Collins

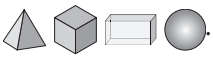
The Shanghai Maths Project

For the English National Curriculum

Teacher's Guide 1B

Chapter 4
Recognising shapes

Chapter overview

Area of mathematics	National Curriculum Statutory requirements for Key Stage 1	Shanghai Maths Project reference
Geometry – properties of shapes	Year 1 Programme of study: Pupils should be taught to recognise and name common 2-D and 3-D shapes, including: ■ 2-D shapes ▭, ○ and △ ■ 3-D shapes 	Year 1, Unit 4.1, 4.2

Unit 4.1
Shapes of objects (1)

Conceptual context

This is the first in a series of units on shape. The focus is on recognising and naming spheres, cylinders, cubes and cuboids, square-based pyramids and tetrahedra. Pupils will, of course, have informal experience of shape. In this unit, they will explore the properties of these in terms of curved surfaces, faces, edges and vertices. It is important that pupils develop their knowledge of properties of shapes because they are necessary for recognising and naming them. (Discerning similarities and differences to group and sort is a vital aspect of mathematical thinking and an important skill to develop). 3-D shapes are studied first; this makes sense since the pupils experience 3-D shapes when they are very young in the form of, for example, balls and shape puzzles before they encounter 2-D shapes. 2-D shapes are introduced through the shapes of the faces on the 3-D shapes.

Learning pupils will have achieved at the end of the unit

- Pupils will have explored and can recognise and name spheres, cylinders, cubes and cuboids (Q1)
- Pupils can describe the properties of spheres, cylinders, cubes and cuboids (Q1)
- Pupils will have connected the concept of 3-D shape with other areas of mathematics by counting shapes (Q2)
- Pupils will have applied knowledge of counting in the context of counting up to 10 shapes (Q2)
- Pupils will have explored and can recognise and name square-based pyramids and tetrahedrons (Q2)
- Pupils can describe the properties of square-based pyramids and tetrahedrons (Q2)
- Pupils will investigate whether and how different 'real-life' shapes roll (Q3)
- Pupils will have applied their knowledge of spheres, cylinders, cubes and cuboids to conjecture and analyse their findings (Q3)

National curriculum context

Statutory requirements for KS1
Y1 Programme of study for Geometry – properties of shape
Pupils should be taught to:

- recognise and name common 2-D and 3-D shapes, including:
- 2-D shapes ▭, ○ and △
- 3-D shapes [for example, cuboids (including cubes), pyramids and spheres].

Resources

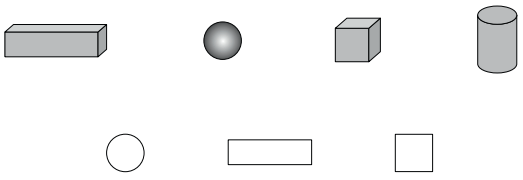
spheres, cylinders, cubes, cuboids, variety of different balls (for example, football, tennis ball, table tennis ball, golf ball, oranges, globe and anything else that is spherical), kitchen roll tubes, savoury snack tubes, cans and jars that are cylindrical, variety of cube and cuboid shaped boxes and other classroom items, modelling clay, coloured paint, paper, square-based pyramids, tetrahedra, cloth bags, hoops

Vocabulary

sphere, cylinder, cube, cuboid, square-based pyramid, tetrahedron, curved surface, face, edge, vertex, vertices, right angle

Question 1

1 Draw lines to match the solid figures with the shapes below.



What learning will pupils have achieved by the conclusion of Question 1?

- Pupils have explored and can recognise and name spheres, cylinders, cubes and cuboids.
- Pupils can describe the properties of spheres, cylinders, cubes and cuboids.

Activities for whole-class instruction

- Organise your class so that pupils are working in mixed-attainment groups of four or five. Give them a selection of shapes. Encourage pupils to sort them into like types and to talk about what they know about these shapes. Take feedback after five or 10 minutes.
- Show your selection of spherical objects of different sizes to the class. Can pupils identify what each is? Give four to each group of pupils. Let them feel them and explore what they can do. Ask them to order their spheres from smallest to largest. Ask pupils to test out which of the spheres rolls the furthest. Ask them to describe what the spheres all have in common. Introduce the vocabulary of 'curved surface'.
- Give each pupil a piece of modelling clay or other malleable substance. Ask them to roll it to make a sphere. Do this with them. As they roll it, ask them to say the word: *sphere*.

All say ... *A sphere has a curved surface.*

- Pupils have a rolling competition in small groups. Who can roll their sphere the furthest? Discuss why some will roll more successfully than others (smoothness of the surface of their shape).
- Ask pupils what shape they will have if they cut the sphere in half. Demonstrate this on your sphere. The two resultant shapes are hemispheres.

All say ... *Half a sphere is called a hemisphere.*

- Show the face of one of your hemispheres. Can pupils recognise the circle? Talk about the circle and the fact that it has one curved side.

Look out for ... those pupils who say 'sofia' or 'spear' and help them to enunciate the word sphere correctly.

- Repeat the above activities for a cylinder. Ensure that you ask pupils how spheres and cylinders are the same and how they are different. Introduce pupils to the vocabulary of face for the circular faces on the cylinder and edges for where the face and curved surface meet.
- Give pupils a variety of cubes. Ask them to explore these and to tell you what they notice about them. They should notice that the cubes all have six faces which are the same size. Talk about those faces and establish that they are squares. Elicit that a square has four sides which are the same length. Introduce the word edge. Be sure to tell pupils that an edge is found where two faces meet.

All say ... *An edge is where two faces meet.*

- Encourage pupils to trace their fingers along some of the cubes' edges. Tell them that where edges (in this case three) meet, is a vertex.

