# Unit 15
## Geometry – angles and 2D shapes

**Mastery Expert tip!** "When I taught this unit, I made sure children were able to have as much experience with hands on manipulatives as possible. It made their ability to visualise shapes far stronger!"

**Don't forget to watch the Unit 15 video!**

### WHY THIS UNIT IS IMPORTANT

This unit develops children's understanding of types of 2D shapes and their properties. Children begin by learning about three types of angles: acute, obtuse and right angles. They will use right angles as a way of recognising when angles are acute or obtuse. Children will then compare and order angles in ascending and descending order. Children will then learn about how shapes can be regular or irregular and will discover what this means and how it relates to the angles they have been learning about.

Children then learn about different types of triangles and different types of quadrilaterals. Children will be encouraged to apply all they have learnt to deduce facts about shapes and solve shape based problems and puzzles.

Finally, children will develop their understanding of symmetry, both inside and outside of shapes, and will complete symmetrical shapes and patterns.

### WHERE THIS UNIT FITS

- Unit 14: Statistics
- **Unit 15: Geometry – angles and 2D shapes**
- Unit 16: Geometry – position and direction

This unit builds upon the previous work children have done on recognising and identifying the basic properties of 2D shapes from Year 3. Children learnt to recognise angles as a turn and learnt about right angles. This unit also builds upon previous work children did on types of line in Year 3, where they learnt about horizontal and vertical lines including symmetry, and parallel and perpendicular lines.

Before they start this unit, it is expected that children:
- recognise and identify the basic properties of 2D shapes
- use basic vocabulary of shapes to describe 2D shapes
- recognise angles as a turn
- recognise horizontal and vertical lines of symmetry.

### ASSESSING MASTERY

Children will demonstrate mastery by being able to confidently recognise and order acute, obtuse and right angles, explaining how right angles can help them to do so. They will be able to name and describe the different types of triangles and quadrilaterals, clearly explaining the similarities and differences. In the case of quadrilaterals, they will be able to point out where a shape may fit under more than one heading. Children will be able to confidently complete shapes and patterns across lines of symmetry in different orientations and will be able to apply their knowledge and understanding to solve problems.

| COMMON MISCONCEPTIONS | STRENGTHENING UNDERSTANDING | GOING DEEPER |
|---|---|---|
| Children may incorrectly identify irregular polygons as regular, most commonly an oblong rectangle. They may fail to correctly identify the names of irregular polygons. | Provide children with opportunities to explore and sort a variety of triangles and polygons, discussing their similarities and differences. | Children could explore ways of creating different triangles and quadrilaterals by cutting them up or combining them. |
| Identifying all lines of symmetry can be challenging and some children may only identify those that bisect angles or bisect sides. | Allow children to draw and cut out different types of triangles and quadrilaterals and fold them in order to find the lines of symmetry. Also, provide mirrors so children can see the reflections of complex designs. | |

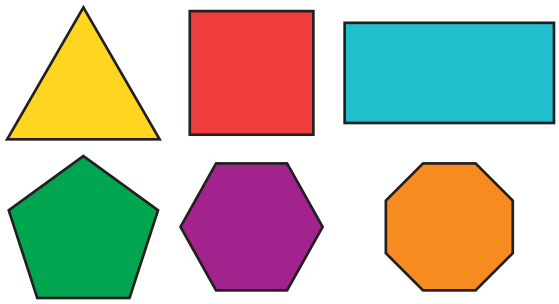
# Unit 15: Geometry – angles and 2D shapes

## WAYS OF WORKING

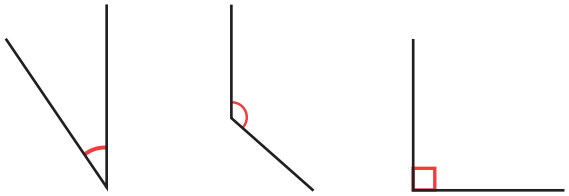
Talk through the key learning points, which the characters mention, and the key vocabulary. Do children have any misconceptions? Do they understand what the vocabulary means? A classroom display showing all of the key information will support children throughout this unit.

## STRUCTURES AND REPRESENTATIONS

**2D shapes:** In this unit, children will learn more about the properties of 2D shapes, including whether they are regular or irregular and about the internal angles of shapes.



**Angles:** In this unit, children will be introduced to acute, obtuse and right angles.

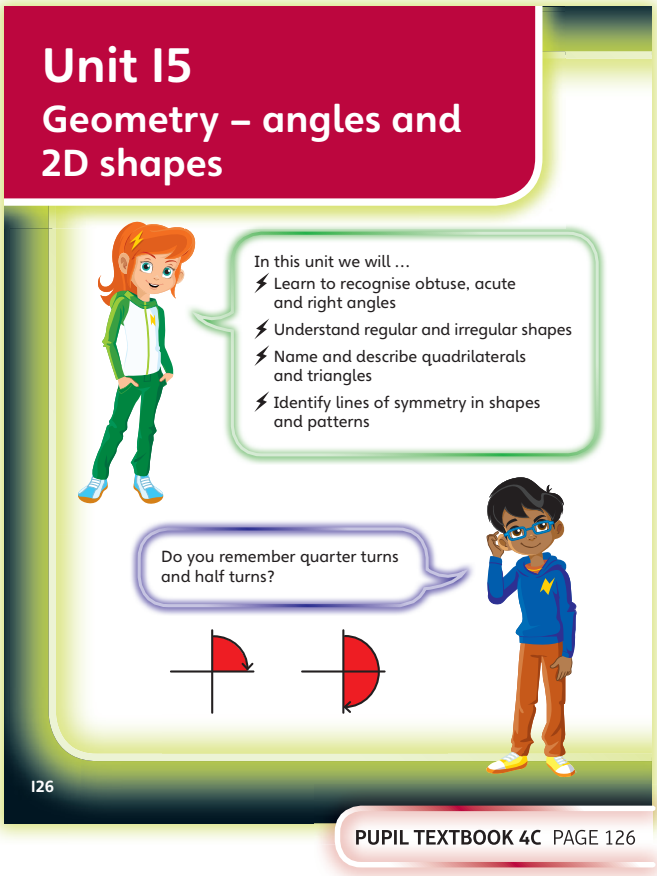


acute angle obtuse angle right angle

## KEY LANGUAGE

There is some key language that children will need to know as part of the learning in this unit.

- angle, acute, obtuse, right angle, quarter turn, half turn, interior angles, exterior angles
- quadrilateral, square, oblong, rectangle, rhombus, parallelogram, trapezium, pentagon, hexagon, octagon, hexadecagon, kite arrowhead, polygon, circle
- triangle, isosceles, equilateral, scalene
- regular, irregular, side length, length, perimeter
- symmetrical, symmetry, line of symmetry, horizontal, vertical, diagonal, reflective, sequence, pattern
- sort, group, compare, order, properties
- shape, vertices, parallel

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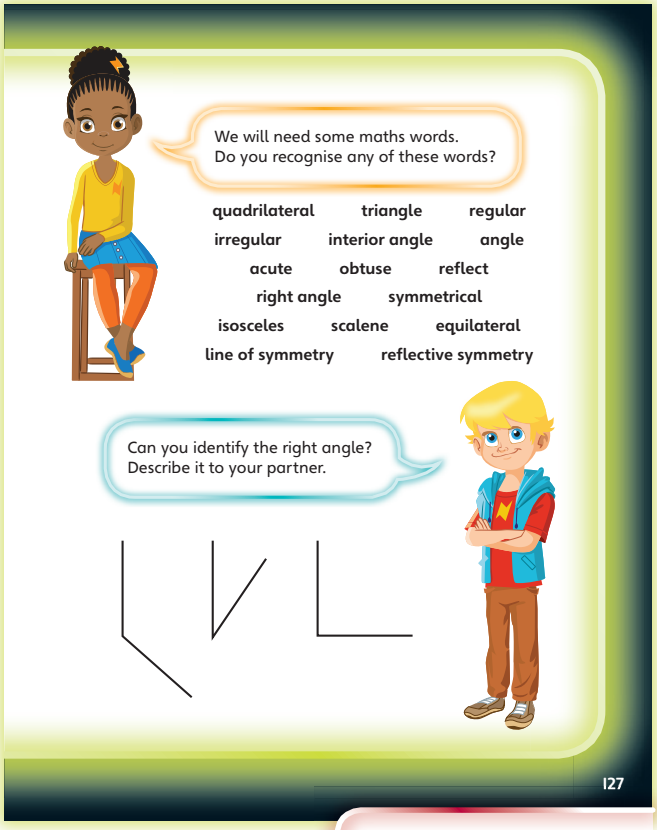


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# Identifying angles

## Learning focus

In this lesson, children will compare angles and identify acute, obtuse and right angles.

## Small steps

- Previous step: Problem solving – graphs
- **This step: Identifying angles**
- Next step: Comparing and ordering angles

## NATIONAL CURRICULUM LINKS

**Year 4 Geometry – Properties of Shapes**

Identify acute and obtuse angles and compare and order angles up to two right angles by size.

## ASSESSING MASTERY

Children can identify right angles as a quarter turn and understand that angles less than a quarter turn are acute and that angles greater than a quarter turn but smaller than a half turn are obtuse. They can begin to apply this knowledge to describing the angles within 2D shapes.

## COMMON MISCONCEPTIONS

Children may need support to identify the type of angle when the orientation means that neither line is vertical or horizontal. Ask:

- *What if you rotated the angle so that one line was horizontal (straight across) or vertical (straight up)? Would that make it easier to see what type of angle it is?*

## STRENGTHENING UNDERSTANDING

Strengthen children's understanding by providing them with a square or a quarter circle so that they have a right angle that they can physically compare to other angles.

## GOING DEEPER

Challenge children by giving them a paper square and ask them to draw two lines that join the opposite corners of the square. Ask: *Can you identify each angle? Are they acute, obtuse or right angles?*

## KEY LANGUAGE

**In lesson:** angle, corner, size, larger, smaller, quarter turn, right angle, half turn, **obtuse**, **acute**, clock hand, point, shape, vertices, facing

**Other language to be used by the teacher:** 2D

## STRUCTURES AND REPRESENTATIONS

angles, clock face

## RESOURCES

**Optional:** a range of 2D shapes, paper squares, clock face

In the eTextbook of this lesson, you will find interactive links to a selection of teaching tools.

## Before you teach

- Are children aware that angles are a measure of a turn around a point?
- How secure are children in describing turns?
- What practical opportunities can you provide for children to explore turns in relation to acute, obtuse and right angles?

# Discover

**WAYS OF WORKING** Pair work

**ASK**

- Question 1 a): *Can you see any angles that are the same?*
- Question 1 a): *Do the angles of the bench match any angles in the garden?*
- Question 1 b): *How would you describe the different angles?*

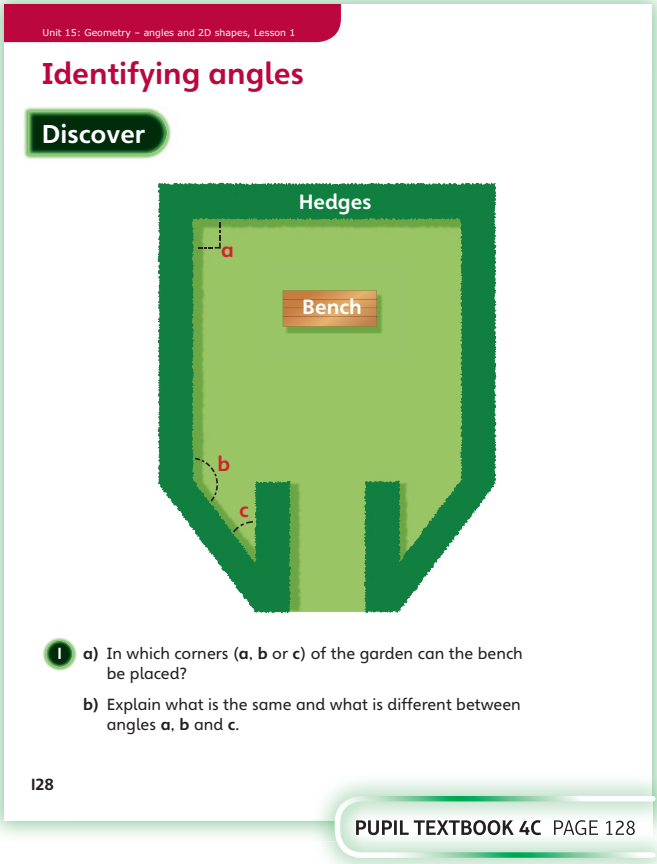
**IN FOCUS** Question 1 b) encourages children to compare the different angles. Children may not be aware of the terms acute and obtuse, so encourage children to describe them in relation to the right angles.

**PRACTICAL TIPS** Get children to stand and make quarter turns in both directions so that they get a 'feel' of what a right angle is. Ask them to make a turn less than a right angle and a turn between a quarter turn and a half turn.

**ANSWERS**

Question 1 a): The bench can fit in corners **a** and **b**.

Question 1 b): Accept any features that are the same/different including:
Same: All of the angles measure the turn between two walls of the garden.
Different:
Angle **a** is a quarter turn or a right angle.
Angle **b** is larger than a right angle.
Angle **c** is smaller than a right angle.

