectangle has _____ sets of parallel lines.

d

A regular hexagon has _____ sets of parallel lines.

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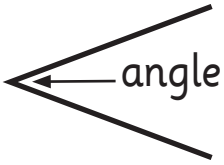
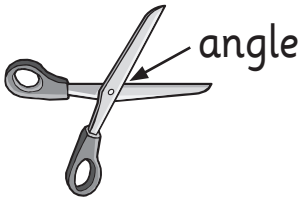
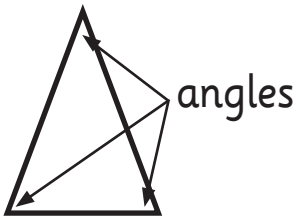
2D space – lines and angles

Angles are formed when 2 or more lines meet.

Here are some different angles.







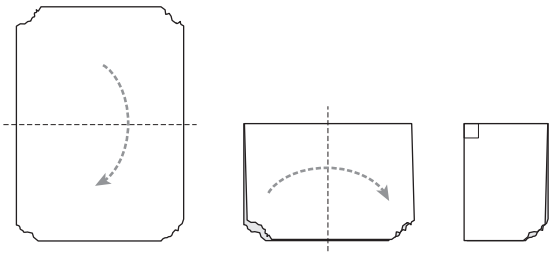
Sometimes angles are called **corners** or **vertices**.

1 Draw sets of 2 lines to make some different angles.

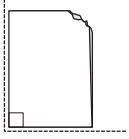
When lines meet like this we call the angle a square corner.

We can mark the square corner like this to show we know it's square.

2 **a** You will need a piece of paper. Rip the corners and fold it to make a square corner tester like this.



b Use the tester to measure the corners of this page like this. Are they square corners?



c Use your square corner tester and find other square corners around your room.

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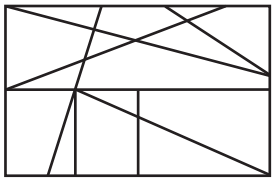
2D space – lines and angles

You will need: a ruler and pencil

What to do:



Rule some lines in the box below. This is one example of how it could be done.

Did you make any square corners? Find them and mark them.

What to do next:

How many triangles did you make? Trace or colour them.

Do any of your triangles have square corners?

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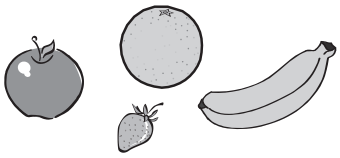
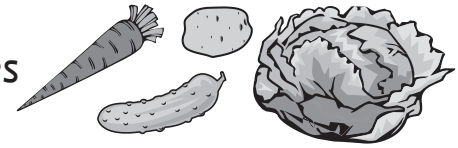
2D space – sorting

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



fruits

vegetables

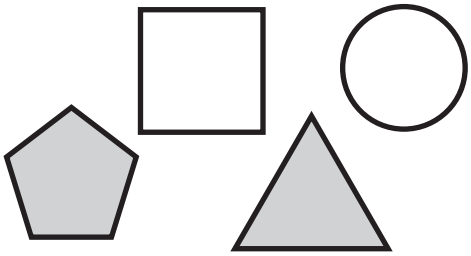


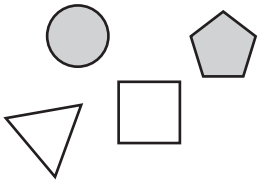
We could also sort them by colour, shape, size or whether we liked them or not. There are LOTS of ways to sort things.

You will need: a partner attribute blocks

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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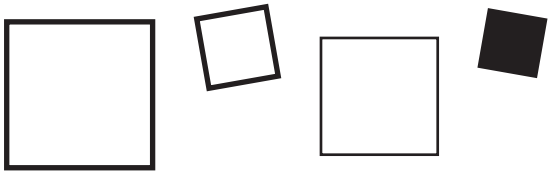
2D space – sorting

Mathematicians sort and group shapes according to their **angles**, or **corners**, **sides** and **lines**.

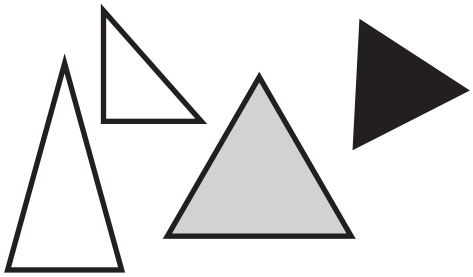


Let's look at these shapes.

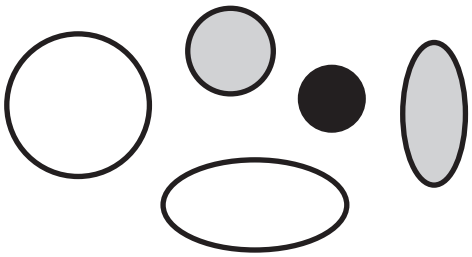
We say these are all **squares** because they all have 4 sides, which are all the same length. They each have 2 sets of parallel lines. They have 4 square corners. They are different colours and sizes and in different positions, but they are still squares.

There are different rules for different shapes.

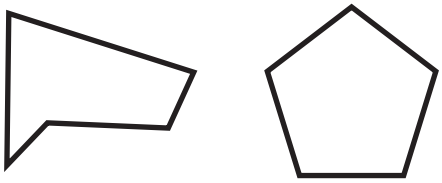
1 Are these all triangles? Explain your thinking.



2 Are these all circles? Explain your thinking.



3 Are these both pentagons? Explain your thinking.



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2D space – 4-sided shapes

Here are two 4-sided shapes you probably know already.

square rectangle

You will need: a partner attribute blocks

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 attribute blocks. What other 4-sided shapes can you find? Trace or draw them here.

Look closely at the lines, corners 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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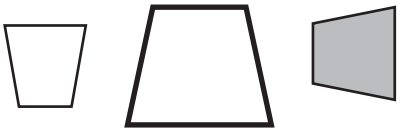
2D space – 4-sided shapes

Here are 2 other kinds of 4-sided shapes.

These are **rhombuses**.

These are **trapeziums**.



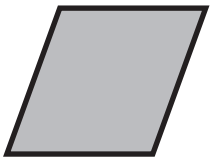
We know these shapes have 4 sides. Let's look closely at the lines and angles to find out more about them.

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 corners? ☐

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 corners? ☐

Is there anything else you notice about me?

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2D space – 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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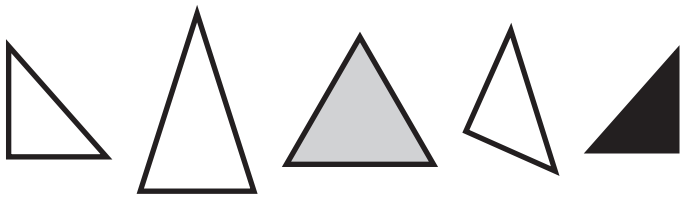
2D space – triangles

Triangles can be different shapes and sizes.