All say ... *A vertex is where edges meet.*

- Introduce the word 'vertices' as more than one vertex.
- Ask pupils to make a sphere out of modelling clay and then to turn it into a cube. Let them discuss with a partner what they are doing to make the cube. Agree that they are flattening the curved surface to make six faces. Recap a cube's properties as above.
- Repeat the activities you did with the cube for a cuboid. Ensure that you ask pupils how cubes and cuboids are similar and how they are different. Establish that a cuboid has the same number of faces, edges and vertices as a cube. The difference is the shapes of the faces. Cuboids may have six rectangular faces or four rectangular and two square faces. Talk about a rectangle as a shape with four sides and four right angles. Show pupils an example of a right angle in the classroom, for example, the corner of a window, and ask them to tell you other examples that they can see. Discuss the differences and similarities between squares and rectangles.
- Provide the opportunity for pupils to make repeating patterns using paint and the faces of the cylinder, cube and cuboid. They name the 2-D shapes that they can see and then describe their pattern to a friend.
- Put a sphere, cylinder, cube and cuboid in a bag. Invite pupils to feel one and describe it to the class using the shape's properties.

- Ask pupils to compete Question 1 in the Practice Book independently.

Same-day intervention

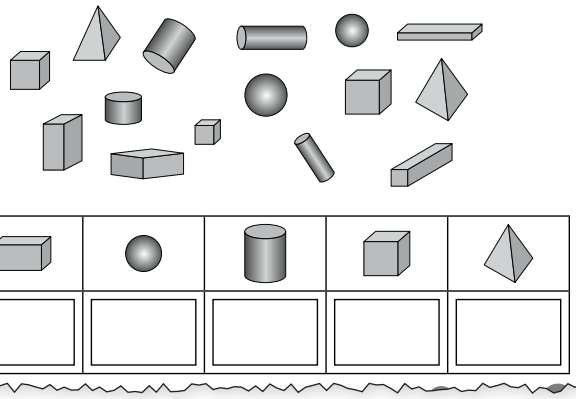
- If at any point pupils cannot recognise and name the shape you have explored during the lesson, repeat one or more of the activities suggested with those pupils, directly questioning them about what they notice about the shapes, including their properties.

Same-day enrichment

- Explain a Venn diagram to pupils. Ask them to sort a selection of spheres, cylinders, cubes and cones according to their own chosen criteria (perhaps related to colour, purpose or location). They place those that fulfil the criterion into the circle of the Venn diagram and those that don't fulfil it outside. Encourage them to draw a picture of what they did. Once they have sorted against their criterion, ask them to make up another… and another.

Question 2

2 Count the number of each shape and then fill in the boxes.



What learning will pupils have achieved by the conclusion of Question 2?

- Pupils will have connected the concept of 3-D shape with other areas of mathematics by counting shapes
- Pupils will have applied knowledge of counting in the context of counting up to 10 shapes
- Pupils have explored and can recognise and name square-based pyramids and tetrahedra
- Pupils can describe the properties of square-based pyramids and tetrahedra.

Activities for whole-class instruction

- Give mixed-attainment groups of four or five a selection of real-world 3-D shapes (suggestions in resources list). Ask them to sort them, according to the shapes they explored previously. Once they have, recap the names and properties of the spheres, cylinders, cubes and cuboids. Next, ask them to look carefully at the new shapes and to tell you what they notice. How are they similar/different? Expect them to be able to tell you that they have all or some faces in the shape of a triangle and a pointed end.
- Each pupil holds up a square-based pyramid.

This is a square-based pyramid.

- Ask them to run their fingers over each face. How many are there? What shape are they? Establish that there are five faces in total, four are triangles and one is square. Spend some time comparing squares and triangles. How are they the same/different? Agree that they are both 2-D shapes with straight sides. The difference is that the square has four sides and the triangle three. Next, ask them what makes an edge. Can they remember that an edge is where two faces meet? Ask pupils to run their fingers along the edges. How many are there? Ask pupils to tell you what a vertex is. Can they remember that it is where the edges meet? Ask pupils to point at each one. How many are there?
- Give pupils paper and felt pens. Ask them to draw around the square base of the pyramid and then one of the triangular faces. Let them practise doing this a few times and then ask them to make a repeating pattern. They describe their pattern to a partner. Can their partner carry on the pattern? Encourage them to do this a few times so that they really have to think about how to make their pattern sequences different.
- Focus on the tetrahedron. If possible, give one to each pupil. They hold it up and say: *This is a tetrahedron*. Ask them to run their fingers over the faces. How many can they count? They next run their fingers along the edges. Ask them to tell you, in a complete sentence, what makes an edge and agree that there are six. Ask them to touch the vertices after asking them to tell you, again in a complete sentence, what one is and agree that there are four.
- Give pupils all the shapes that they explored at the beginning of Question 2 and ask them to talk to each other about ways in which they could sort the shapes. Take some of their ideas and together try them out. You could, at this point, introduce the Carroll diagram.

square faces	not square faces
 picture of square-based pyramid	 picture of tetrahedron

- Examples for these shapes could be pyramid / not pyramid, curved surface / not curved surface, six faces / not six faces. Encourage pupils to try recording these.
- Look at Question 2. Ask pupils to count all the shapes that they can see. Agree that there are 15.

Look out for … pupils who count the shapes. Do they count one at a time or in twos? Can they subitise a few and then count on from that amount? (Subitising is being able to instantly recognise the number of objects in a small group, without counting. Most Y1 pupils should be able to subitise four or five objects. For example, if throwing a dice, pupils should be able to tell you the number of dots without counting them. There are five dots on this dice.) 