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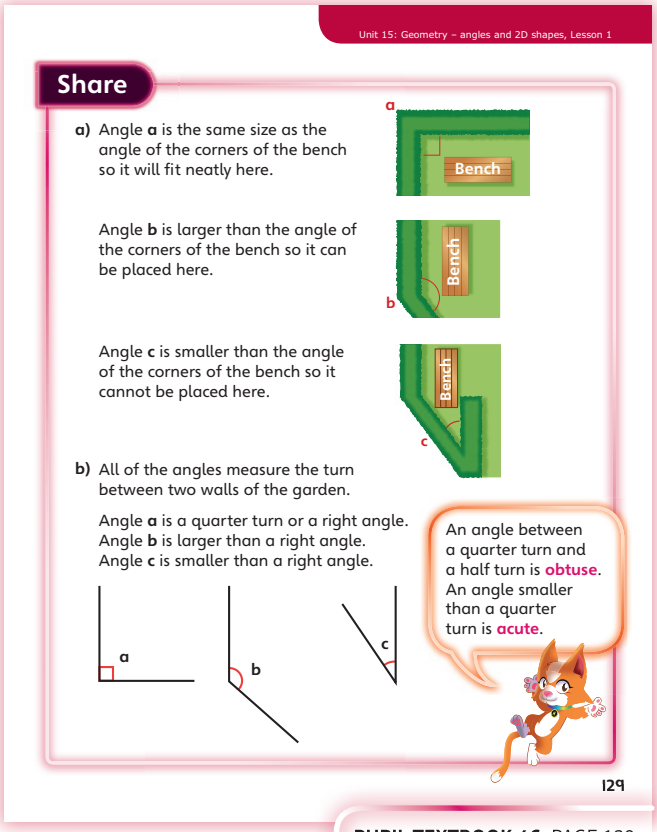
# Share

**WAYS OF WORKING** Whole class teacher led

**ASK**

- Question 1 a): *Why can the bench fit in corner **b** but not corner **c**?*
- Question 1 a) and b): *What can you say about the angles of the bench?*
- Question 1 a) and b): *Are there any other shapes that have the same angles as the bench?*

**IN FOCUS** Sparks's comment introduces children to the vocabulary of obtuse and acute and defines them by comparison to a quarter turn. It is important that children understand this definition. Therefore, provide children with the opportunity to compare angles practically with a right angle, using the corner of a square as a right angle. Ask: *Can you find any acute or obtuse angles around the classroom?*

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# Think together

**WAYS OF WORKING** Whole class teacher led (I do, We do, You do)

**ASK**

- Question 2: *Can you describe the angles on the bench?*
- Question 2: *Can you think of any other shapes that would fit in the corner?*
- Question 3: *Have you found all the possibilities?*

**IN FOCUS** Question 3 relates angles to the size of a turn around a point. Children could use clocks to explore this question in order to reinforce their understanding. Children will discover that there is only one answer for a right angle yet more than one for obtuse and acute. Some children may give possibilities for obtuse that go beyond half a turn. It is important to refer back to the definitions in the **Share** section so children understand that obtuse is between a quarter and half turn.

**STRENGTHEN** For question 1, provide children with 2D shapes to represent the benches. This enables children to physically compare the angles between the hedges with the angles of the bench.

**DEEPEN** For question 3, ask children: *A turn between which two numbers would create a right angle? Can you find all the possibilities?*

**ASSESSMENT CHECKPOINT** Questions 1 and 2 will demonstrate whether children can compare angles with a right angle. Question 3 will demonstrate whether children are able to identify acute, obtuse and right angles.

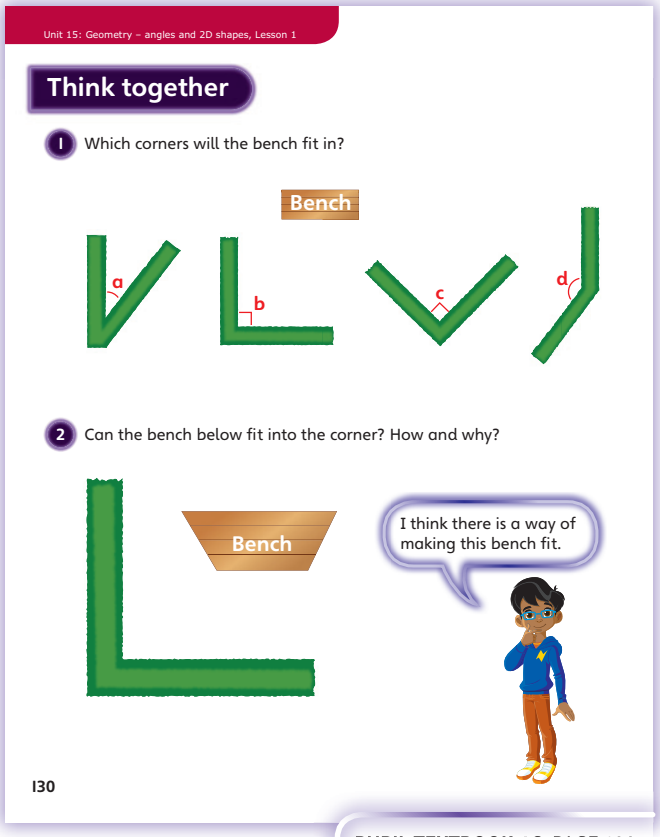
**ANSWERS**

Question 1: The bench will fit in corners b, c and d.

Question 2: The acute angle of the bench will fit in the corner if the bench is turned round.

Question 3 a): i) Numbers 1 and 2 will create an acute turn.
ii) Number 3 will create a right angle.
iii) Numbers 4 and 5 will create an obtuse turn.

Question 3 b): The hand started at number 2.

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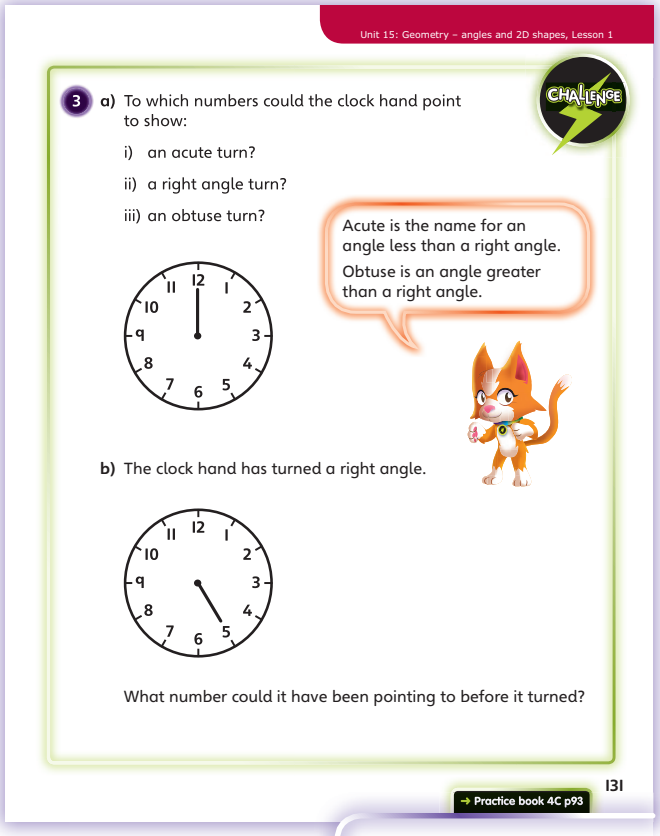


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## Practice

**WAYS OF WORKING** Independent thinking

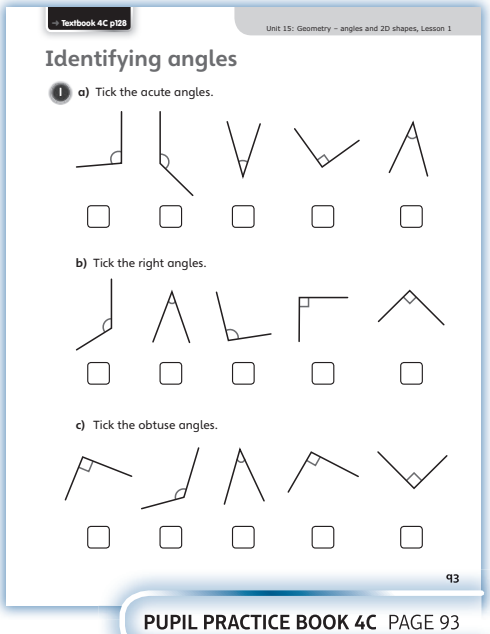
**IN FOCUS** Question 3 looks at sorting shapes by their types of angles. Children not only need to identify the types of angles in the shapes but also sort the shapes based on two criteria.

**STRENGTHEN** Using squared paper, ask children to draw a shape with only right angles, only obtuse angles or only acute angles. They can use a 2D square to check their angles.

**DEEPEN** Challenge children by providing them with a range of 2D shapes and asking them to sort them based on their angles. Ask: *Can you sort the shapes in different ways?*

**ASSESSMENT CHECKPOINT** Children should now be confident identifying and drawing acute, obtuse and right angles. Questions 3 and 4 will demonstrate whether children can identify angles within different 2D shapes.

**ANSWERS** Answers for the **Practice** part of the lesson appear in the separate **Practice and Reflect answer guide**.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Unit 15: Geometry – angles and 2D shapes, Lesson 1

Identifying angles

1 a) Tick the acute angles.

b) Tick the right angles.

c) Tick the obtuse angles.

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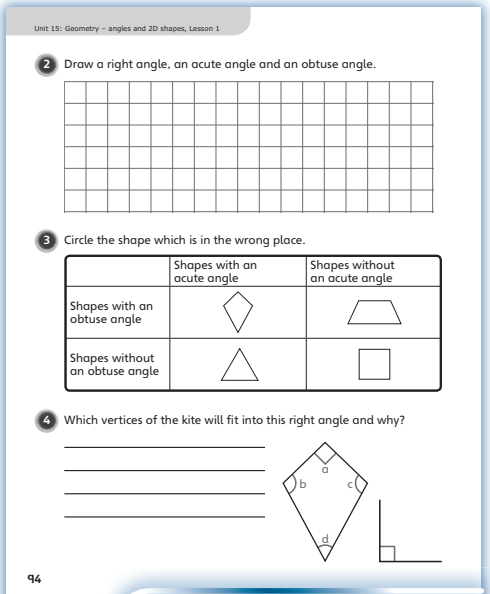
Unit 15: Geometry – angles and 2D shapes, Lesson 1

2 Draw a right angle, an acute angle and an obtuse angle.

3 Circle the shape which is in the wrong place.

| | Shapes with an acute angle | Shapes without an acute angle |
|---|---|---|
| Shapes with an obtuse angle | | |
| Shapes without an obtuse angle | | |

4 Which vertices of the kite will fit into this right angle and why?

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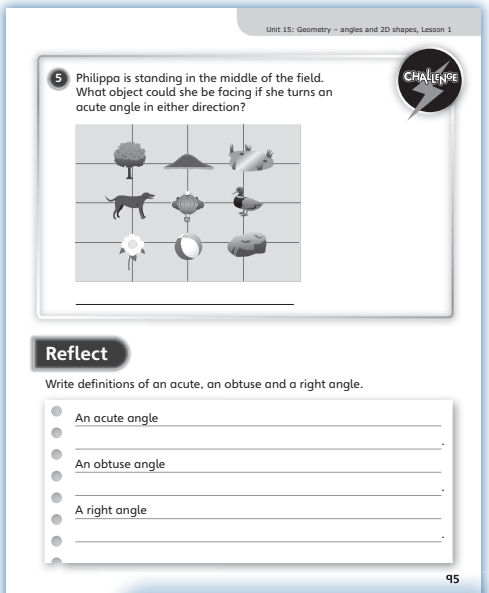
## Reflect

**WAYS OF WORKING** Independent thinking

**IN FOCUS** This section asks children to give a definition for each of the three types of angles, in their own words. This will help to secure their understanding of acute, obtuse and right angles.

**ASSESSMENT CHECKPOINT** This section will demonstrate if children understand the definitions of acute, obtuse and right angles.

**ANSWERS** Answers for the **Reflect** part of the lesson appear in the separate **Practice and Reflect answer guide**.


Unit 15: Geometry – angles and 2D shapes, Lesson 1

5 Philippa is standing in the middle of the field. What object could she be facing if she turns an acute angle in either direction?

CHALLENGE

Reflect

Write definitions of an acute, an obtuse and a right angle.

An acute angle

An obtuse angle

A right angle

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## After the lesson

- Were children able to relate angles to turns around a point?
- Are children secure in identifying the three types of angle?

# Comparing and ordering angles

## Learning focus

In this lesson, children will identify acute and obtuse angles, using what they already know about angles. They will compare the size of angles and use their comparisons to order them.

## Small steps

- Previous step: Identifying angles
- **This step: Comparing and ordering angles**
- Next step: Identifying regular and irregular shapes

## NATIONAL CURRICULUM LINKS

**Year 4 Geometry – Properties of Shapes**

Identify acute and obtuse angles and compare and order angles up to two right angles by size.

## ASSESSING MASTERY

Children can use what they know about angles to accurately identify acute, obtuse and right angles. They will be able to recognise which angles are larger or smaller than others and use their understanding to put them in ascending or descending order of size.

## COMMON MISCONCEPTIONS

Children may think that a right angle is obtuse as it is not smaller than 90°. Ask:

- *What did you call this angle in the previous lesson? Is the angle you are looking at larger or smaller than a right angle?*

## STRENGTHENING UNDERSTANDING

Take photos of children holding their arms wide, above their head, at different angles. Ask: *Can you order the pictures from the person who has their arms the widest to the person who has their arms held the least wide?*

## GOING DEEPER

Challenge children by giving them a sequence of angles, ordered in ascending or descending order. Take one of the angles out, leaving a missing angle space in the sequence. Ask: *Was the angle I took away acute, obtuse or a right angle?* Ask children to draw missing angle. Ask: *Is this the only angle it could have been?*

## KEY LANGUAGE

**In lesson:** acute, greater, smaller, right angle, larger, obtuse, sort, groups, compare, order, smallest, largest, fewest, most, four-sided, shape, size, interior, pattern, ascending

**Other language to be used by the teacher:** descending, triangle, equilateral triangle, pentagon, hexagon, octagon, rectangle, polygon

## STRUCTURES AND REPRESENTATIONS

angles, 2D shapes

## RESOURCES

**Optional:** 2D shapes, rulers, set squares

In the eTextbook of this lesson, you will find interactive links to a selection of teaching tools.

## Before you teach

- Are children confident at recognising angles inside and outside of a shape?
- Can children reliably identify right angles?