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

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

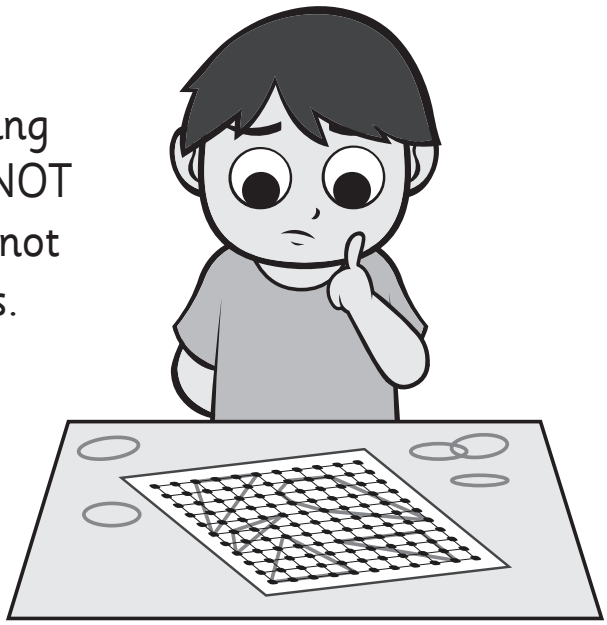
What makes them all triangles is the fact they have 3 sides and 3 angles.



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 corner.' '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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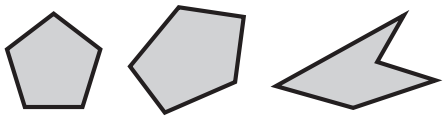
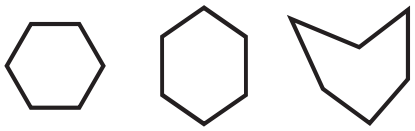
2D space – 5- and 6-sided shapes

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



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



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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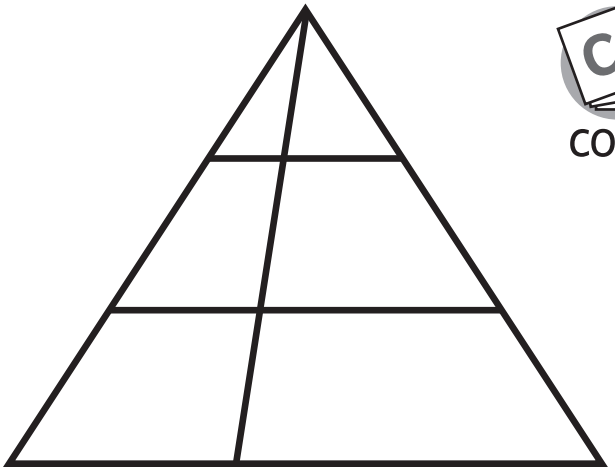
2D space – explore

1 How many triangles can you find?

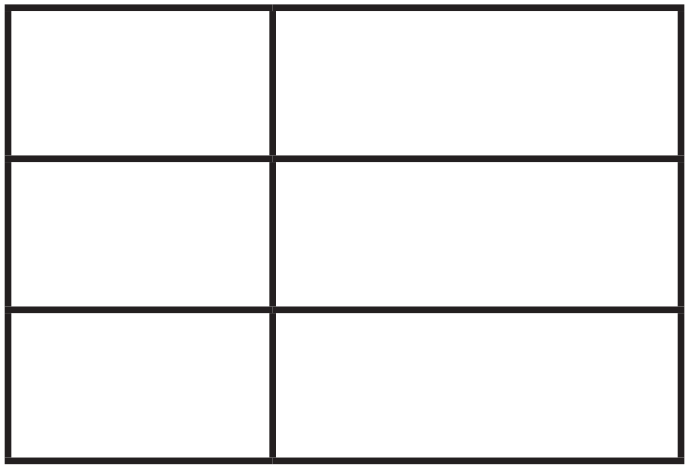
Compare your answer with that of a partner. Do you both agree?



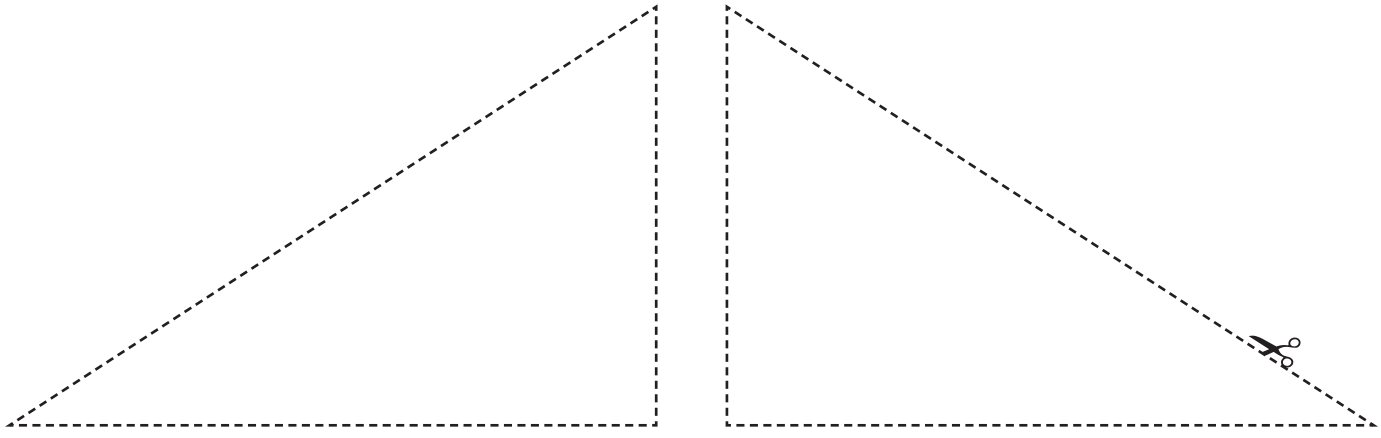
C copy

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 space – explore

You will need: 3 partners a pillowcase or library bag

attribute blocks

What to do:

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

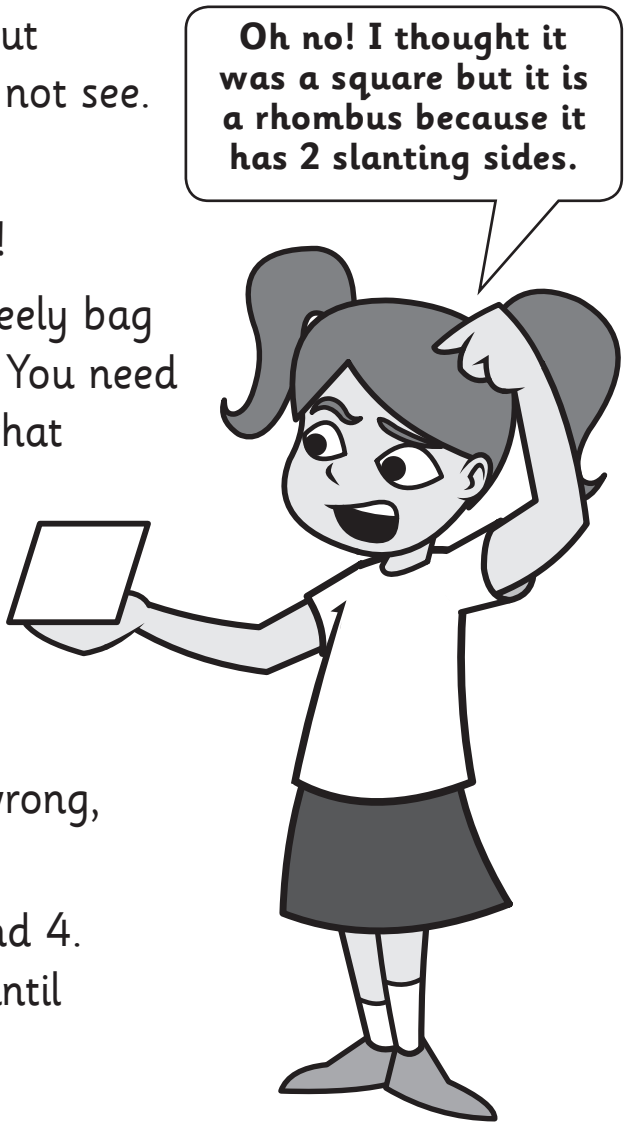
Put 1 shape into the bag at a time.