- Give groups a cube and ask them to use that to help them identify those in the picture. Ask them to tell you what is the same about those in the picture and the cube they have. Expect them to be able to tell you that they can count six faces on their cube, but only three on those in the picture. How many faces are hidden? Next, ask them to tell you what is the same and what is different about the cubes in the picture. Expect them to tell you that they are all cubes with square faces but they are different sizes. Repeat for the spheres, cylinders and cuboids.
- Ask them to complete the task in Question 2 independently.

Same-day intervention

- If at any point pupils cannot recognise and name square-based pyramids and tetrahedrons, repeat one or more of the activities suggested with those pupils, directly questioning them about what they notice about the shapes, including their properties.

Same-day enrichment

- Ask pupils to make up clues about one of the shapes. They give their clues to a partner one at a time. After each clue their partner has a guess the shape. How many clues do they need? Take turns.

Question 3

3 Try rolling each shape and then fill in the table with a tick ✓ or a cross ✗. The first one has been done for you.

	Cannot roll	Can roll	
		in one direction	in all directions
	✓		
			
			

What learning will pupils have achieved by the conclusion of Question 3?

- Pupils will investigate whether and how different 'real-life' shapes roll.
- Pupils will have applied their knowledge of spheres, cylinders, cubes and cuboids to conjecture and analyse their findings.

Activities for whole-class instruction

- Recap the names and properties of the shapes the pupils have explored so far. Invite pupils to feel a shape that you have hidden in a bag and to work out what shape it is from the properties that they can feel. They describe the shape to the class. Can the class work out the shape from the description? Give mixed-attainment groups of four or five pupils one of each shape and a cloth bag. One pupil closes their eyes and the others choose a shape to put in the bag. The pupil with their eyes closed works out the shape and tells the rest of the group why they know which one it is. Ensure each pupil in the group has a turn.
- Ask the pupils to tell you what they think is meant by sliding. Agree that sliding means to move something smoothly along a surface keeping continuous contact with it. Ask the pupils to slide their hands, palms down, on a surface. Show all six shapes. Ask pupils to discuss with a partner which of them will slide along a surface. After a few minutes, invite pupils to try to slide each one of the shapes. Agree that the cube, cuboid, square-based pyramid and tetrahedron will slide. What about the cylinder? Establish that if a circular face is flat on the table it will slide, the curved surface won't slide.

- Roll the sphere and ask the pupils what it is doing. Ensure that they can tell you that it rolls. Establish that rolling is turning over and over again smoothly. You could tell pupils that a sphere will roll forever and ever unless something stops it. Ask pupils to sort all six shapes into two groups: shapes that slide and shapes that roll. As they sort them they should test whether they roll or slide. In which group does the cube belong? Some pupils might suggest that the cube can roll because they have had experience of rolling dice. Demonstrate how it rolls and ask the pupils to tell you the difference between how it rolls and how a sphere rolls. Establish that the faces of the cube stop it moving smoothly, so for this sorting activity the cube doesn't roll. In which group does the cylinder belong? Introduce the idea of a two-criteria Venn diagram. You could do this with overlapping hoops. On paper, label the inside of one hoop 'slide' and the other 'roll'. Invite pupils to place the shapes in the correct place. Leave the cylinder so that it is the last to be placed. Ask pupils where they think it should be placed. Agree that it can both slide and roll, so it should be placed in the overlapping section.
- Ask the pupils to find spheres, cylinders, cubes and cuboids from around the classroom. (You may need to make sure there are plenty available.) In their groups, they place two hoops so that they overlap. They check whether their objects slide or roll and place them in the appropriate section of their Venn 'diagram'. Ask them to draw a picture of what they have done.
- Discuss what the surface of a sphere and the curved surface of the cylinder have in common and why these two shapes can roll. Discuss why the others cannot roll smoothly. Encourage them to think of a generalisation, for example, shapes with curved surfaces will roll. Focus on the way spheres and cylinders roll. Ask groups to experiment with the shapes and to come up with their own conclusions which they need to share with the rest of the class. Establish that spheres can roll in any direction and cylinders can roll in just one direction.
- Ask the pupils to complete Question 3 with a partner.

Same-day intervention

- If any pupils have difficulty differentiating between rolling and sliding, spend time with them in a group practising rolling and sliding different objects. Establish that objects with flat faces will slide and curved surfaces will roll. Hold up different objects and ask them to use this information to predict how they will move.

Same-day enrichment

- Ask pupils to look around the classroom and make a list of items that will slide, another for those that will roll and a third that will do both. They take the items and test them to see if they are correct.
- Pupils draw their own Venn diagram that has two overlapping circles. They label one circle 'slide' and the other 'roll'. They then draw pictures of real-life objects, for example, car, bicycle, television, into the correct section.

Challenge and extension question

Question 4

5 On which day did your school's most recent holidays start, and on which day did they end?

(a) Write the dates in words and numbers and in numbers only.

Start date:

In words and numbers: _____ .

In numbers: _____

End date:

In words and numbers: _____ .

In numbers: _____

(b) What days of the week did they fall on?

Start date: _____

End date: _____

(c) How many days did the holidays last?

_____ days

This question draws on the skills and knowledge that the pupils have learned from the previous three questions. Before they tackle the question, give them two of each of the 3-D shapes that they have been learning about and ask them to build something. Recap the properties of the shapes that they have used. Ask pupils to tell you how they can identify them in their structure, for example: *The two square faces I can see on this shape show that this is a cube.* Ask them to sketch their structure on paper. Ask pupils to explain to a partner how to position their shapes in relation to each other – can they use correct vocabulary?