# Discover

**WAYS OF WORKING** Pair work

**ASK**

- Question 1 a): *How can you tell which ramp will allow for the highest jump?*
- Question 1 a): *What is the same and what is different about the two ramps?*
- Question 1 a): *Can you see any other angles in the picture?*

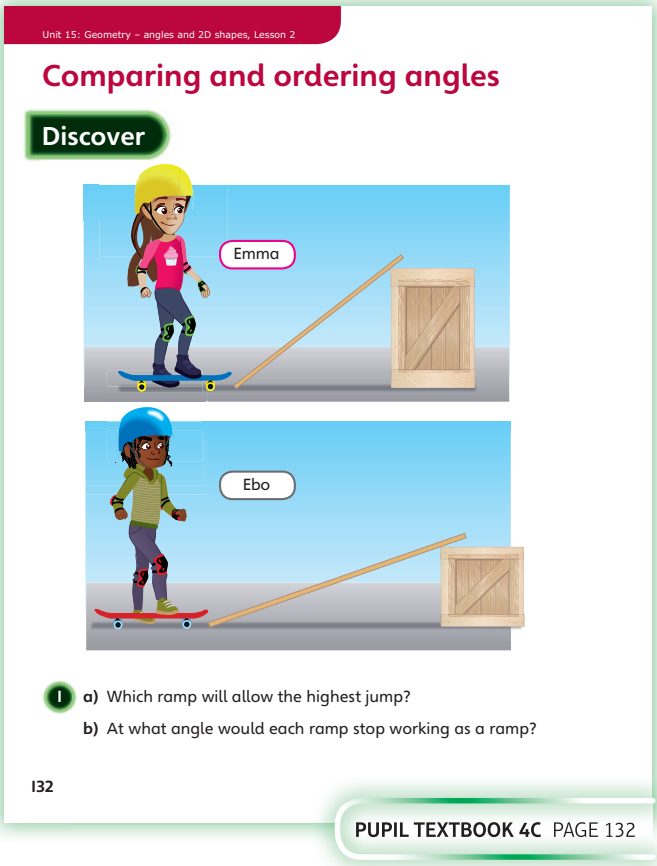
**IN FOCUS** Use this opportunity to remind children of right angles and discuss how the ramps they can see in the picture are similar and different to the angles they have met before. Encourage children to recognise how the ramps are set to smaller angles than a right angle.

**PRACTICAL TIPS** Give children the opportunity to create ramps as shown in the picture. This could also be linked to a science or PE lesson.

**ANSWERS**

Question 1 a): Emma's ramp will allow for the highest jump.

Question 1 b): A ramp set at a right angle would not work.

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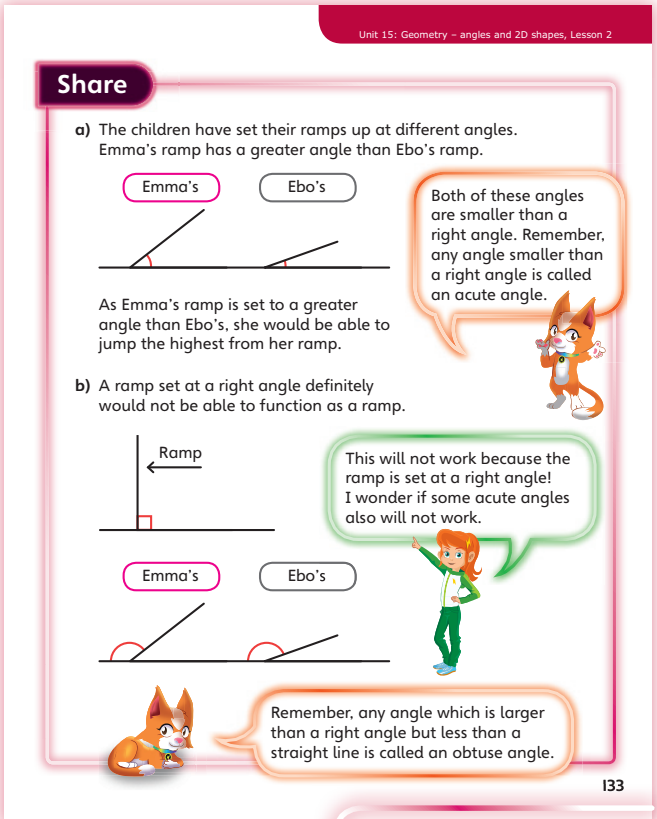
# Share

**WAYS OF WORKING** Whole class teacher led

**ASK**

- Question 1 a): *What part of the ramp did you look at to find the angle?*
- Question 1 a): *How did you know which angle was bigger?*
- Question 1 a): *Could you use what you know about a right angle to help compare the two angles?*
- Question 1 a): *What is the same and what is different about acute and obtuse angles?*
- Question 1 b): *Why would a right angle not function as a ramp?*

**IN FOCUS** It will be important in this part of the lesson to make sure children are able to explain the properties of each of the three types of angle they are studying: acute, obtuse and right angles. Ensure that children understand that an obtuse angle is greater than a right angle but less than a straight line.

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# Think together

**WAYS OF WORKING** Whole class teacher led (I do, We do, You do)

**ASK**

- Question 1: *What types of angles can you see?*
- Question 1: *How will you know which are acute angles, which are obtuse angles and which are right angles?*
- Question 2: *Which angles will be easiest to sort first?*
- Question 3: *Which angles will you look at in each shape?*

**IN FOCUS** At this point in the lesson, children begin to order angles based on size. Use questions 1 and 2 to discuss how the task of ordering angles can be broken down into two smaller steps, first sorting into type, then ordering them accurately.

**STRENGTHEN** To help children find which angles are larger or smaller than a right angle, offer them set squares to use. Ask: *How can you use the right angle on the set square to help you find acute and obtuse angles?*

**DEEPEN** Question 3 deepens children's understanding of angles within shapes. Children should recognise how angles found in shapes can be acute, obtuse or right angles. Challenge children by asking questions such as: *Are all the obtuse angles in each of the shapes the same? What would happen to the shape you drew if you used larger acute angles? What about smaller?*

**ASSESSMENT CHECKPOINT** Children should be able to use their understanding of right angles to identify whether they are looking at an acute or obtuse angle. Through observation, they should be able to more confidently order angles in ascending and descending order.

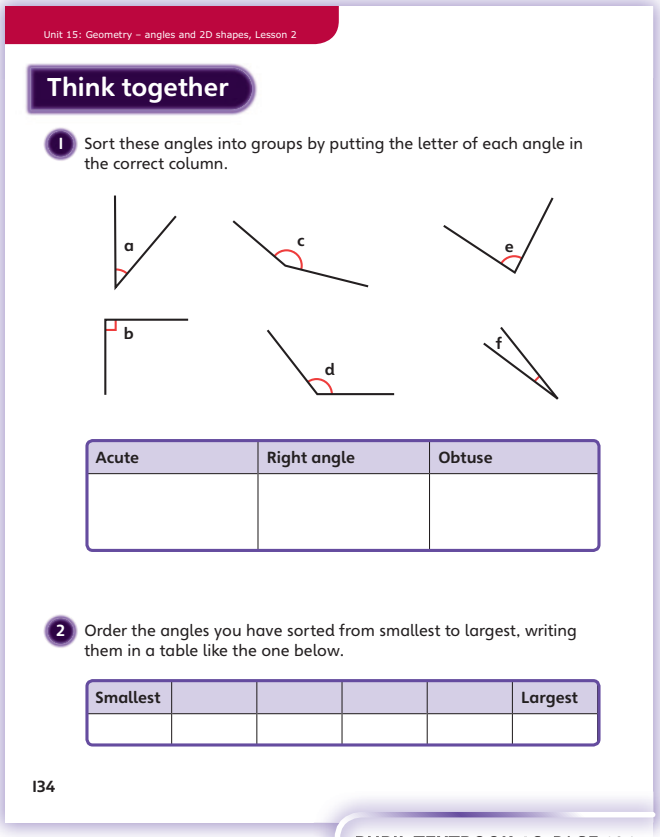
**ANSWERS**

Question 1: Acute angles: a, e, f
Right angles: b
Obtuse angles: c, d

Question 2: f, a, e, b, d, c

Question 3 a): Fewest to most acute angles: C, A, B
Fewest to most right angles: C, B, A
Fewest to most obtuse angles: B, A, C

Question 3 b): It is not possible to draw the shape described. For a four-sided shape with only one right angle, at least one of the other three angles must be bigger than a right angle.

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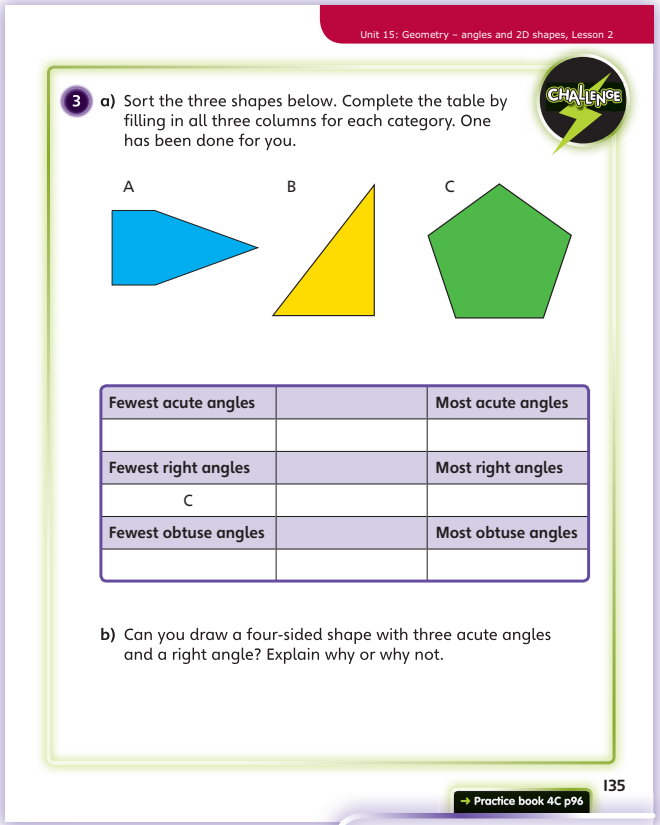


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## Practice

**WAYS OF WORKING** Independent thinking

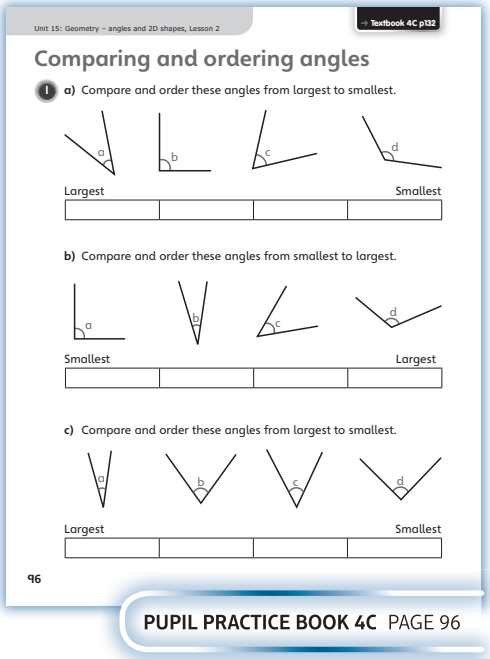
**IN FOCUS** Question 1 will give children the opportunity to compare and order angles. It will be important for children to recognise the varying ways in which angles can be ordered and recorded as it is not always in ascending order.

**STRENGTHEN** If children are finding it difficult to compare the angles by sight, ask: *Are there any angles you can recognise easily? How can you use those angles to help you begin to order the rest?* Children will need to use a set square or something that they know to be a right angle, such as the corner of a piece of paper, to help them judge angles that are close to a right angle.

**DEEPEN** Use question 4 to deepen children's reasoning. Ask questions such as: *Which two shapes make the smallest/largest obtuse angle? Are there two shapes which can't be used to make an obtuse angle? Is it possible to use any of the shapes to create an acute angle?* Encourage children to explain their ideas. Some children will find it easier if they have actual cut-out 2D shapes with which to work. Other children will quickly see that two acute angles do not always make an obtuse angle; they can also make a larger acute angle or a right angle.

**ASSESSMENT CHECKPOINT** Children should be able to confidently identify and order acute, obtuse and right angles. They should be able to fluently arrange angles in both ascending and descending order and be able to clearly explain how their understanding of right angles can help them.

**ANSWERS** Answers for the **Practice** part of the lesson appear in the separate **Practice and Reflect answer guide**.

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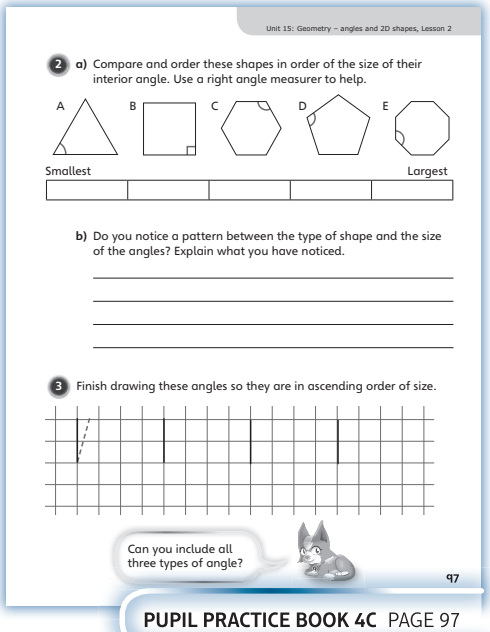


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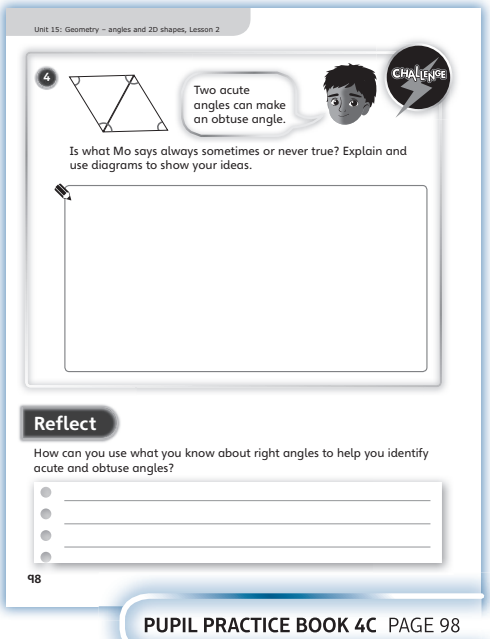
## Reflect

**WAYS OF WORKING** Independent thinking

**IN FOCUS** Give children time to consider what they have learnt in this lesson and then discuss this with a partner. Once they have done so, children should write their thoughts and share their ideas with the class.