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 corners.'

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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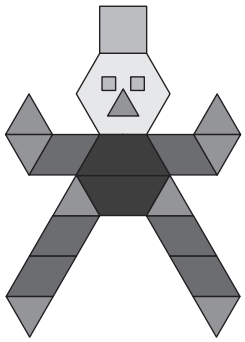
2D space – tessellation

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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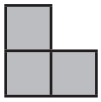
2D space – tessellation

You will need: a partner or work by yourself scissors

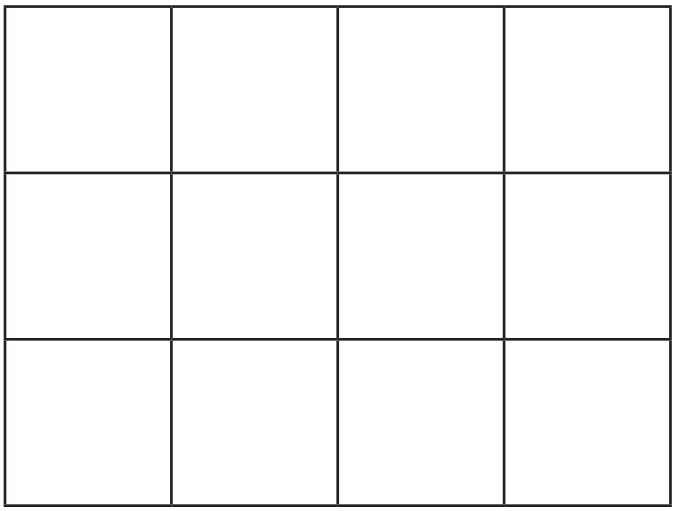
copy

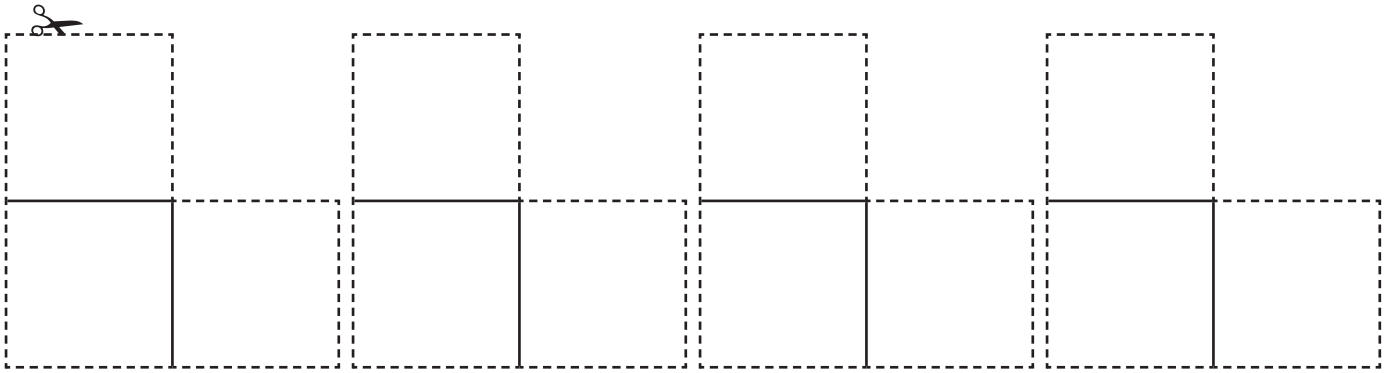
What to do:

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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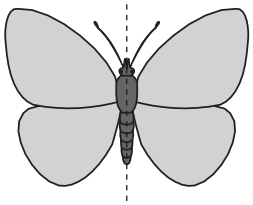
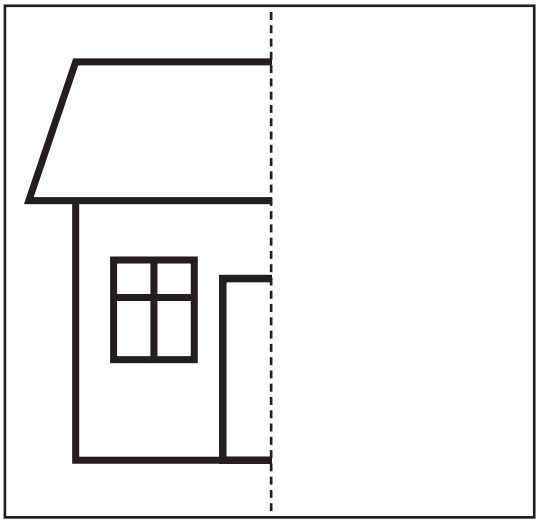
2D space – symmetry