Collins

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For the English National Curriculum

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Practice Book 1B

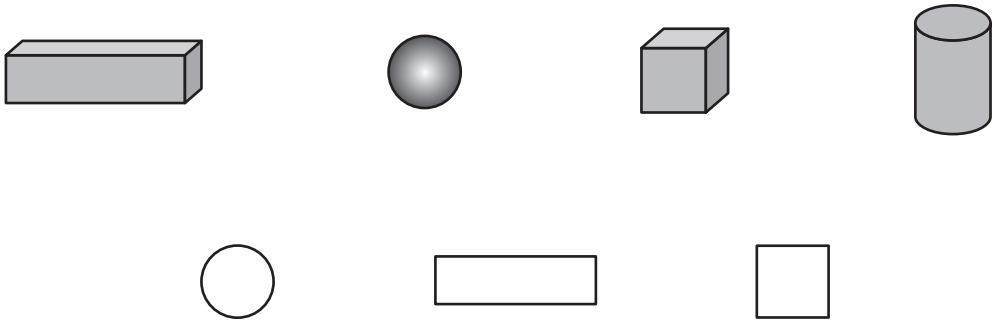
Chapter 4 Recognising shapes

4.1 Shapes of objects (1)

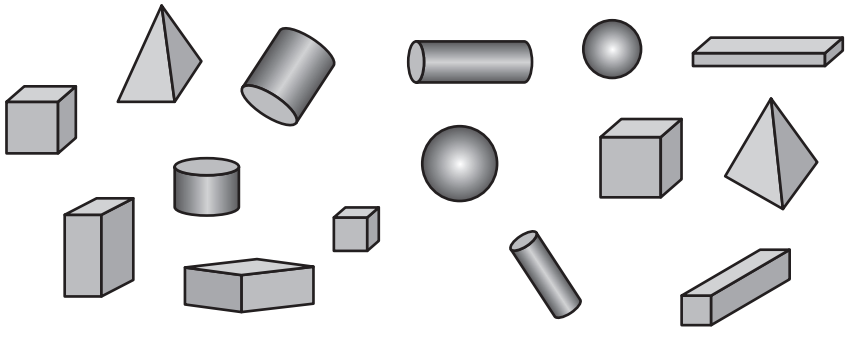
Learning objective Recognise and name 3-D shapes

Basic questions

1 Draw lines to match the solid figures with the shapes below.



2 Count the number of each shape and then fill in the boxes.

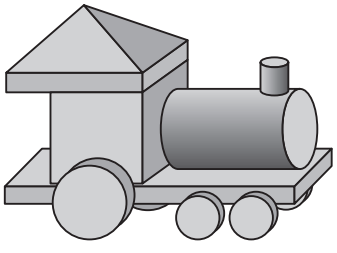


3 Try rolling each shape and then fill in the table with a tick ✓ or a cross ✗. The first one has been done for you.

	Cannot roll	Can roll	
		in one direction	in all directions
	✓		
			
			
			

Challenge and extension question

4 Count the shapes and write the correct number in the box.

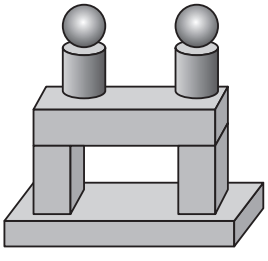


Cubes ☐

Cuboids ☐

Cylinders ☐

Pyramids ☐



Cubes ☐

Cylinders ☐

Cuboids ☐

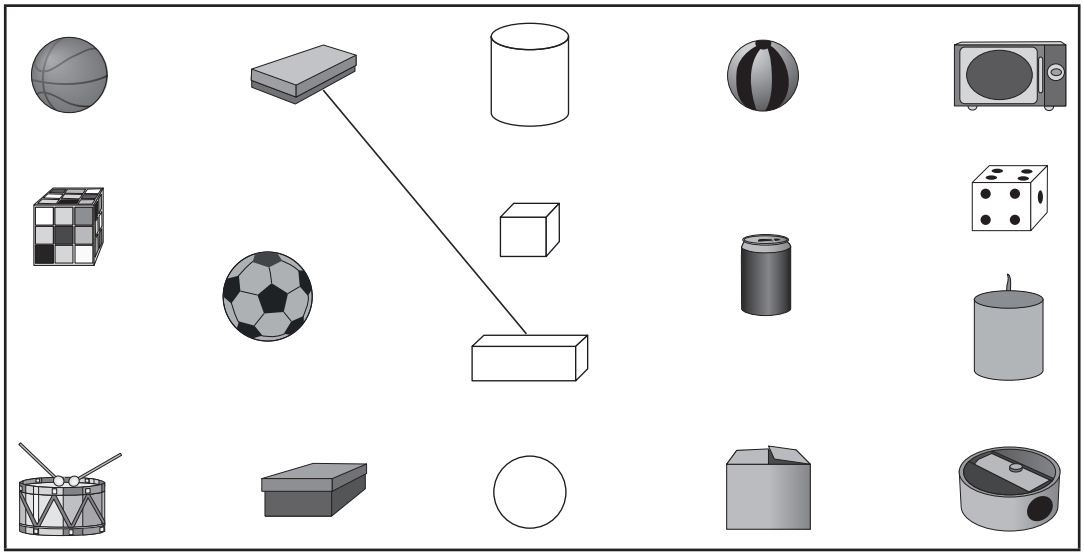
Spheres ☐

4.2 Shapes of objects (2)

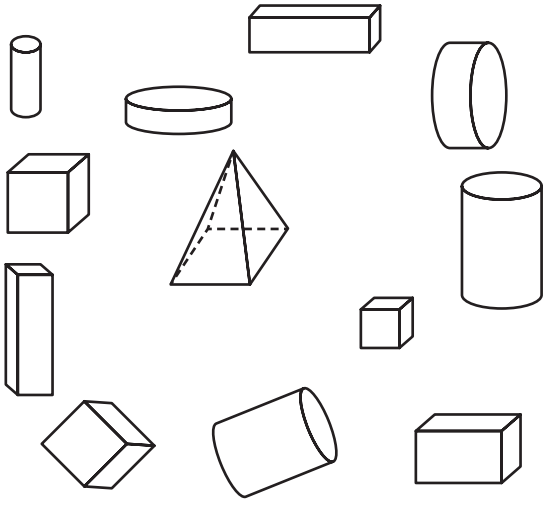
Learning objective Recognise and name 3-D shapes