**ASSESSMENT CHECKPOINT** Children should be demonstrating their understanding that the right angle can be used a reference point to easily spot acute and obtuse angles.

**ANSWERS** Answers for the **Reflect** part of the lesson appear in the separate **Practice and Reflect answer guide**.

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## After the lesson

- Are children confident at identifying all three types of angle?
- Have children recognised the importance of working systematically when ordering angles?

# Identifying regular and irregular shapes

## Learning focus

In this lesson, children will recognise the similarities and differences between regular and irregular polygons. They will use this vocabulary to help their reasoning about 2D shapes.

## Small steps

- Previous step: Comparing and ordering angles
- **This step: Identifying regular and irregular shapes**
- Next step: Classifying triangles

## NATIONAL CURRICULUM LINKS

**Year 4 Geometry – Properties of Shapes**

Compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes.

## ASSESSING MASTERY

Children can reliably identify regular and irregular shapes. They can fluently explain how the angles and side lengths can make a shape regular or irregular and can explain how only one property needs to be different for a shape to be classed as irregular.

## COMMON MISCONCEPTIONS

Children may muddle interior and exterior angles when deciding if a shape is regular or not. Ask:

- *Which angles in a 2D shape have you been looking at? The ones on the inside or outside?*

When studying a shape with an interior reflex angle (larger than 180° but less than 360°), children may use the exterior angle instead as it will be smaller and more recognisable to them. Again, ask:

- *Where in the shape do the angles you have been comparing appear? On the inside or outside?*

## STRENGTHENING UNDERSTANDING

Before learning the mathematical vocabulary introduced in this lesson, support children by asking them to organise shapes into different categories. For example, ask: *Can you find all the six-sided shapes? What other name do you know for six-sided shapes? What is the same and what is different about these shapes?*

## GOING DEEPER

Children should use their learning from the previous lesson to deepen their understanding in this lesson. Challenge them to draw an irregular hexagon with four acute angles, one obtuse angle and one right angle.

## KEY LANGUAGE

**In lesson:** **regular**, **irregular**, hexagonal, hexagon, side length, **interior angles**, equal, different, 2D

**Other language to be used by the teacher:** isometric dots, exterior angles, polygon

## STRUCTURES AND REPRESENTATIONS

2D shapes

## RESOURCES

**Optional:** 2D shapes, ruler

In the eTextbook of this lesson, you will find interactive links to a selection of teaching tools.

## Before you teach

- How will you ensure children recognise that they are studying the interior angles of shapes?
- What practical opportunities to find and compare regular and irregular shapes will you provide?

## Discover

**WAYS OF WORKING** Pair work

**ASK**

- Question 1 a): *What shape tents are on the campsite?*
- Question 1 a): *How do you know there is more than one hexagon?*

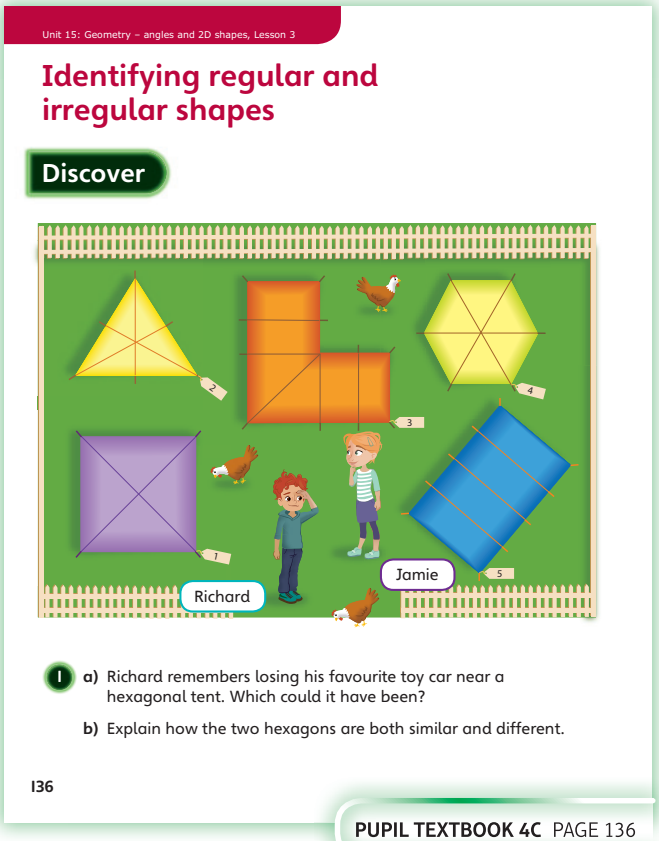
**IN FOCUS** Encourage children to notice that there are two hexagonal tents. Ask children to convince each other that there are definitely two hexagons. Discuss with children how they can be sure.

**PRACTICAL TIPS** Encourage children to find as many different types of one shape around the room as they can. Ask: *Can you find all the pentagons? What do you notice is the same and what is different about these shapes?* Children could be encouraged to take photos of the shapes to sort later.

**ANSWERS**

Question 1 a): Richard could have lost his toy car near tent 3 or tent 4.

Question 1 b): The two hexagons are similar as they both have six sides and six angles. They are different because their side lengths and interior angles are different sizes.

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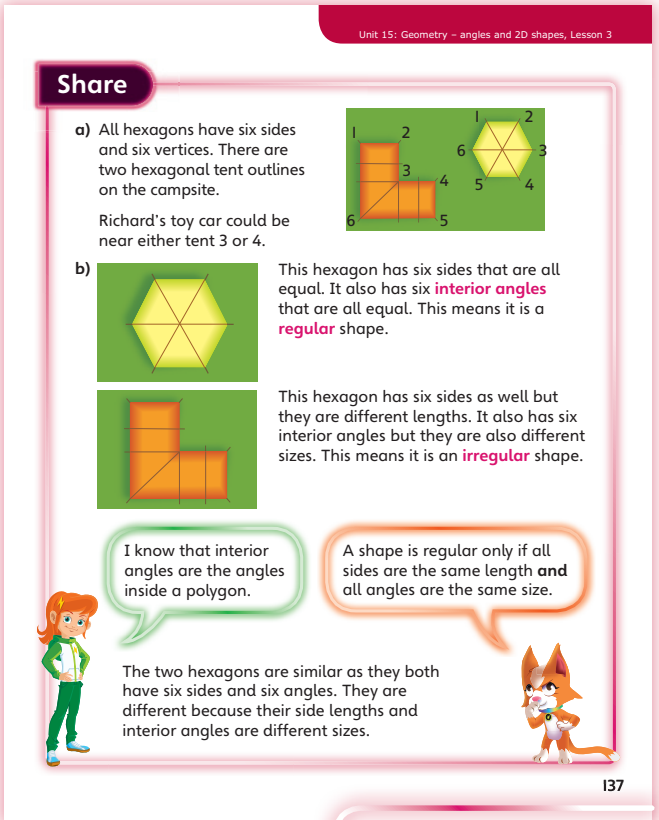
## Share

**WAYS OF WORKING** Whole class teacher led

**ASK**

- Question 1 a): *How did you know which shapes were hexagonal?*
- Question 1 b): *Which hexagonal shape was strange and why?*
- Question 1 b): *Where would you look to find a shape's interior angles?*

**IN FOCUS** It will be important, during this part of the lesson, to make sure children are comfortable with what an 'interior angle' is and where it can be found. Remind children that 2D shapes are called polygons and that interior angles are found inside a shape. For example, the irregular hexagon (a compound L shape) has a three quarter turn interior angle, as well as smaller angles.

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# Think together

**WAYS OF WORKING** Whole class teacher led (I do, We do, You do)

**ASK**

- Questions 1 and 2: *What properties will we need to look at when finding regular and irregular shapes?*
- Question 3: *Can a shape be irregular if all the sides are the same?*

**IN FOCUS** Question 1 gives an opportunity to recap how only one of the properties needs to change for a shape to be irregular. Focus on the rectangle, where only the property of side length is different, to help scaffold this understanding.

**STRENGTHEN** For children who are still confusing the interior and exterior angles in each shape, it may be beneficial to encourage them to draw the shapes they are looking at. Ask: *What angles can you spot inside the shape? Can you compare all the interior angles you have found?*

**DEEPEN** Question 3 deepens children's reasoning by requiring them to interrogate each shape and work out where Alex has made a mistake. Encourage children's reasoning by asking: *What mistakes did Alex make? What advice would you give Alex to help her understand her mistake?*

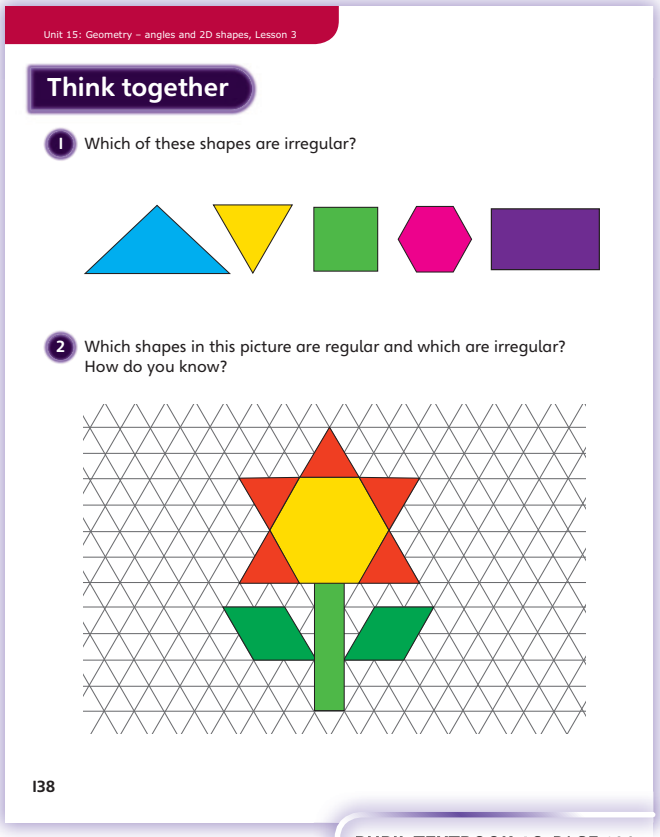
**ASSESSMENT CHECKPOINT** At this point in the lesson, children should be able to discuss what makes a shape regular or irregular. Question 2 provides a good opportunity to check their understanding. They should be more confident at identifying regular and irregular shapes and should be able to explain their ideas using the correct vocabulary.

**ANSWERS**

Question 1: The irregular shapes are the isosceles triangle and the rectangle.

Question 2: The triangles (all equilateral) and the hexagon are regular. The rectangle and parallelograms are irregular.

Question 3: Alex has mistakenly put the isosceles triangle (not regular) and the rectangle (not regular) in the wrong places in the table.
Other shapes that could go in each section:
A four-sided shape:
Irregular: trapezoid
Regular: square
Not a four-sided shape:
Irregular: circle
Regular: hexagon

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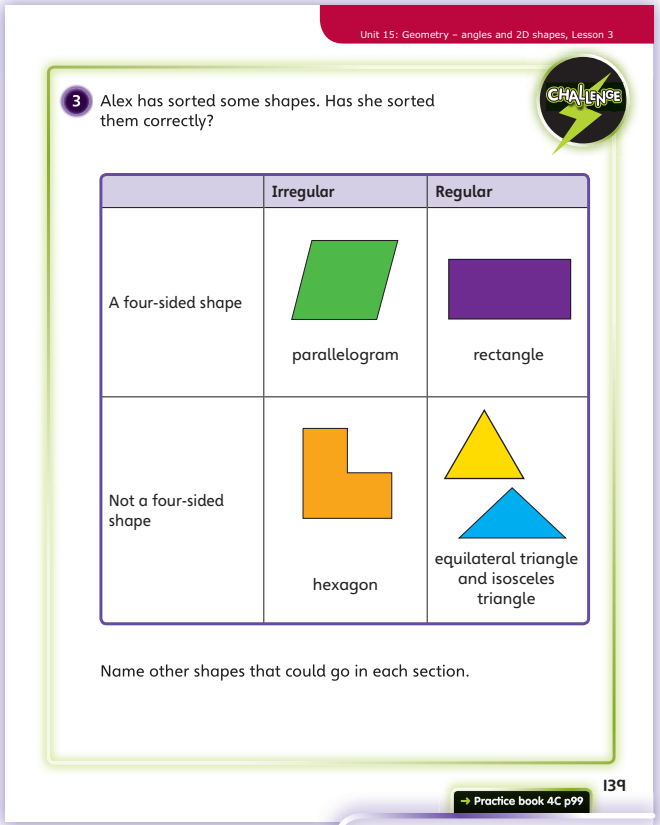


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## Practice

**WAYS OF WORKING** Independent thinking

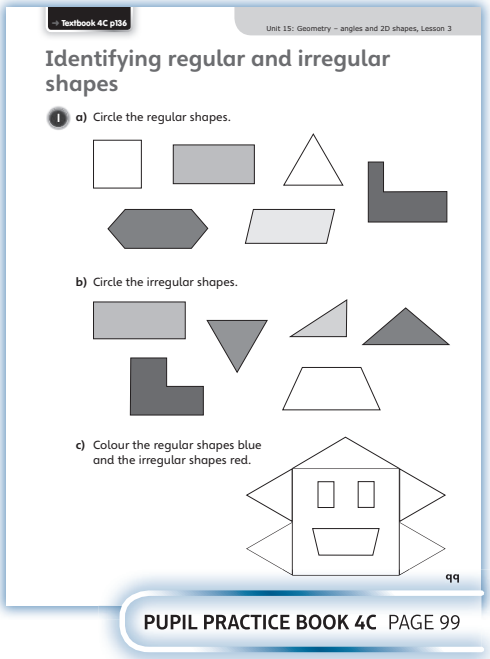
**IN FOCUS** For questions 2 and 3, ensure that children are aware that the pattern of dotted paper is different in each question. This could be highlighted to children by asking: *What is the same and what is different about these two questions? How will the dotted paper help you? What do you need to be careful of when drawing your shapes?*

**STRENGTHEN** In questions 2 and 3, it may be helpful to provide children with pictures of shapes or plastic 2D shapes for them to manipulate. Ask: *Which shape matches what you need to draw? Can you use the dots to help you draw that shape?*

**DEEPEN** When solving question 5, deepen children's understanding and reasoning by asking them to provide proof of their findings. You could offer them pre-drawn, cut out versions of the shapes in the question. Alternatively, the children could be given isometric dotted paper to draw their own versions. Ask children how many solutions they can find and to prove that they have found all possibilities.