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

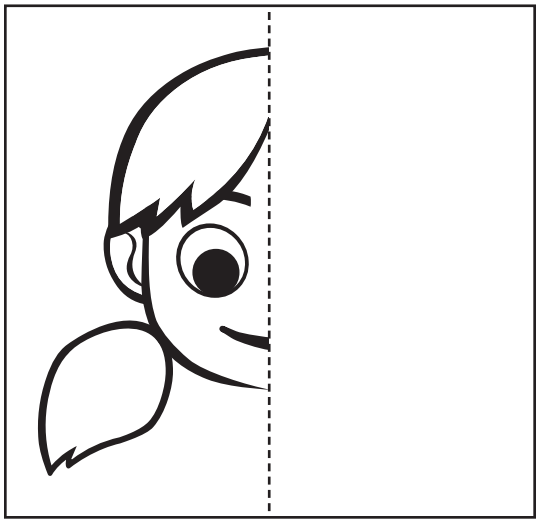


1 Draw the other side of the pictures to make them symmetrical. Colour them symmetrically.

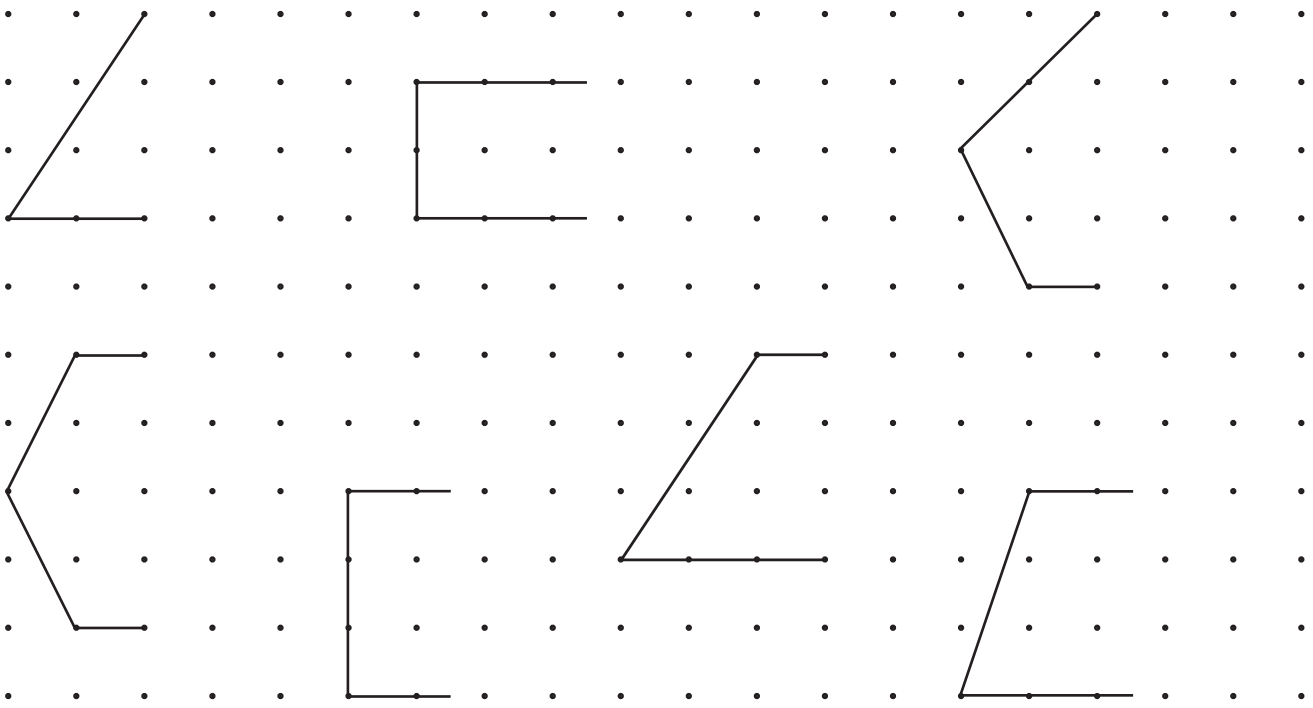
a



b



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



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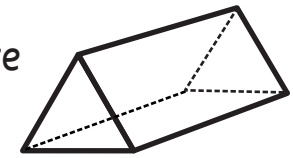
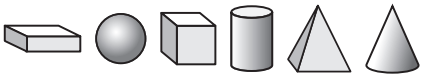
3D space – faces, edges and corners

The flat surfaces of 3D objects or solids are called **faces**. If the face is curved, we usually call it a **curved surface** instead.

This prism has 5 faces. 2 faces are triangles and 3 are rectangles.



You will need: a partner  these solids

What to do:

Choose a solid 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 solid. 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 solids have been described.

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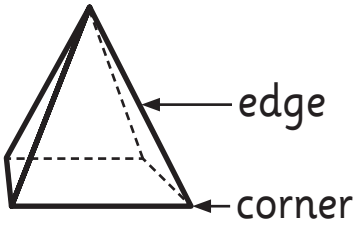
3D space – faces, edges and corners

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

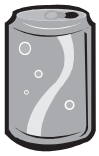


You will need: a partner classroom objects

What to do:

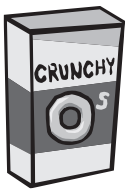
Your task is to investigate the faces, edges and corners of some common classroom or household objects. Record the number of each to finish the fact files.

	faces
	edges
	corners



	faces
	edges
	corners

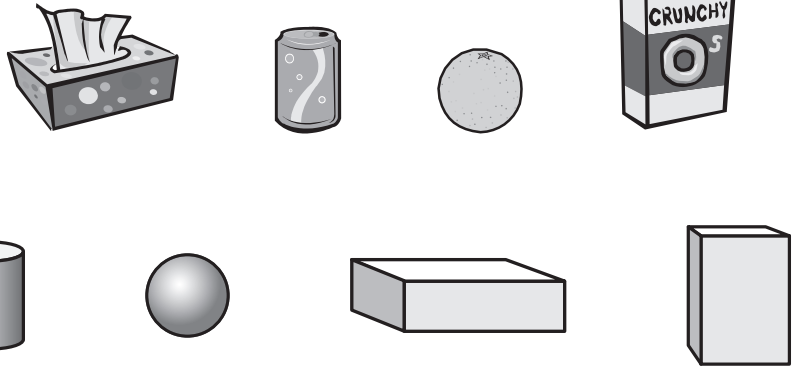
	face
	edges
	corners



	faces
	edges
	corners

What to do next:

Draw lines to join the objects with their matching solids below.



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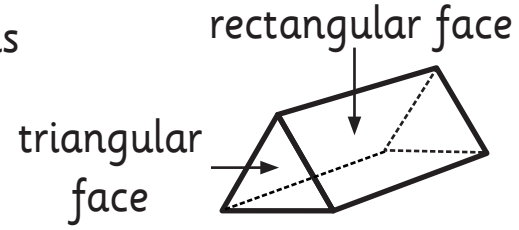
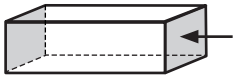
3D space – prisms

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**.

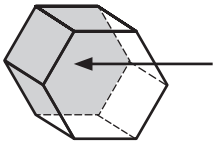


1 Look at the end faces of these solids. Choose words from the box to finish the statements.

a 

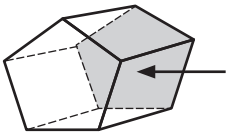
My end faces are _____.

I am a _____ prism.

b 

My end faces are _____.

I am a _____ prism.

c 

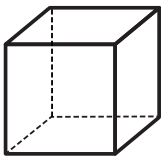
My end faces are _____.

I am a _____ prism.

hexagons
hexagonal
pentagons
pentagonal
rectangles
rectangular

This is 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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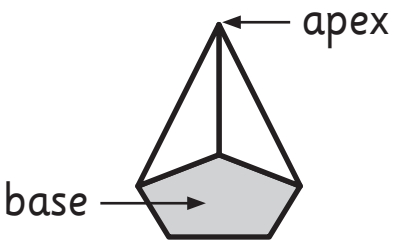
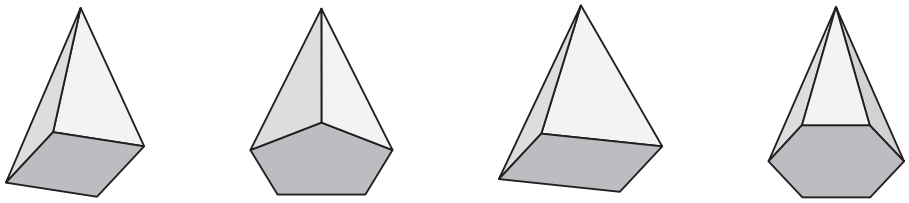
3D space – pyramids

Pyramids have one base. The **base** always has straight sides.
The other faces are always **triangles**.
The triangular faces meet at the **apex**.
Pyramids are named after their bases.
This is a **pentagonal pyramid**.