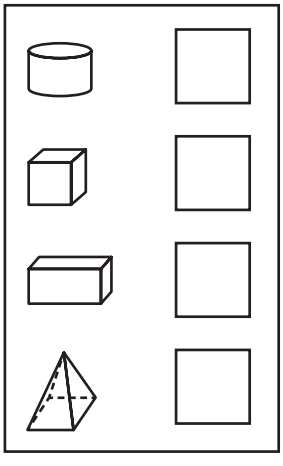
Basic questions

1 Draw lines to match the objects with the shapes. The first one has been done for you.

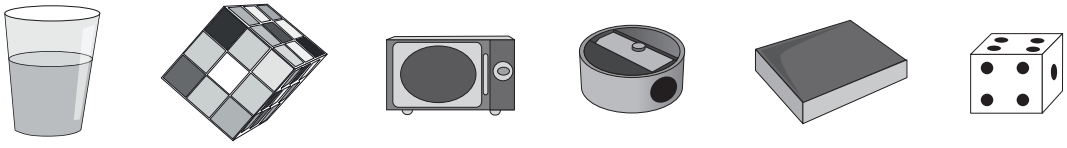


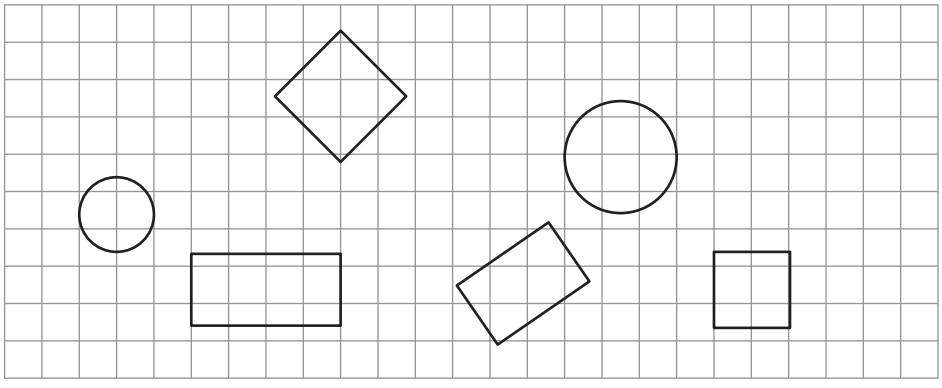
2 Count the shapes and write the correct number in the box.





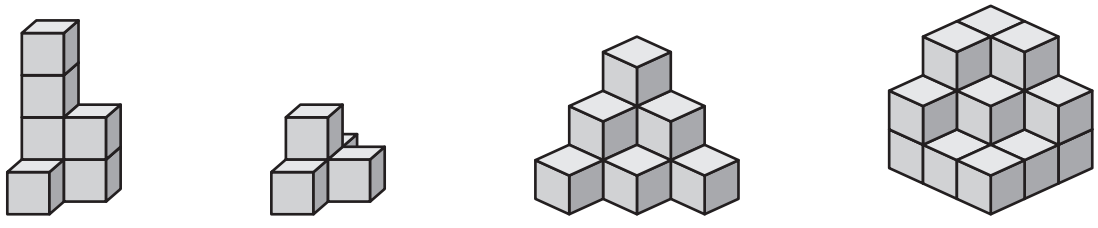
3 Draw lines to match each object to the correct shape below.



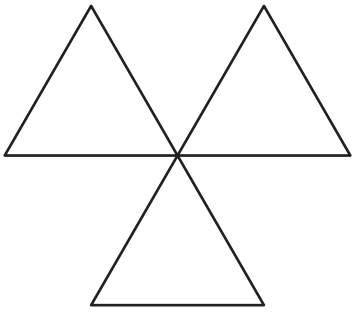


Challenge and extension questions

4 Count the cubes in each tower and write the number underneath.



5 3 triangles are formed using 9 sticks. Move 3 of the sticks to form 5 triangles. Draw how you did it on the right.