**ASSESSMENT CHECKPOINT** At this point in the lesson children should be able to confidently identify what makes a shape regular or irregular. Questions 2 and 3 are a good opportunity for children to demonstrate that they recognise that, for example, an irregular hexagon is still a hexagon. Question 1 provides children with an opportunity to demonstrate that they are able to confidently identify and sort shapes based on whether they are regular or irregular.

**ANSWERS** Answers for the **Practice** part of the lesson appear in the separate **Practice and Reflect answer guide**.

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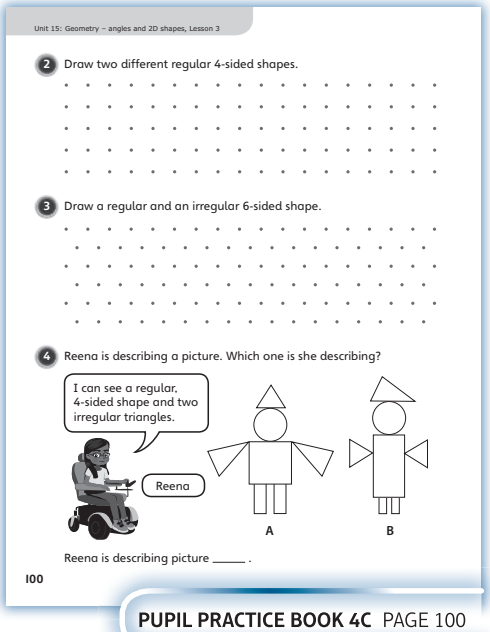


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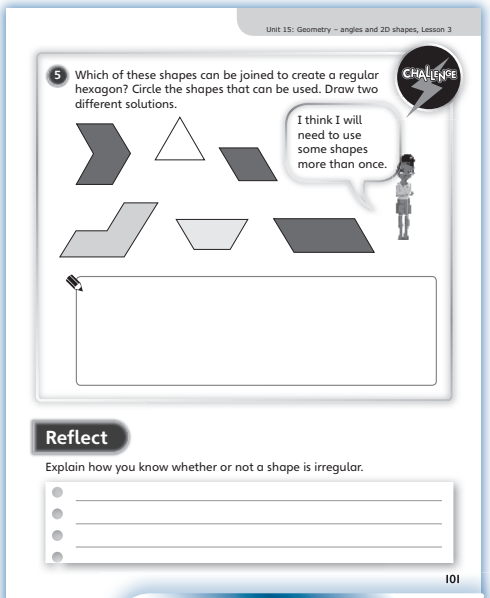
## Reflect

**WAYS OF WORKING** Independent thinking

**IN FOCUS** Children should formulate their ideas and summarise their learning about irregular shapes. Children should then be given the opportunity to share their ideas with a partner and in class discussion.

**ASSESSMENT CHECKPOINT** Children should be able to summarise clearly that it is important to remember that either the side lengths or angles should be different sizes if a shape is irregular. Look for children to point out that a shape is irregular if either both or only one of these things are not equal.

**ANSWERS** Answers for the **Reflect** part of the lesson appear in the separate **Practice and Reflect answer guide**.

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## After the lesson

- Are children confident at recognising what can vary in irregular shapes?
- Are children able to recognise and explain concisely how regular and irregular shapes are similar?

# Classifying triangles

## Learning focus

In this lesson, children will identify the three different types of triangles. They will understand the properties of scalene, isosceles and equilateral triangles in relation to their angles and the length of sides.

## Small steps

- Previous step: Identifying regular and irregular shapes
- **This step: Classifying triangles**
- Next step: Classifying and comparing quadrilaterals

## NATIONAL CURRICULUM LINKS

**Year 4 Geometry – Properties of Shapes**

Compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes.

## ASSESSING MASTERY

Children can identify and classify scalene, isosceles and equilateral triangles. They can identify that equilateral triangles have three sides which are the same length and three angles the same size; that isosceles triangles have two sides which are the same length and two angles the same size; and that scalene triangles have three sides of different lengths and three angles of different sizes.

## COMMON MISCONCEPTIONS

Children may need support to identify the different types of triangles when their orientation is unfamiliar. Ask:

- *Is it easier if you draw the shape and turn it around? Are the sides of the triangle all the same length? Are the interior angles of this triangle all the same?*

## STRENGTHENING UNDERSTANDING

Provide children with a range of different triangles that they can sort, either drawn on paper, as 2D shapes, or photos of shapes. Discuss with children how they sort them and encourage them to look at the properties of the shapes. For example, hold up a scalene triangle and ask: *Which triangle is similar? Why?*

## GOING DEEPER

Challenge children by giving them a large paper equilateral triangle and asking: *How many different triangles can you find by folding or cutting the paper?*

## KEY LANGUAGE

**In lesson:** classify, triangle, similar, different, **isosceles**, **scalene**, **equilateral**, sides, angles, acute, quarter turn, geoboard, rotated, 90°, equal

**Other language to be used by the teacher:** longer, shorter, obtuse, half turn, right angle

## STRUCTURES AND REPRESENTATIONS

2D shapes

## RESOURCES

**Optional:** A range of different triangles, 2D shapes

In the eTextbook of this lesson, you will find interactive links to a selection of teaching tools.

## Before you teach

- What knowledge do children have of triangles?
- How secure are children in comparing angles?

# Discover

**WAYS OF WORKING** Pair work

**ASK**

- Question 1 a): *Can you draw a scalene/isosceles triangle on a white board?*
- Question 1 b): *What can you tell me about the angles of the triangles?*
- Question 1 b): *What can you tell me about the sides of the triangles?*

**IN FOCUS** Question 1 b) encourages children to compare the triangles and think about their properties. Prompt children, if necessary, to look at the length of the sides and the size of the interior angles. This will lay the groundwork for identifying different types of triangles.

**PRACTICAL TIPS** Provide children with square and rectangular pieces of paper so that they can carry out the folding themselves. They will then be able to directly compare the two triangles.

**ANSWERS**

Question 1 a): Ambika and Lee have made triangles.

Question 1 b): Ways in which triangles are the same:
Both triangles have a right-angle.
Ways in which triangles are different:
When folded, the square makes a triangle that has two equal sides and two equal angles (an isosceles triangle) and the rectangle makes a triangle that has three unequal sides and three unequal angles (a scalene triangle).

## Classifying triangles

### Discover



1 a) Ambika folds a square piece of paper in half diagonally and Lee folds a rectangular piece of paper in half diagonally. What shapes have they made?

b) How are the two different triangles similar and how are they different?

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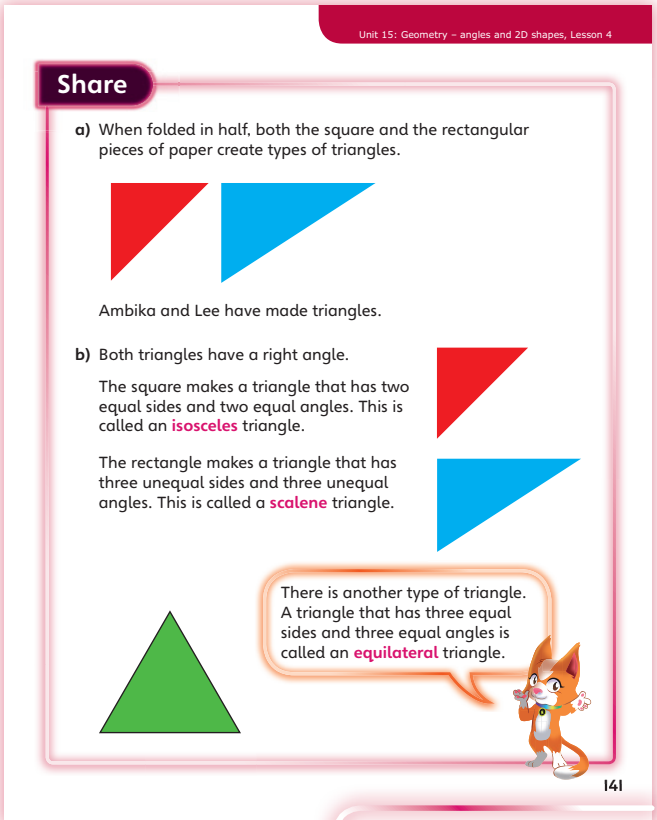
# Share

**WAYS OF WORKING** Whole class teacher led

**ASK**

- Question 1 a): *What type of triangle would it make if you folded the square piece of paper in half a second time?*
- Question 1 a): *Is it possible to make an equilateral triangle from either paper?*
- Question 1 b): *Could you draw a third triangle that is different to the two in the question?*

**IN FOCUS** Question 1 b) provides a definition of scalene and isosceles triangles. Ensure children understand these definitions. If necessary, get children to measure the sides of the triangles as proof. Give them two identical isosceles triangles so that they can directly compare the size of the angles.




### Share

a) When folded in half, both the square and the rectangular pieces of paper create types of triangles.

Ambika and Lee have made triangles.

b) Both triangles have a right angle.

The square makes a triangle that has two equal sides and two equal angles. This is called an **isosceles** triangle.

The rectangle makes a triangle that has three unequal sides and three unequal angles. This is called a **scalene** triangle.

There is another type of triangle. A triangle that has three equal sides and three equal angles is called an **equilateral** triangle.

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# Think together

**WAYS OF WORKING** Whole class teacher led (I do, We do, You do)

**ASK**

- Question 1: *Do all isosceles/scalene triangles look the same?*
- Question 3: *How do you know which type of triangle you have created?*
- Question 3: *How can you be sure that all of your triangles are different?*

**IN FOCUS** Question 2 presents children with different isosceles triangles that look different both in orientation and size of angles. It is important to highlight that an isosceles triangle is only defined by two equal sides and two equal angles and that therefore isosceles triangles can look quite different from each other.

**STRENGTHEN** Provide children with a range of triangles that they can explore and sort. In order to compare angles within a triangle, children can draw around one triangle and then see if any of the angles match by comparing directly. For question 1 children could measure the lengths of the sides using a ruler to help determine what type of triangle they are.

**DEEPEN** Challenge children to explore questions about triangles by providing them with triangles to draw around. Ask: *Can you join triangles together to make a new triangle? How many equilateral triangles are needed to make a larger equilateral triangle?*

**ASSESSMENT CHECKPOINT** Question 3 will demonstrate whether children understand the properties of scalene, isosceles and equilateral triangles.

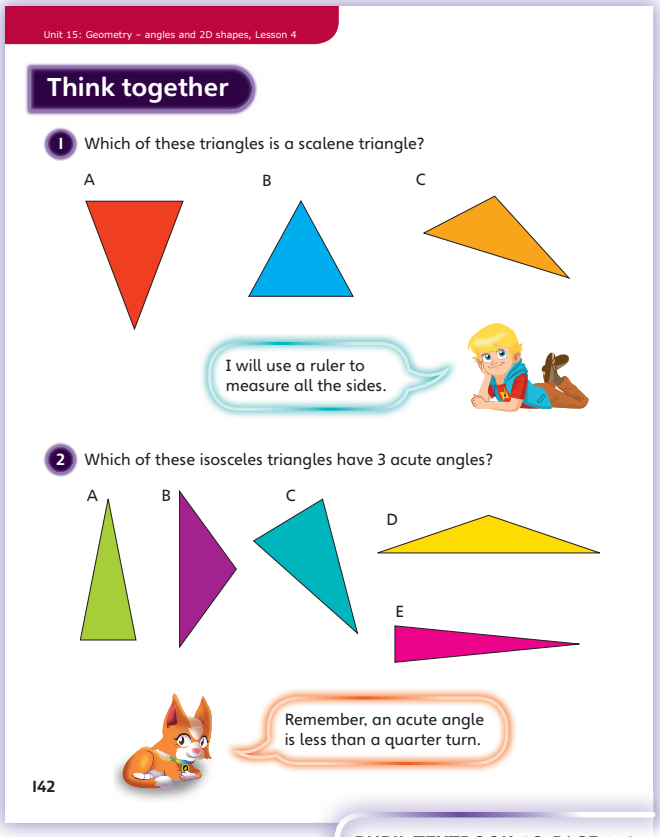
**ANSWERS**

Question 1: C is a scalene triangle

Question 2: A, C and E have 3 acute angles.

Question 3 a): There are a number of triangles that can be made. Each triangle should be different in size or angles and/or length of sides, not just in orientation. There are 8 different triangles that can be made.

Question 3 b): Ask children for suggestions as to how they know they have found them all. Discuss these suggestions as a class. The easiest way would be to draw a number of 3×3 grids or geoboards on squared paper and draw one triangle on each, until you cannot find any more.