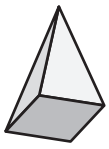


1 Match the pyramids to their labels.

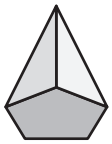


hexagonal pyramid	square pyramid	pentagonal pyramid	rectangular pyramid

2 Use real solids 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 space – pyramids

You will need: scissors

copy

What to do:

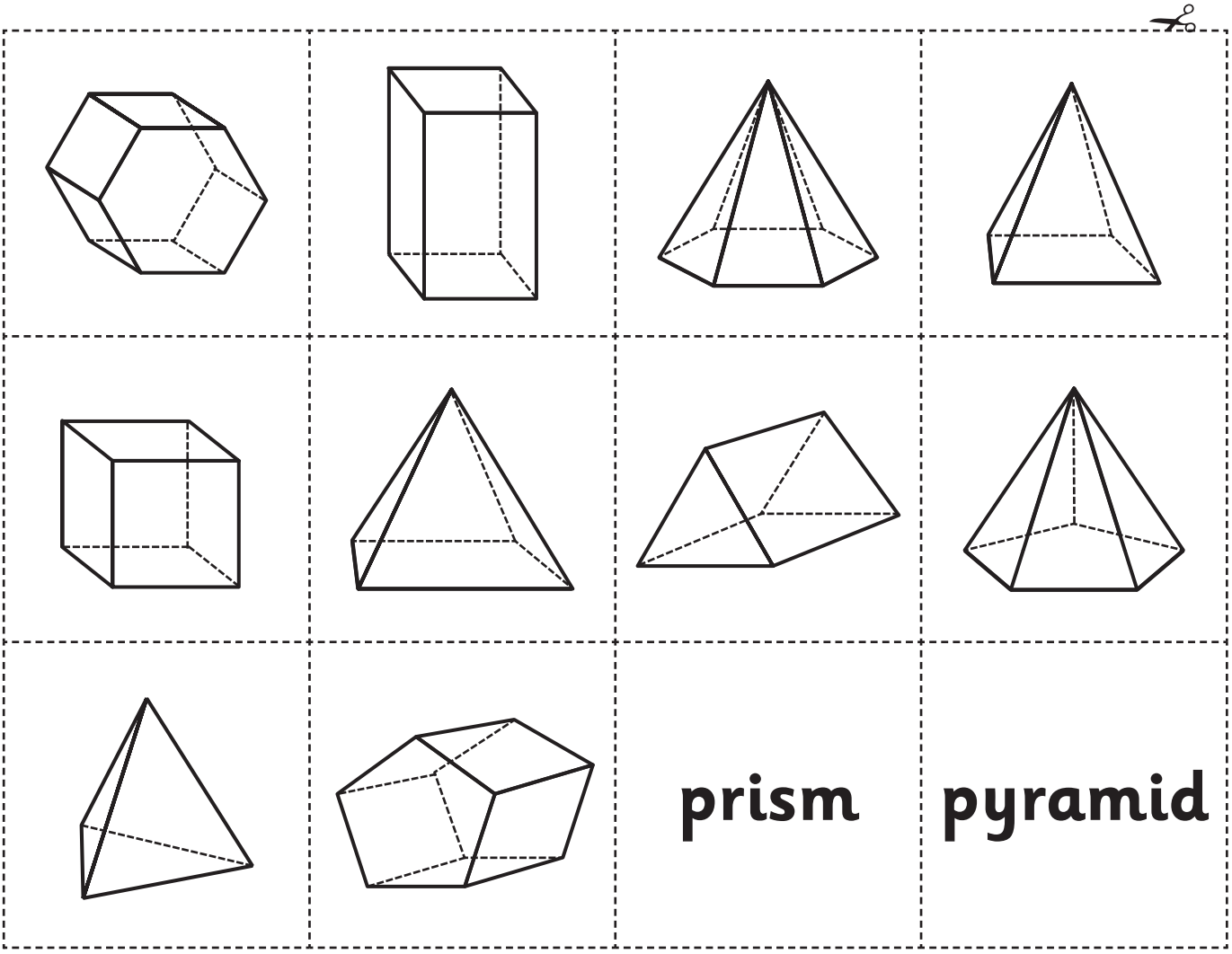
Cut out the solid cards and put them in a pile, face down. Cut out the labels and put them side by side, face up.

Turn over the solid 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 solid cards with those of a partner and play Snap!



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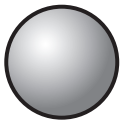
3D space – spheres, cylinders and cones

This is a ...

cylinder

cone



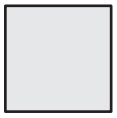
sphere

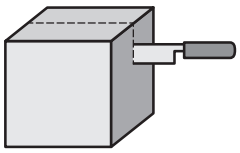
1 What is the **same** about these 3 solids?

2 What is **different** about these 3 solids?

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

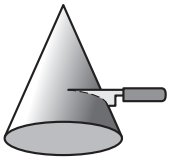
The cross-section of a cube would look like this.



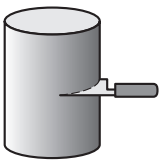


3 Draw the shape you would see if you cut these cross-sections.

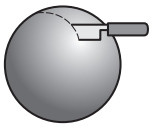
a



b



c



Do your answers surprise you?

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3D space – explore

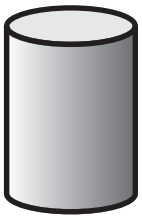
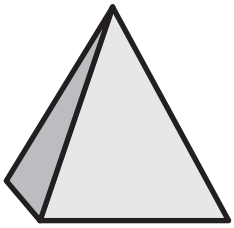
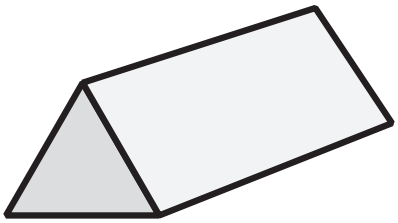
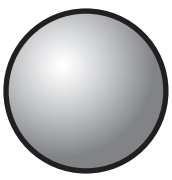
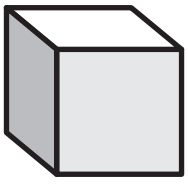
You will need: scissors glue stick

C copy

What to do:

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

Label each solid. You score 5 points for each solid 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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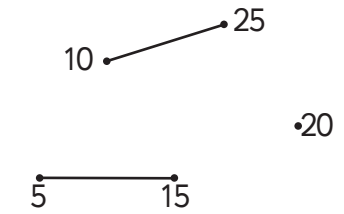
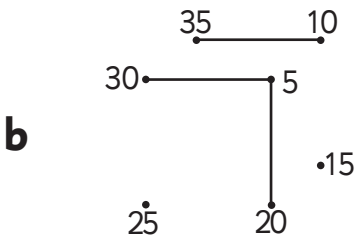
3D space – draw and build

1 Count by 5s to join the dots and finish these 3D objects. Label them.

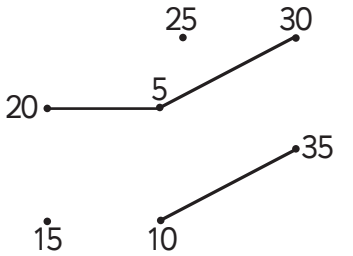
a



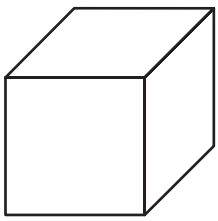
b

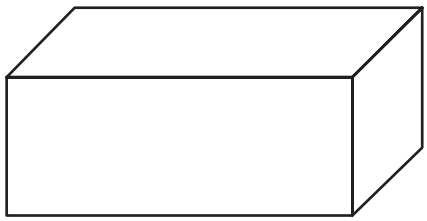


c



2 Draw these 3D objects on the dot paper. It may take a few attempts to get them right so just keep having a go! What other shapes can you draw?