Chapter test 4

1 Calculate the following mentally.

5 + 2 = ☐ 3 + 7 = ☐ 14 – 6 = ☐

☐ + 6 = 10 4 + 2 = ☐ 18 – 6 = ☐

17 – 3 = ☐ 15 = ☐ + 4 9 – 3 = ☐

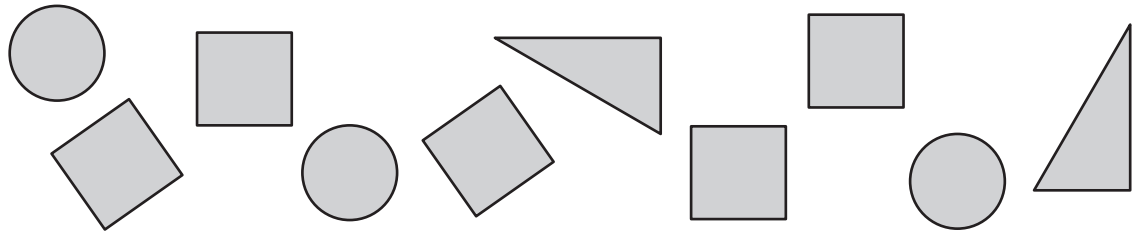
4 + 6 = ☐ 9 + 8 = ☐ 6 = ☐ – 2

15 + 2 = ☐ 10 + 7 = ☐ 14 + 4 = ☐

☐ – 3 = 9 7 – 3 = ☐ 5 + 7 = ☐

7 + 7 = ☐ 7 + ☐ = 13 – ☐

2 Count and then compare.



Shape	How many?
▭	
○	
◺	

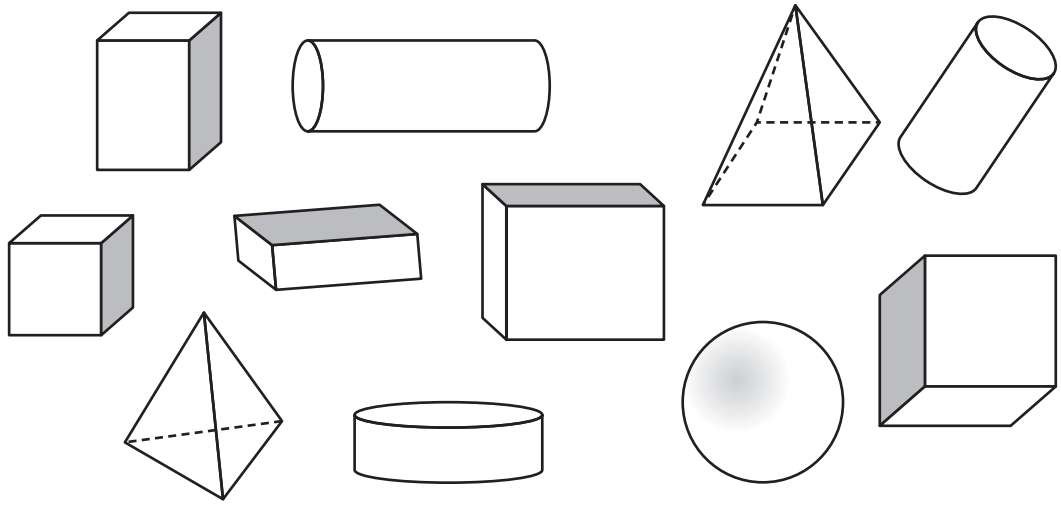
There are ____ more ▭ than ○.

There are ____ fewer ◺ than ▭.

There are ____ ▭ ○ and ◺ altogether.

☐ + ☐ + ☐ = ☐.

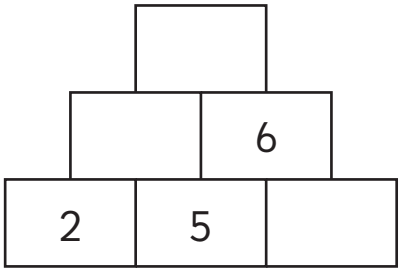
3 Count the shapes and then write the correct number in each box.