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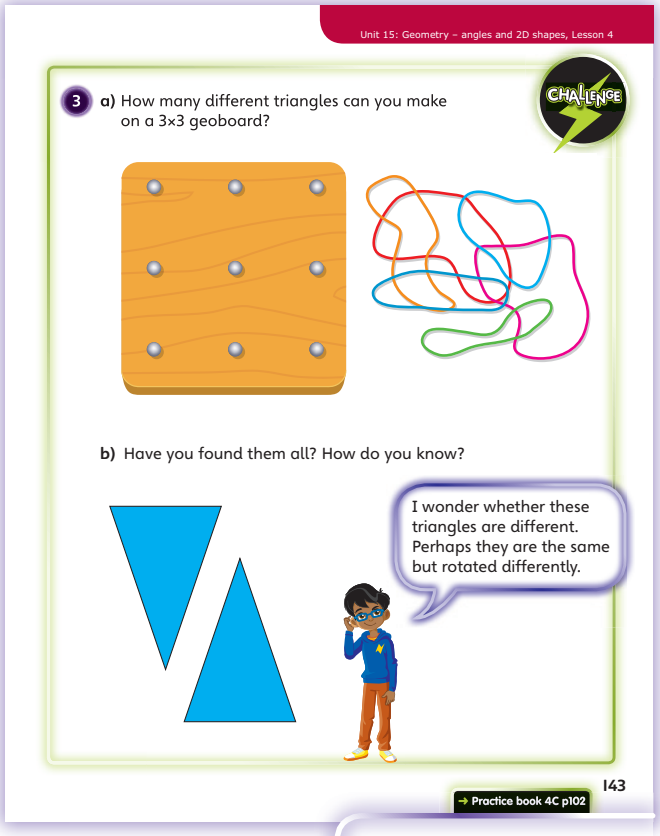


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## Practice

**WAYS OF WORKING** Independent thinking

**IN FOCUS** Question 4 asks children to sort the triangles based on the properties that determine the type of triangle. Children need to look carefully at the length of sides and the size of the angles of each triangle in order to place them correctly in the table. The comment made by Ash should help children come to the realisation that if a triangle has two sides of equal length, then it will have two angles of equal size also.

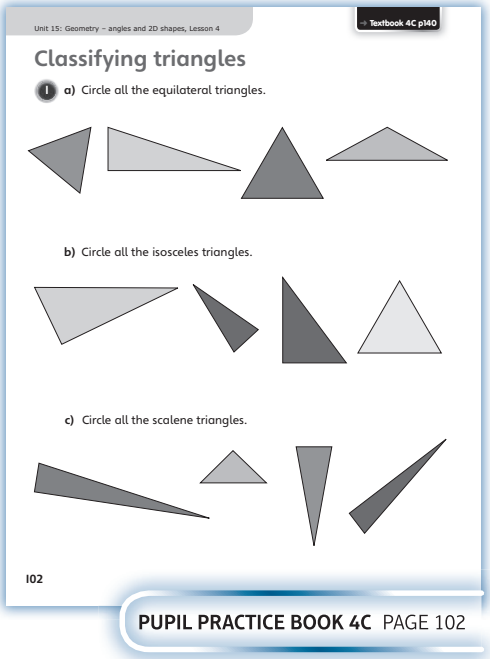
**STRENGTHEN** Provide children with examples of each type of triangle with labels and definitions to refer to. They could look around their environment to try to find examples of each type of triangle.

**DEEPEN** To extend question 5, give children a range of 2D shapes to draw around. Ask: *Which shapes can be divided like the pentagon in the question to create scalene/isosceles/equilateral triangles?*

**THINK DIFFERENTLY** Question 3 requires children to visualise the types of triangles required. They need to reason that in order to create an isosceles triangle, they will need to draw lines from the midpoint of one side to the two opposite corners. The children need to have a secure understanding of what makes a triangle an isosceles triangle in order to solve this problem.

**ASSESSMENT CHECKPOINT** Question 1 will demonstrate whether the children can identify equilateral, isosceles and scalene triangles. Questions 2 and 4 will demonstrate whether children are able to define the types of triangle, give them the correct properties and identify triangles with different dimensions and in different orientations.

**ANSWERS** Answers for the **Practice** part of the lesson appear in the separate **Practice and Reflect answer guide**.

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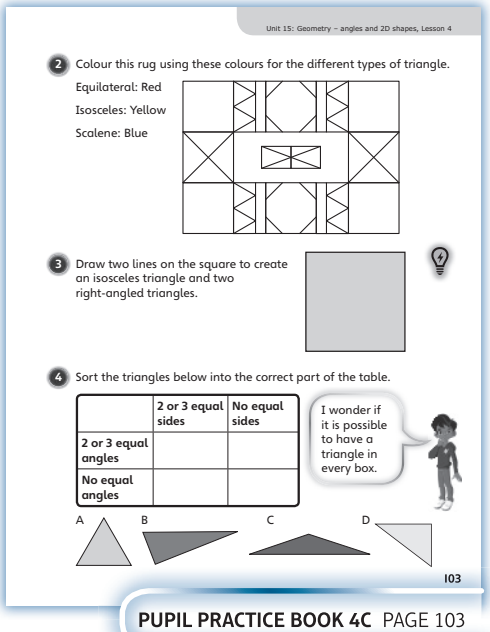


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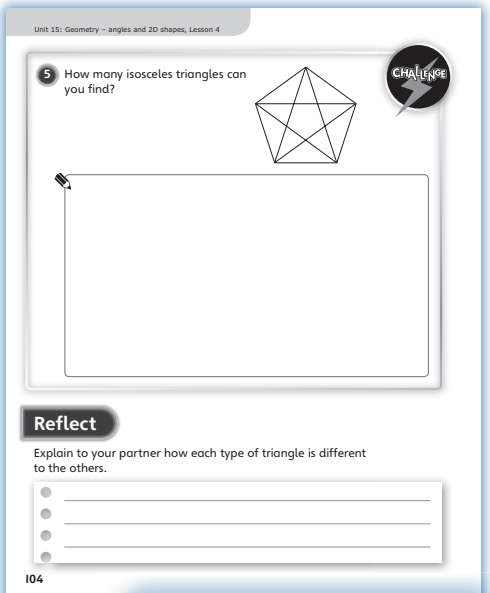
## Reflect

**WAYS OF WORKING** Independent thinking

**IN FOCUS** This section prompts children to discuss the properties of the different types of triangles. This will consolidate their learning from this lesson or help to identify any misconceptions about the properties of scalene, isosceles and equilateral triangles.

**ASSESSMENT CHECKPOINT** This section will determine whether children are secure in their understanding of the definitions of each type of triangle.

**ANSWERS** Answers for the **Reflect** part of the lesson appear in the separate **Practice and Reflect answer guide**.

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## After the lesson

- Do children have a secure understanding of the differences between the three types of triangle?
- How can you link the learning from this lesson to the next lesson on classifying and comparing quadrilaterals?

# Classifying and comparing quadrilaterals

## Learning focus

In this lesson, children will name, describe and identify quadrilaterals, recognising their similarities and differences. They will use their knowledge to classify and compare quadrilaterals.

## Small steps

- Previous step: Classifying triangles
- **This step: Classifying and comparing quadrilaterals**
- Next step: Deducing facts about shapes

## NATIONAL CURRICULUM LINKS

**Year 4 Geometry – Properties of Shapes**

Compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes.

## ASSESSING MASTERY

Children can confidently identify quadrilaterals, giving each their specific name and describing their properties. They can explain how different quadrilaterals are similar and how they are different and can use this understanding to solve mathematical problems.

## COMMON MISCONCEPTIONS

Children may assume that the word 'quadrilateral' is the name of only one shape. Create a visual reminder, such as a wall display, showing the quadrilaterals children will be studying. Ask:

- *What is similar about all these shapes? What is different?*

## STRENGTHENING UNDERSTANDING

Give children a large loop of string. In groups of 4 to 6, ask children to create different four-sided shapes with the loop of string, holding it taut between them. Ask: *Can you draw each shape you make? What do you notice is similar and what is different about your shapes?*

## GOING DEEPER

Encourage children to investigate different kinds of quadrilaterals. For example, ask children: *Can you find a quadrilateral that only has acute interior angles? Can you find a quadrilateral that only has obtuse interior angles? If you draw two lines through a quadrilateral, what types of triangles can you find?*

## KEY LANGUAGE

**In lesson:** classify, compare, quadrilateral, regular, properties, different, sides, angles, 2D, rhombus, interior angles, square, irregular, equal, unequal, parallelogram, parallel, distance, trapezium, sorting circle, rectangle

**Other language to be used by the teacher:** same, kite, polygon

## STRUCTURES AND REPRESENTATIONS

2D shapes

## RESOURCES

**Optional:** 2D shapes, geo boards with elastic bands, geo strip kit

In the eTextbook of this lesson, you will find interactive links to a selection of teaching tools.

## Before you teach

- What manipulatives could you provide beyond plastic 2D shapes to help children visualise quadrilaterals?
- How will you link this lesson to children's learning about angles?

# Discover

**WAYS OF WORKING** Pair work

**ASK**

- Question 1 a): *What is the same about the shapes Olivia has made? What is different about them?*
- Question 1 b): *Could she have made any different four-sided shapes?*
- Question 1 b): *Are there any four-sided shapes you already know? Are there any you don't recognise in the picture?*

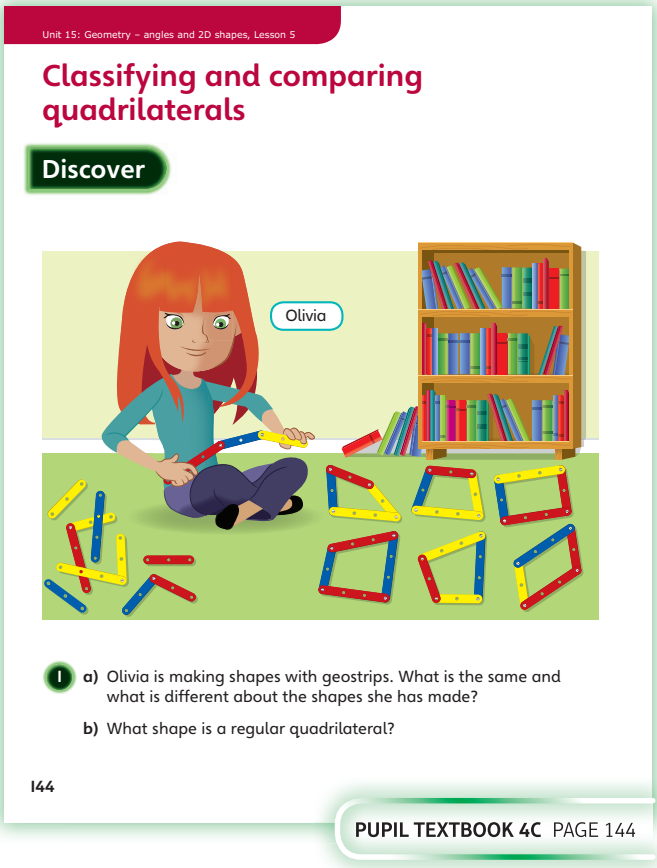
**IN FOCUS** During this part of the lesson it will be important, through discussion, to give children the opportunity to generalise about quadrilaterals. Using the practical tips below will help scaffold these generalisations.

**PRACTICAL TIPS** Provide children with geostrips or geoboards to create different four-sided shapes. Once they have made two or three shapes, ask: *Can you describe what is similar and what is different about these shapes? Can you compare them with your partner's shapes and describe the similarities and differences?*

**ANSWERS**

Question 1 a): Properties which are the same: All have four sides and four angles so all of these shapes are quadrilaterals.
Differences: The shapes have different side lengths and angle sizes.

Question 1 b): A regular quadrilateral with four sides and four angles is a square.

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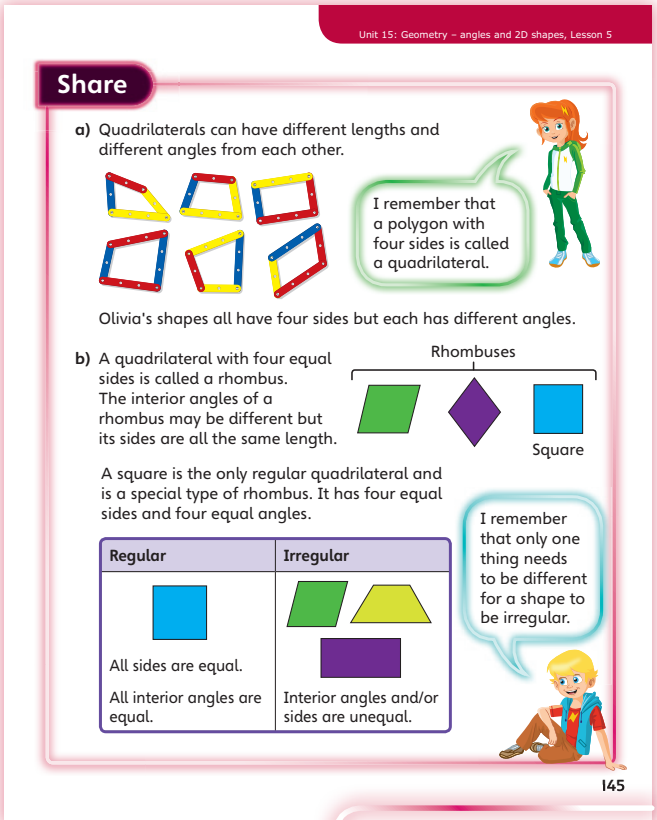
# Share

**WAYS OF WORKING** Whole class teacher led

**ASK**

- Question 1 a): *What is the same about all the sides in every quadrilateral? What is different?*
- Question 1 a): *What is the same about all the angles in a quadrilateral? What is different?*
- Question 1 b): *How is a rhombus different to a square? How is it similar?*
- Question 1 b): *Which quadrilaterals are regular and which are irregular? How do you know?*

**IN FOCUS** Use this part of the lesson to discuss further the features of the quadrilaterals children have seen or made. Discuss how they each fit with the generalisations children made in the **Discover** section of the lesson. It will be interesting for children to discuss which quadrilaterals are regular and irregular, and discover that a square is the only regular quadrilateral.