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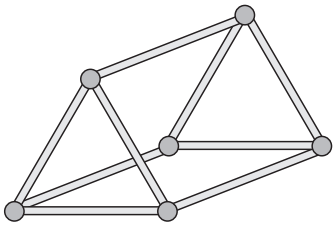
3D space – draw and build

You will need: a partner, straws, plasticene, scissors

What to do:



This is a model of a triangular prism.

It uses 9 straws and 6 balls of plasticene.

Now use 12 straws and 8 balls of plasticene. Which **prism** can you make?

You can cut the straws if you want but the final product must only have 12 edges.

Draw your model below. Label it.

What to do next:

What kind of **pyramid** can you make using 8 straws and 5 balls of plasticine? Record your answer below.

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3D space – draw and build

We can look at this juice box from different view points.

We see it differently each time.

front

top

side

1 Look at your desk from these view points. Draw what you see.

top view	**side view**	***front view***

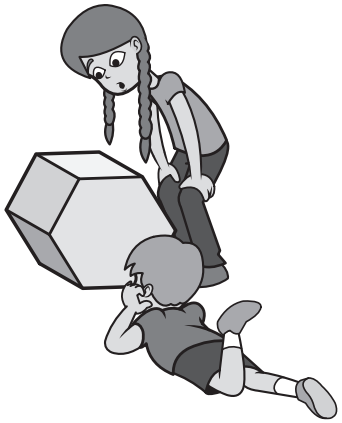
2 Choose something else to look at from different view points. Draw what you see.

top view	**side view**	***front view***

3 Draw:

a what the girl can see.

b what the boy can see.



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3D space – draw and build

You will need: partners solids

What to do:

a Choose a solid. Draw the top view, side view and front view.

top	side	front

b Now turn the solid upside down or lay it on its side. Draw the top view, side view and front view.

top	side	front

c Did your drawings change?

What to do next:

Find some partners to play 'I spy' with. Set up a group of solids on a table top. Say things like, 'I spy with my little eye, a solid whose top view is a square'.

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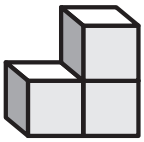
3D space – draw and build

1 Build these models with cubes. Draw the top view.

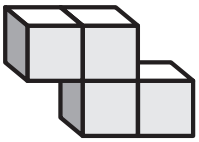
a

.....



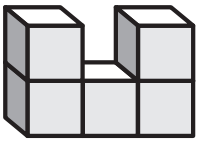
b

.....



c

.....



d

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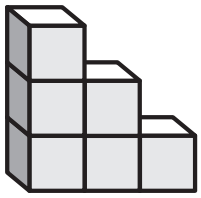

e

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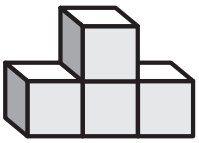

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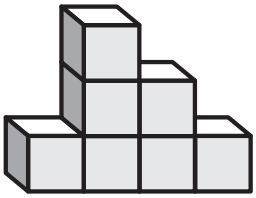

2 Build 3 of your own models. Draw the top view.

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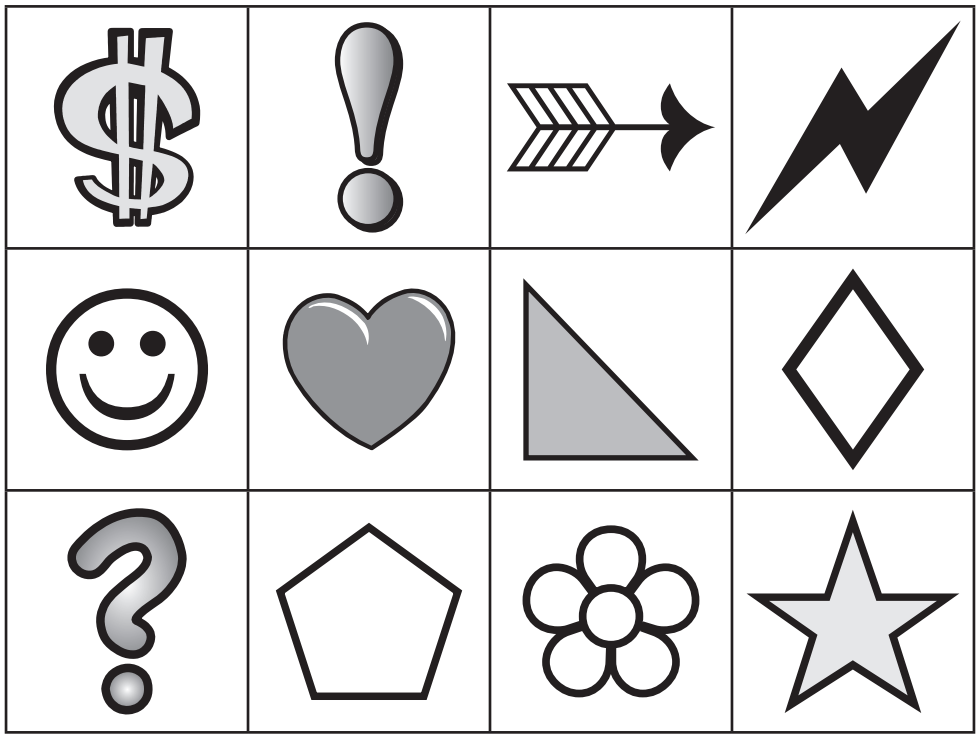
Position – describing position