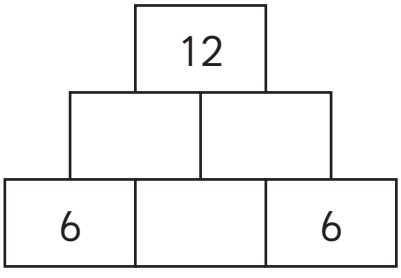


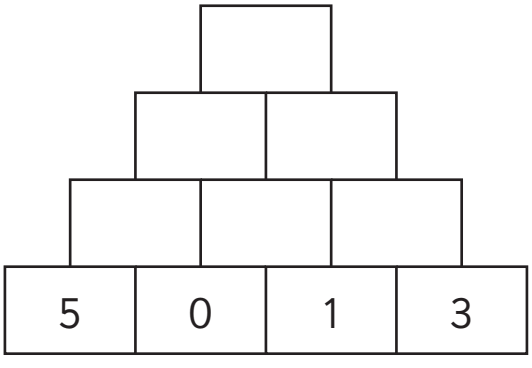
Cuboids ☐ Cubes ☐ Spheres ☐

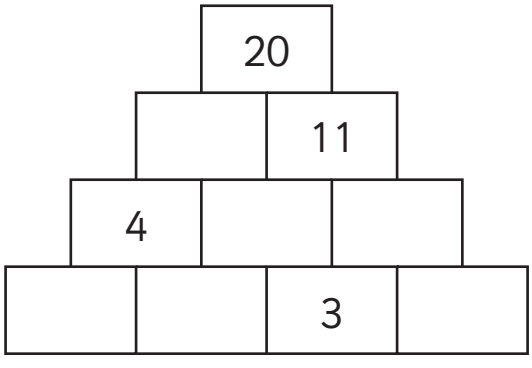
Cylinders ☐ Pyramids ☐

4 Finish the number walls.

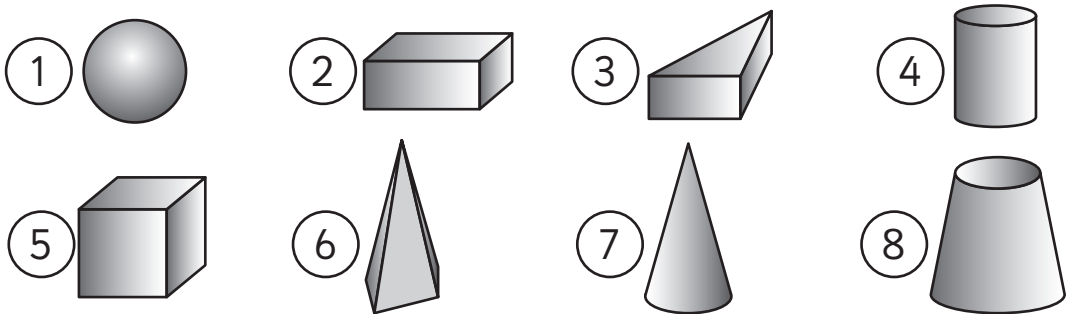








5 Write the correct numbers for each shape below.



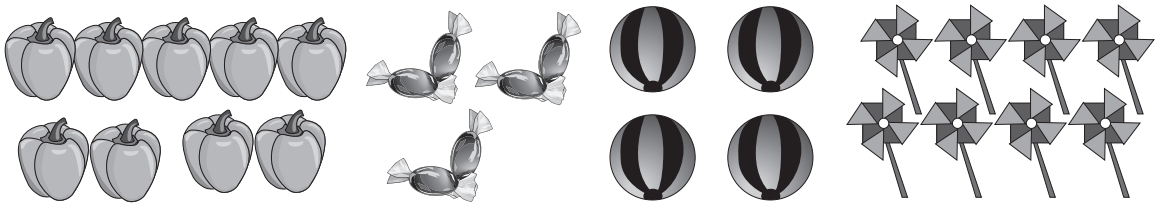
(a) These shapes have rectangular faces  ____

(b) These shapes have square faces  ____

(c) These shapes have triangular faces  ____

(d) These shapes have circular faces  ____

6 Write the number sentences for these pictures.



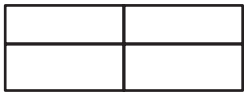
9 + ☐ = ☐

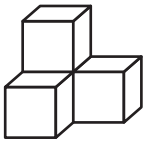
15 − ☐ = ☐

☐ + ☐ = ☐

☐ − ☐ = ☐

7 Look carefully and then complete each sentence.

(a)  There are ☐ rectangles altogether.

(b)  There are ☐ cubes altogether.

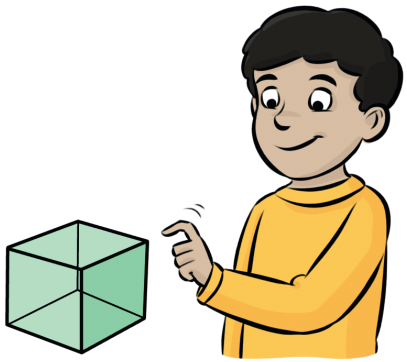
Collins

The Shanghai Maths Project

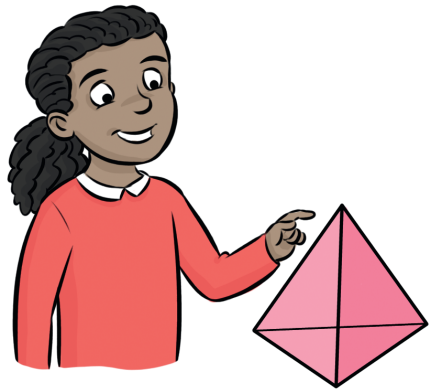
For the English National Curriculum

Year 1 Learning

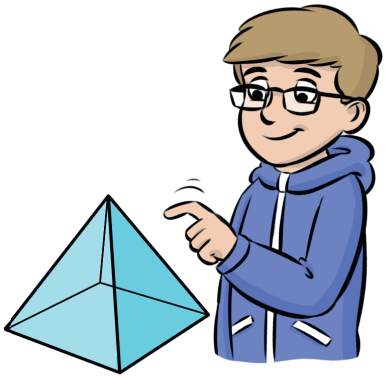
Name	Sphere	Cylinder	Cube	Cuboid	Tetrahedron	Square-based pyramid
Number of faces	1 curved surface	2 and 1 curved surface	6	6	4	5
Number of edges	0	0	12	12	6	8
Number of vertices	0	0	8	8	4	5



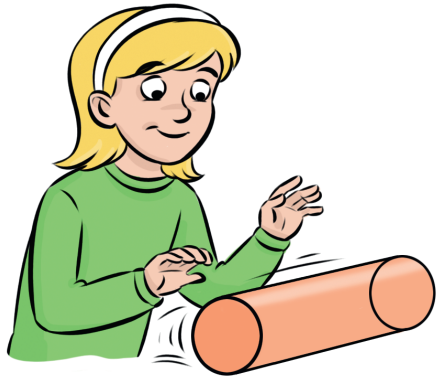
How many faces?



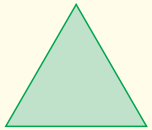
How many vertices?



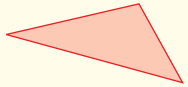
How many edges?

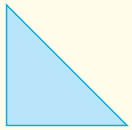


Which can roll? Why?

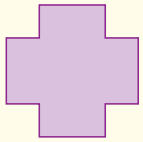

equilateral triangle


isosceles triangle

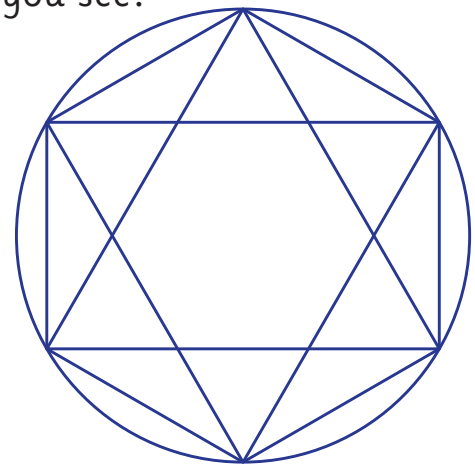

scalene triangle


right-angled triangle


decagon

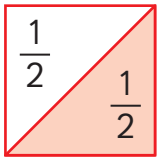

dodecagon

How many triangles can you see?