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# Think together

**WAYS OF WORKING** Whole class teacher led (I do, We do, You do)

**ASK**

- Question 1: *What is important about parallel lines?*
- Question 1: *How can you identify parallel sides?*
- Question 2: *How many different trapeziums can you draw?*
- Question 3: *What quadrilaterals have a right angle? Can you find them all?*

**IN FOCUS** Throughout the activities in this section of the lesson, it would be beneficial to give children the opportunity to explore and create the shapes they are studying using geo boards and/or geo strips.

**STRENGTHEN** For question 2, it may help to offer children pictures of different quadrilaterals. Ask: *Which of these quadrilaterals are trapeziums? Can you use the pictures to help you draw your own trapezium?*

**DEEPEN** When working on question 3 b), children who have successfully completed the sorting circle could be encouraged to come up with another criterion for a third circle or alternatively, three new criteria. Having done so, they could give their new sorting circle to a partner to sort their quadrilaterals into.

**ASSESSMENT CHECKPOINT** At this point in the lesson children should recognise quadrilaterals as shapes with four sides and four angles. They should recognise that there are many different types of quadrilateral and should be able to name some of them with more confidence.

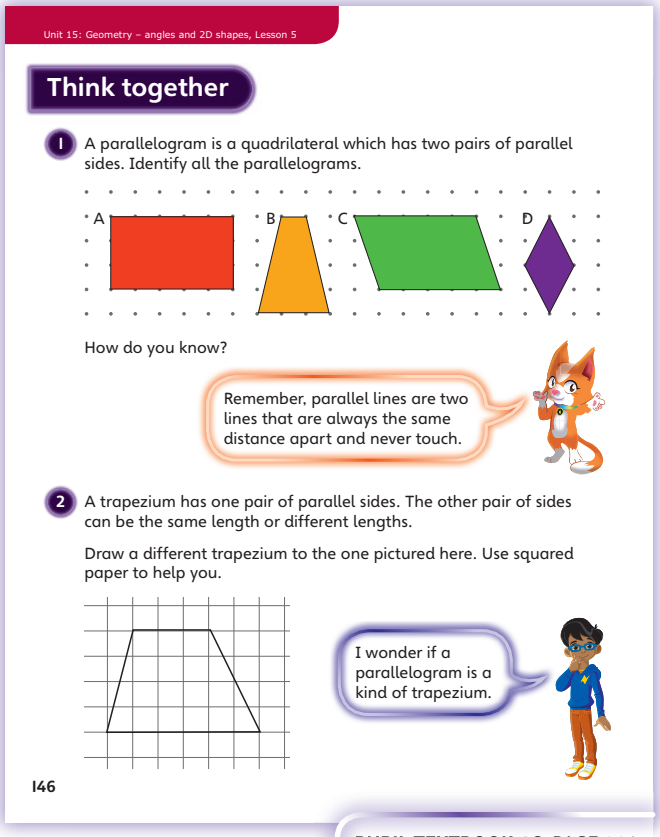
**ANSWERS**

Question 1: A, C and D are parallelograms.

Question 2: Children should draw another, different, trapezium.

Question 3 a): Children should be able to create all the quadrilaterals they have studied so far.

Question 3 b): The quadrilaterals the children have created in part a) should be sorted correctly into the sorting circle.

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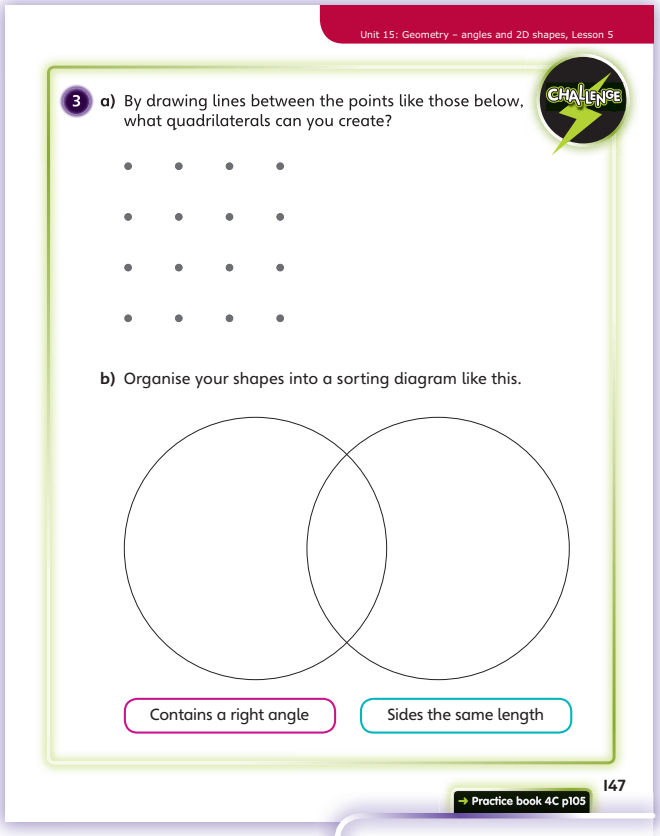


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## Practice

**WAYS OF WORKING** Independent thinking

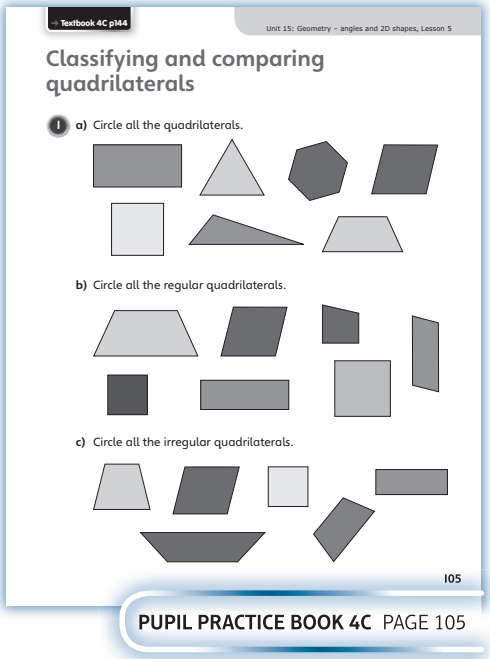
**IN FOCUS** While solving all the problems in this section of the lesson, ask children to name the shapes they see in each question or are drawing themselves. Discuss the properties of each shape and encourage children to link them to the mathematical shape name.

**STRENGTHEN** If children have difficulty drawing the quadrilaterals in questions 2 and 4 using isometric paper, offer them square dotted paper to help them draw the shapes more easily. Ensure children's understanding by continuing to encourage them to describe and name each quadrilateral they draw.

**DEEPEN** If children solve question 4, their learning could be deepened by asking them to create similar challenges for a partner. Ask: *What is the fewest number of clues you can give to someone for them to be able to successfully guess and draw a rhombus?*

**ASSESSMENT CHECKPOINT** Children should be able to name and describe the different types of quadrilateral more confidently. They should be able to point out and explain why some quadrilaterals can be categorised under more than one name, for example a square could also be classed as a rhombus, a rectangle or a parallelogram.

**ANSWERS** Answers for the **Practice** part of the lesson appear in the separate **Practice and Reflect answer guide**.


Textbook 4C p144

Unit 15: Geometry – angles and 2D shapes, Lesson 5

Classifying and comparing quadrilaterals

1 a) Circle all the quadrilaterals.

b) Circle all the regular quadrilaterals.

c) Circle all the irregular quadrilaterals.

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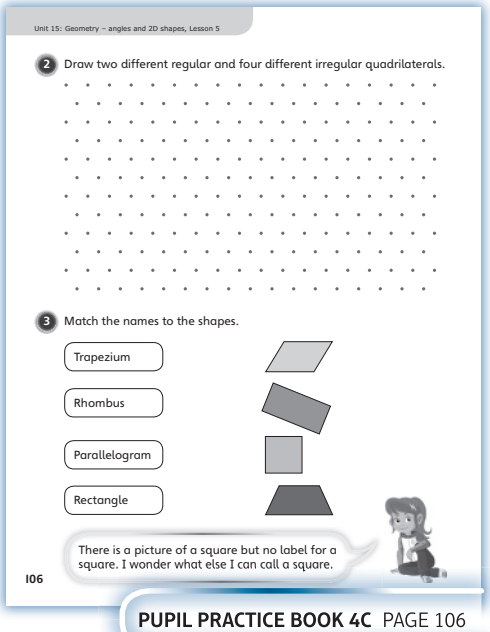
Unit 15: Geometry – angles and 2D shapes, Lesson 5

2 Draw two different regular and four different irregular quadrilaterals.

3 Match the names to the shapes.

Trapezium

Rhombus

Parallelogram

Rectangle

There is a picture of a square but no label for a square. I wonder what else I can call a square.

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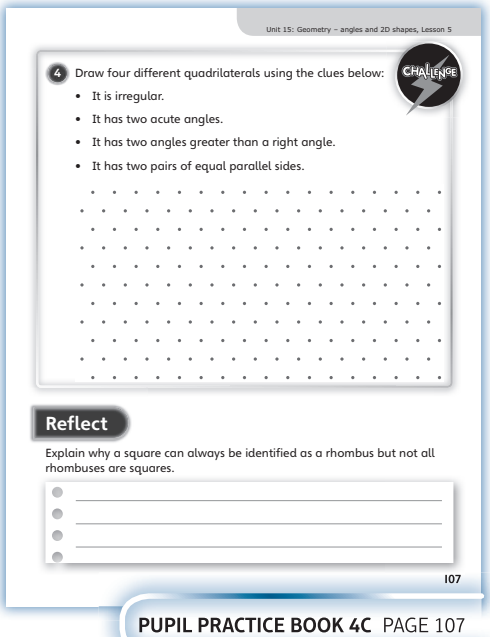
## Reflect

**WAYS OF WORKING** Pair work

**IN FOCUS** Give children time to discuss this question. Ask: *Are there any other instances of this kind of scenario that can happen with different quadrilaterals?* If children come up with other examples, encourage them to offer proof to support their ideas.

**ASSESSMENT CHECKPOINT** Children should be able to explain how the properties of one type of quadrilateral may encompass that of another type of quadrilateral.

**ANSWERS** Answers for the **Reflect** part of the lesson appear in the separate **Practice and Reflect answer guide**.


Unit 15: Geometry – angles and 2D shapes, Lesson 5

4 Draw four different quadrilaterals using the clues below:

- It is irregular.
- It has two acute angles.
- It has two angles greater than a right angle.
- It has two pairs of equal parallel sides.

CHALLENGE

Reflect

Explain why a square can always be identified as a rhombus but not all rhombuses are squares.

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## After the lesson

- How confident are children at naming all the types of quadrilateral?
- What support will you offer for those children who are still developing their understanding of quadrilateral names and properties?

# Deducing facts about shapes

## Learning focus

In this lesson, children will consolidate their learning about 2D shapes and use it to help them solve shape problems and puzzles.

## Small steps

- Previous step: Classifying and comparing quadrilaterals
- **This step: Deducing facts about shapes**
- Next step: Lines of symmetry inside a shape

## NATIONAL CURRICULUM LINKS

**Year 4 Geometry – Properties of Shapes**

Compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes.

## ASSESSING MASTERY

Children can confidently use the vocabulary and properties of 2D shapes and angles to understand and solve problems and puzzles. They can fluently explain their ideas and reasoning.

## COMMON MISCONCEPTIONS

In this lesson, questions will focus on what shapes are created when pieces of paper are overlapped. Some questions will focus on the complete shape made by the two pieces of paper, other questions will focus on the smaller shape made by the overlap. Children may confuse these two ideas. Ask:

- *Have you read the question carefully? What does it ask you to do?*

## STRENGTHENING UNDERSTANDING

Before the lesson, play some games with children that recap their learning about shapes. For example, hold a shape behind your back and describe it. Ask: *Can you guess the shape?* Alternately, children could play pairs – each child should have either a card with a picture of a shape or a card with the name of the shape written on it. The children have to find their pair (the person with the card that matches theirs).

## GOING DEEPER

Encourage children to create puzzles, similar to those in the lesson, for their partners. Ask: *Can you create an overlapping puzzle for your partner?*

## KEY LANGUAGE

**In lesson:** deducing, facts, overlapping, regular, hexagon, largest, corners, sides, equal, angles, hexadecagon, quadrilateral, equilateral, triangle, edge, different, square, rectangle, rhombus, trapezium, kite, arrowhead, pentagon, isosceles, perimeter, length, polygon

**Other language to be used by the teacher:** irregular, scalene, heptagon, octagon, acute, obtuse, right angle, polygon

## STRUCTURES AND REPRESENTATIONS

2D shapes

## RESOURCES

**Optional:** 2D shapes, paper squares, cards for pairs game – set of cards, half with a picture of a shape, the other half with the name of a shape

In the eTextbook of this lesson, you will find interactive links to a selection of teaching tools.

## Before you teach

- Are there any types of shapes that children are less confident with?

# Discover

**WAYS OF WORKING** Pair work

**ASK**

- Question 1 a): *Why is Bella's shape irregular?*
- Question 1 b): *Can you make a regular hexagon?*
- Question 1 b): *What other shapes can you make?*
- Question 1 b): *Is it possible to make a shape with an acute angle using the two squares?*

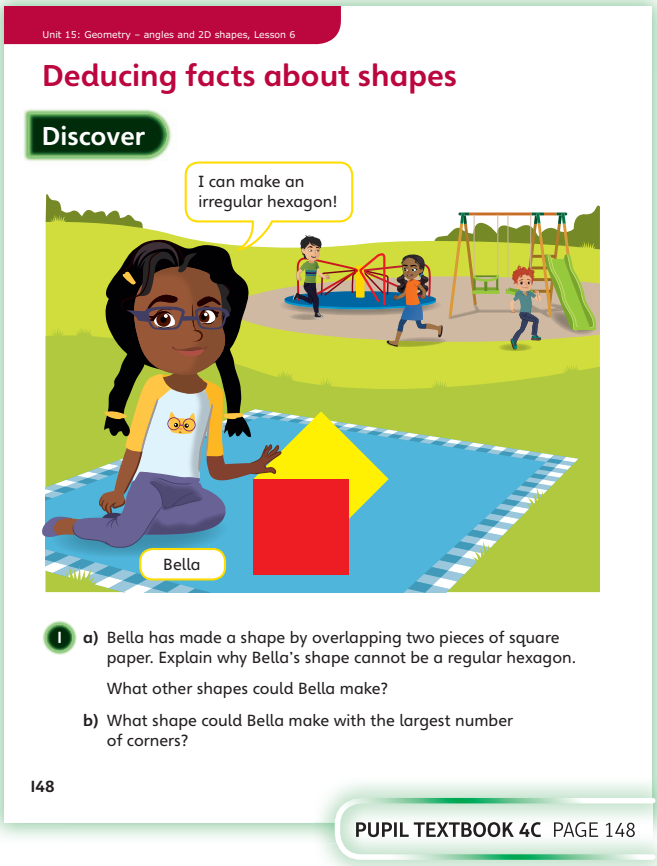
**IN FOCUS** Ensure children understand how the questions in this lesson work. Be sure to point out how the hexagon has been created by the total area of the two overlapping shapes. Children will engage best with this part of the lesson if it is made as practical as possible; be sure to follow the advice below in **Practical Tips**.