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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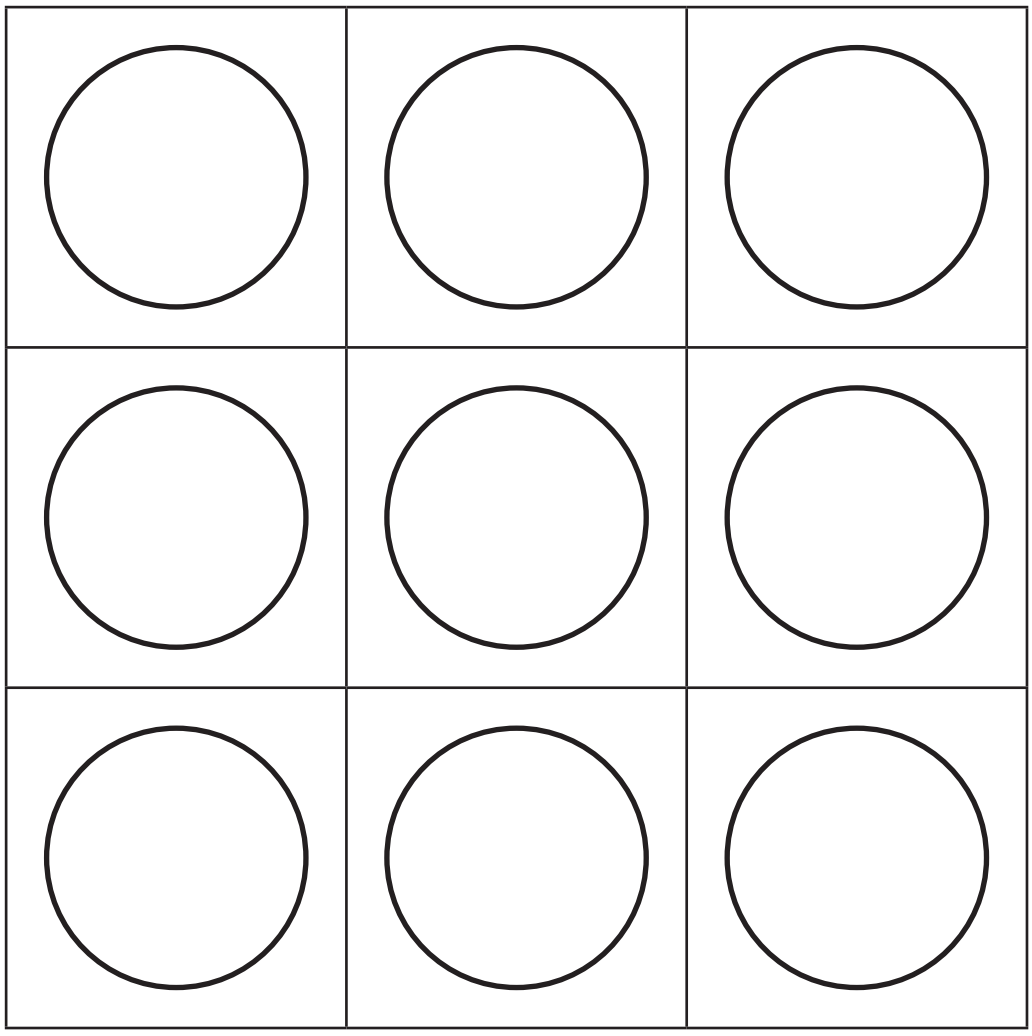
Position – describing position

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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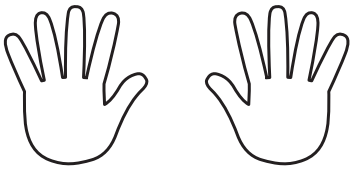
Position – describing position

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



1 Colour:

a the **left** hand blue

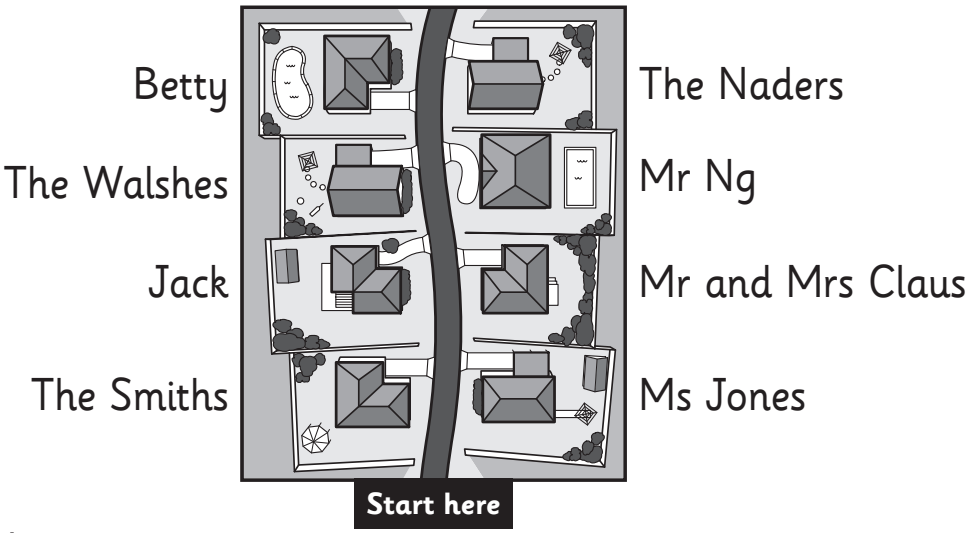
b the **right** hand green

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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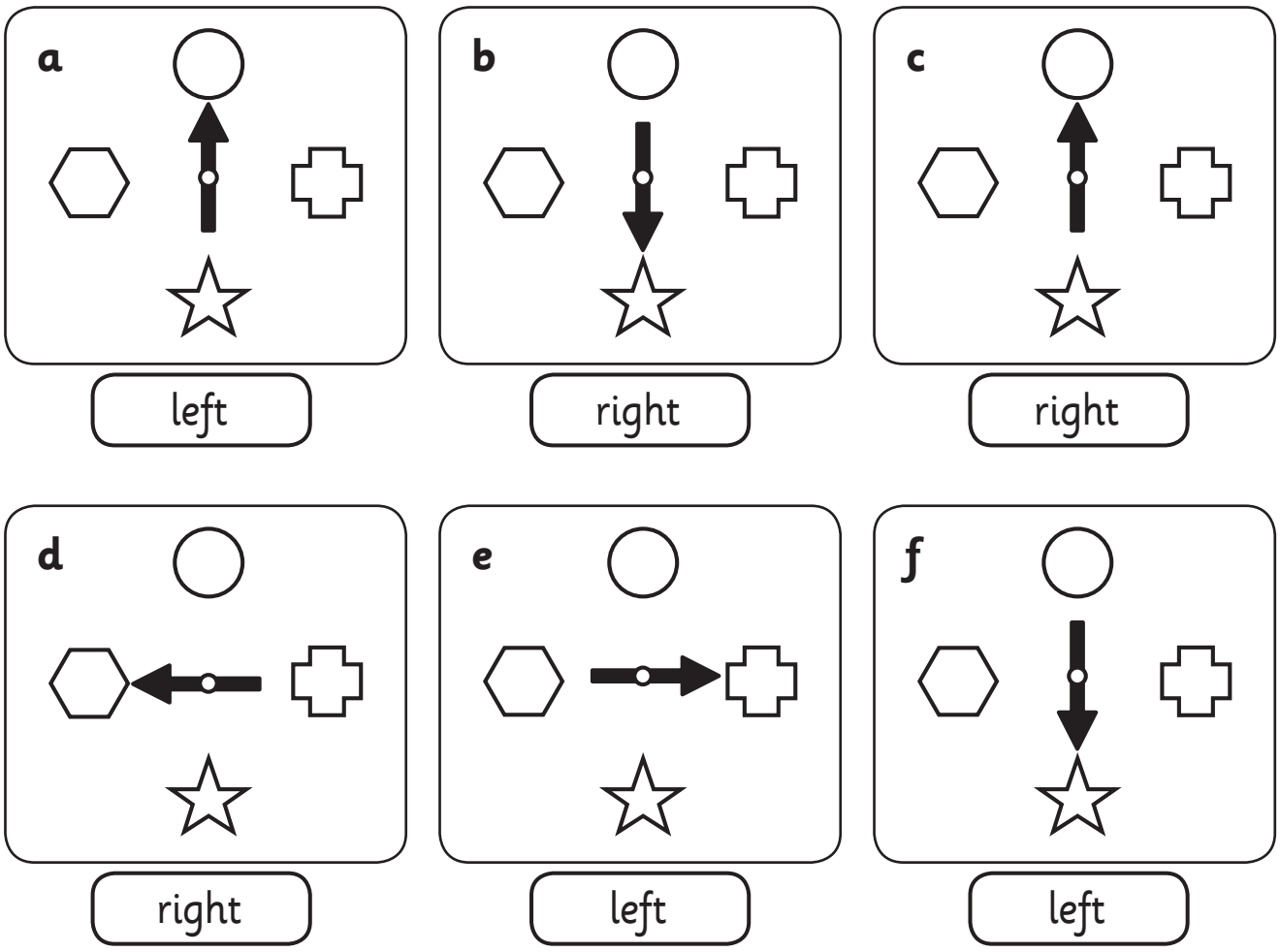
Position – describing position