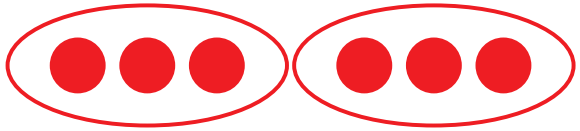


half = $\frac{1}{2}$

1 whole	
$\frac{1}{2}$	$\frac{1}{2}$

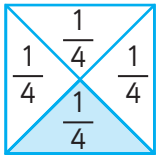


$\frac{1}{2}$ of 6 = 3

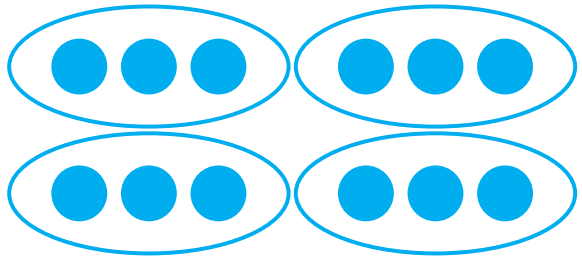


quarter = $\frac{1}{4}$

1 whole			
$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$



$\frac{1}{4}$ of 12 = 3



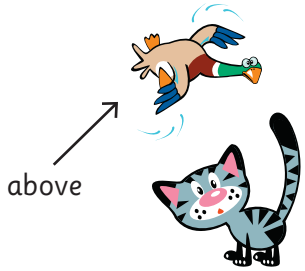
£10 note: a banknote that has a value of £10

£20 note: a banknote that has a value of £20

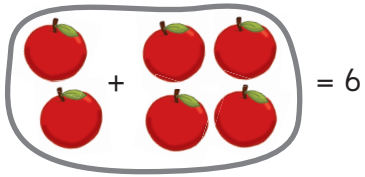
£5 note: a banknote that has a value of £5

£50 note: a banknote that has a value of £50

above: the bird is above the cat



add: increase one number by another or put 2 numbers together



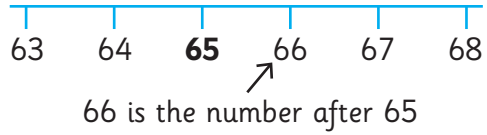
addend: the number being added, or added to, in an addition calculation, addend + addend = sum

4 + 3 = 7
addend addend

addition: join or put together two or more numbers or values

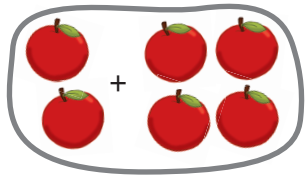
+

after: follows, happens later

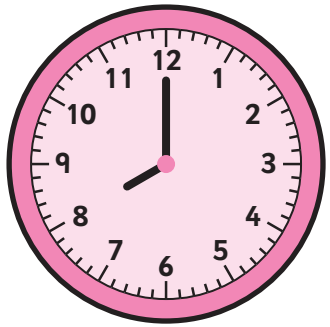


afternoon: the time between morning and evening

altogether: all, everything



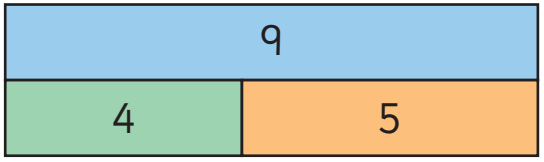
analogue clock: a clock with moving hands and hours marked from 1 to 12 to show you the time



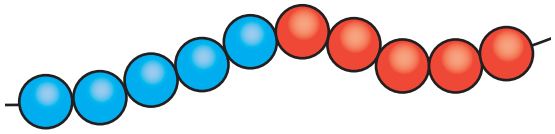
autumn: Autumn is the season between summer and winter. September, October and November are the autumn months

balanced: equivalent in value

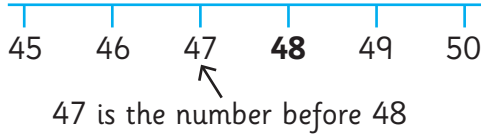
bar model: a diagram to show how wholes are partitioned into parts



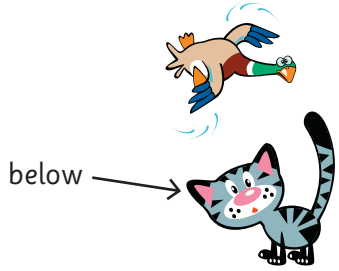
bead string: a string of beads, usually 10, 20, 50 or 100 used to support calculations



before: happens earlier



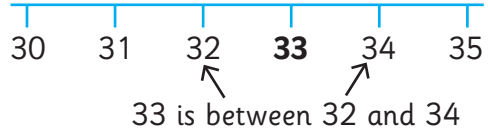
below: the cat is below the bird



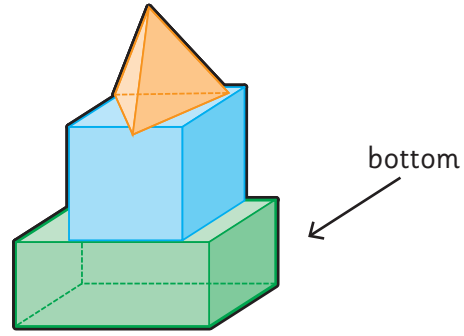
beside: next to

the red car is beside the yellow car

between: has something on both sides of it



bottom: the lowest in a series or pile that is set out vertically



calculate: work out the answer to a number question

calculation: number statement or number sentence

$3 + 6 = 9$, $7 - 2 = 5$