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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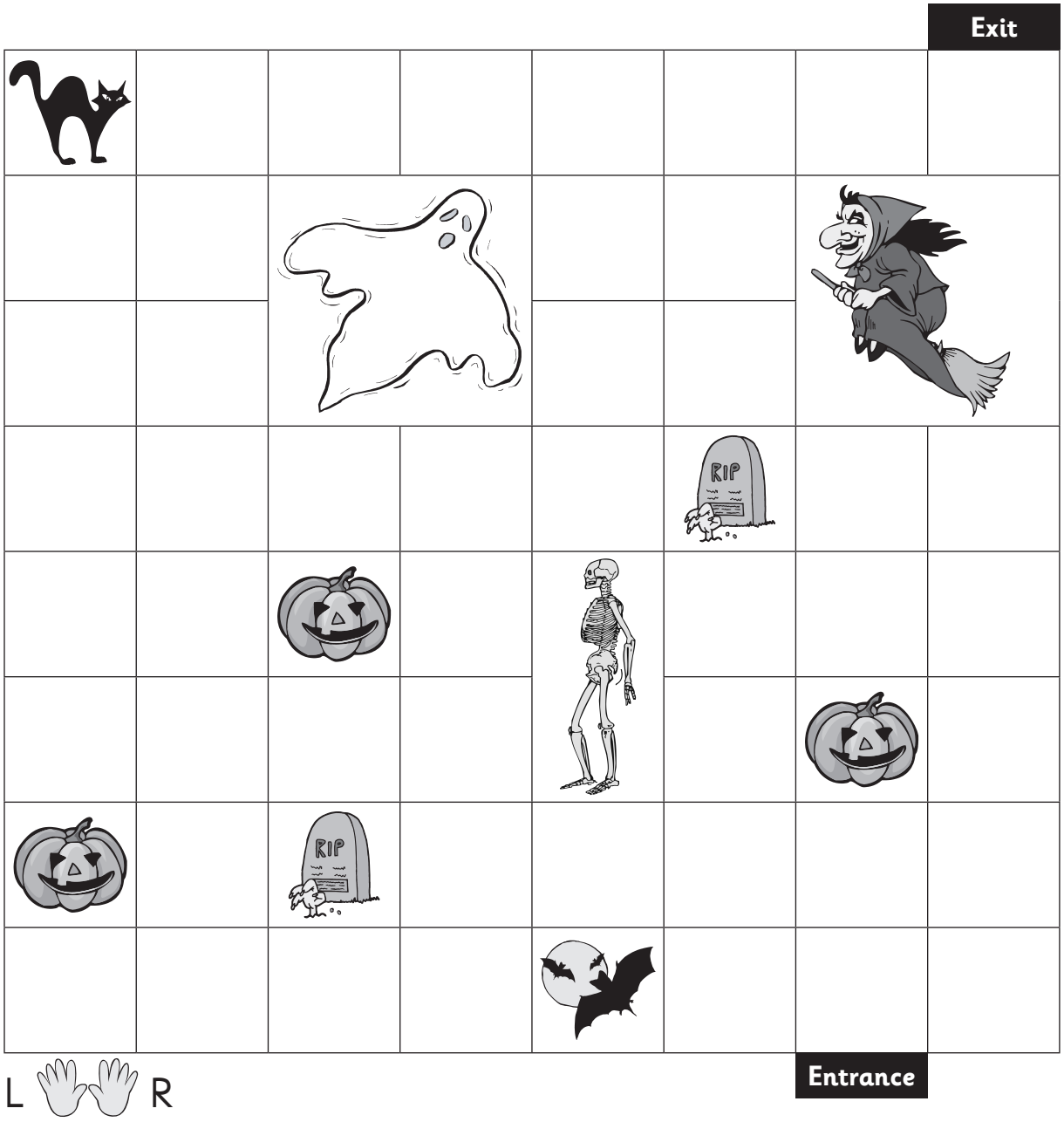
Position – paths and directions

1 Wally's class turn their classroom into a Haunted House for the school fete.

a Colour the path Wally takes to get through the house 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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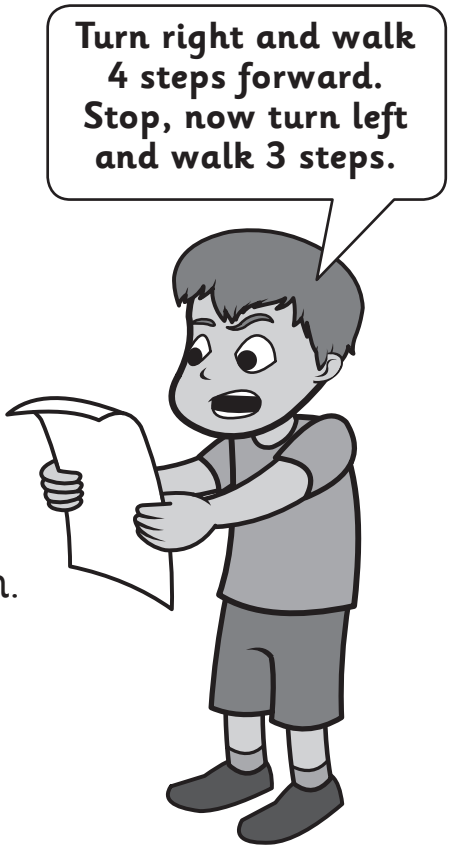
Position – paths and directions

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

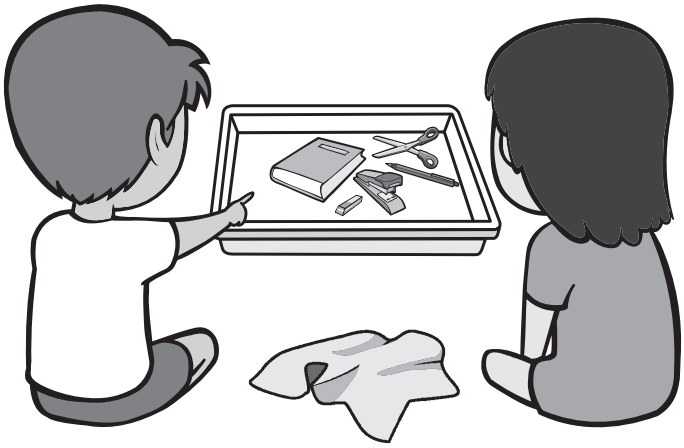
You will need: a partner, tote tray, tea towel, classroom objects

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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