**PRACTICAL TIPS** Make sure you give children an opportunity to copy the activity shown in the **Discover** picture. Children could investigate what other hexagons they can make or how many different shapes it is possible to make. It will be beneficial to give children square pieces of paper to use to recreate the shapes in this lesson. They could also use plain paper to draw the shapes they create as a way of recording them.

**ANSWERS**

Question 1 a): Bella's shape cannot be a regular hexagon as the angles and sides are unequal. Bella could make shapes such as a rectangle, an irregular heptagon and an irregular octagon.

Question 1 b): Bella could make a hexadecagon which has 16 corners.

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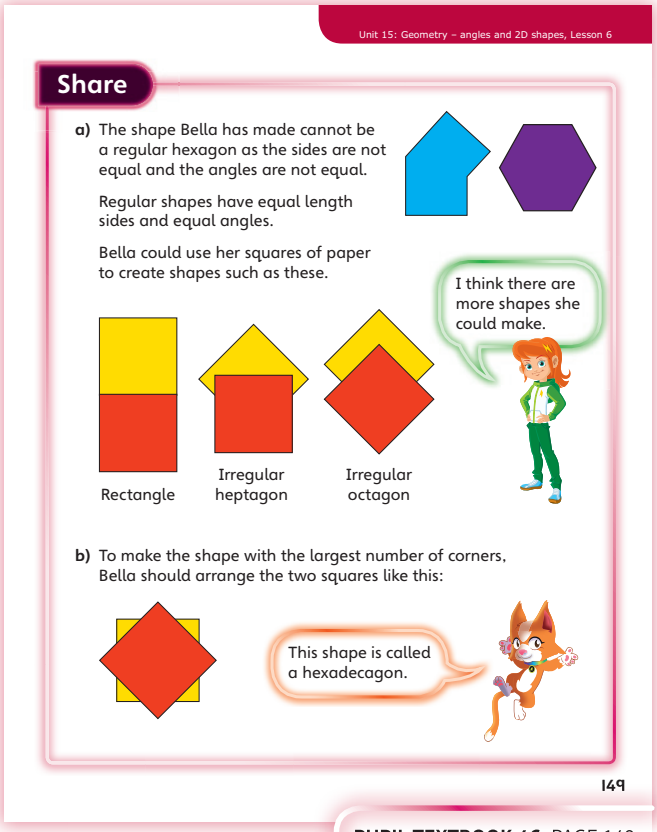
# Share

**WAYS OF WORKING** Whole class teacher led

**ASK**

- Question 1 b): *What shapes did you find?*
- Question 1 b): *Did you and your partner find similar shapes?*
- Question 1 b): *What was the shape with the fewest possible angles/sides?*
- Question 1 b): *What regular shapes were you able to create?*
- Question 1 b): *Was it easier to create regular or irregular shapes?*

**IN FOCUS** Encourage children to consider why some shapes are impossible to create with the given squares of paper. For example, they could be encouraged to reason why it will be impossible to make a shape that has an interior acute angle.

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# Think together

**WAYS OF WORKING** Whole class teacher led (I do, We do, You do)

**ASK**

- Question 1: *What quadrilaterals have you learnt about? What are their properties?*
- Question 2: *Is it possible to make a square using equilateral triangles?*
- Question 2: *How can you prove your ideas?*
- Question 2: *How will you know you have found all the possibilities?*
- Question 3: *What type of angles can you see in this shape?*

**IN FOCUS** For all the questions in this part of the lesson, offer children practical opportunities to investigate the solutions. Have cut out shapes ready for children to manipulate. Question 3 focuses on the shape made within the overlap of two squares of paper. It will be important for children to be aware of this to solve the problem successfully.

**STRENGTHEN** Have resources available for children to manipulate to visualise the shapes. These could include plastic 2D shapes or pictures of the shapes they have been studying. Ask: *Which shapes look like those in the textbook? Can you combine the shapes to make the ones pictured?*

**DEEPEN** Question 3 will deepen children's understanding that a single shape can be classed as multiple types of quadrilateral. If children are insisting that a rhombus or a kite cannot be made, ask them about the rhombuses they made before: *Did they all look the same? Did some look like other shapes they know?*

**ASSESSMENT CHECKPOINT** Children should be showing confidence at using their knowledge and understanding to solve shape puzzles. They should be using the vocabulary they have learnt fluently to explain their reasoning.

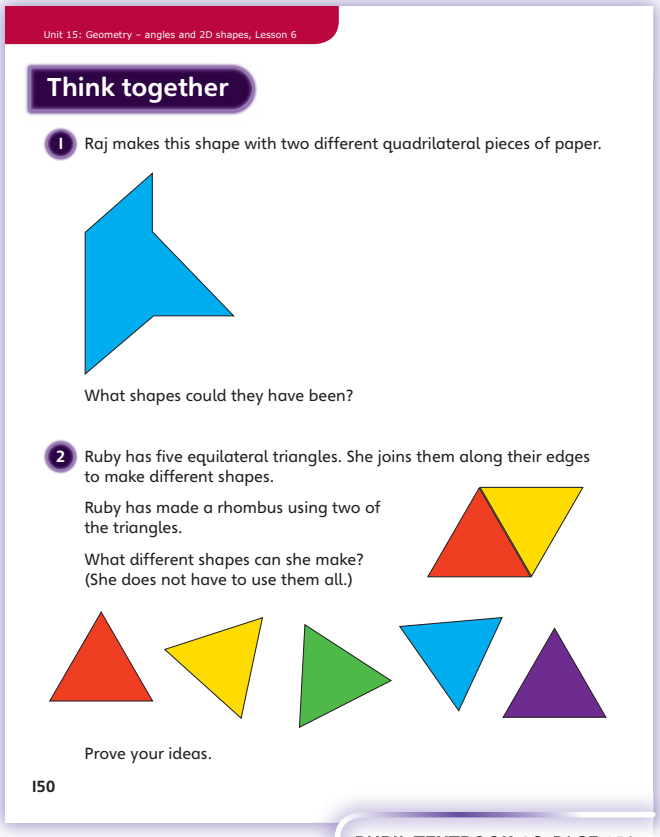
**ANSWERS**

Question 1: Different answers are possible, for example:
He used a trapezium and a parallelogram;
He used two parallelograms.

Question 2: She could make:
A rhombus
An equilateral triangle
A trapezium
An irregular heptagon
An irregular hexagon
A parallelogram
An irregular pentagon

Question 3:

| Quadrilateral | Can it be made? |
|---|---|
| Square | Yes |
| Rectangle | Yes |
| Rhombus | Yes (as a square) |
| Trapezium | No |
| Kite | Yes (as a square) |
| Arrowhead | No |

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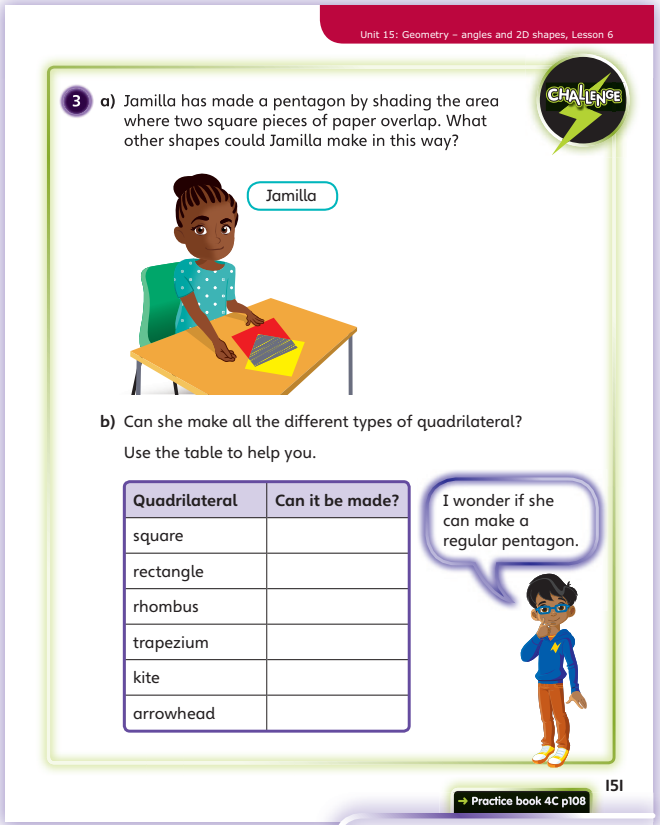


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## Practice

**WAYS OF WORKING** Independent thinking

**IN FOCUS** Provide children with practical manipulatives to help them solve the puzzles in this part of the lesson.

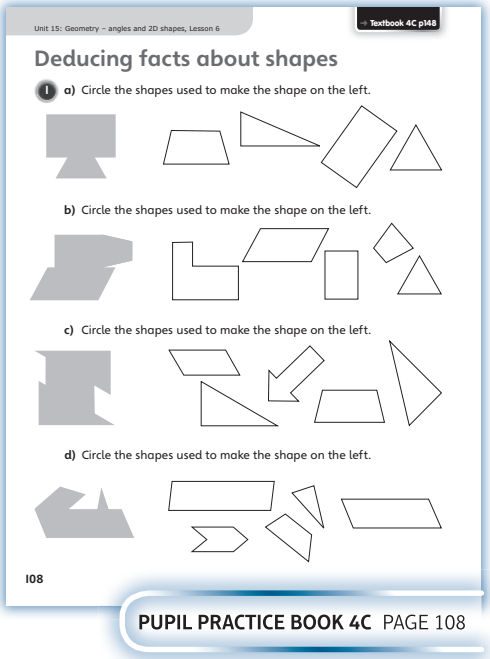
**STRENGTHEN** To help children visualise triangles and quadrilaterals while solving questions 3 and 4, ask them about the triangles and quadrilaterals they have learnt about. Ask: *Can you draw what they look like?* Get children to compare their drawings to the shapes on the page. Ask: *Can you explain how they are similar?*

**DEEPEN** Extend question 5 by asking children to find another way of completing the headings for the table. Ask: *How many solutions are there? How do they know?*

**THINK DIFFERENTLY** When solving question 2, encourage children to investigate how the possible shapes that can be made change, depending on whether they are looking at the whole shape, or just the smaller shape within the overlap. Ask: *Are some shapes possible when looking at the whole shape but not when looking at the overlap of the shapes?*

**ASSESSMENT CHECKPOINT** Children should be confidently and fluently applying their knowledge and understanding, using appropriate vocabulary to describe the shapes and their properties, and sharing their reasoning concisely and clearly.

**ANSWERS** Answers for the **Practice** part of the lesson appear in the separate **Practice and Reflect answer guide**.

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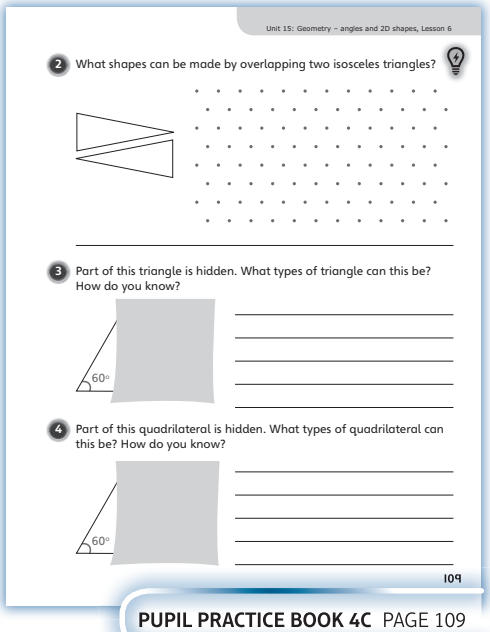


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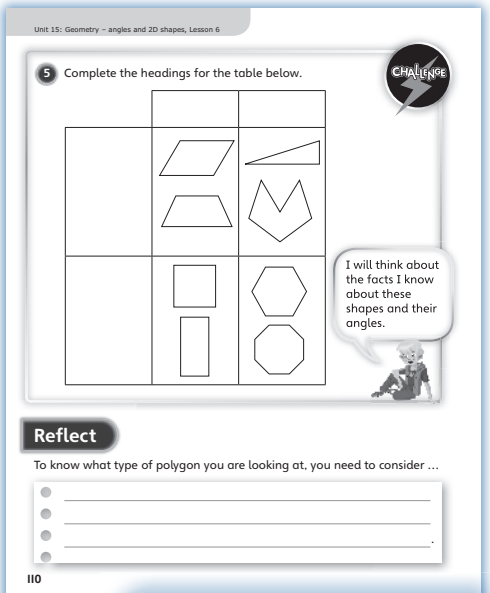
## Reflect

**WAYS OF WORKING** Independent thinking

**IN FOCUS** Give children time to formulate their own reasoning to finish the given sentence starter. Once they have written their ideas, share in partners and with the class.

**ASSESSMENT CHECKPOINT** Children should be able to list all the properties they need to consider to identify a polygon.

**ANSWERS** Answers for the **Reflect** part of the lesson appear in the separate **Practice and Reflect answer guide**.

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## After the lesson

- Were children more confident with certain shapes than with others?
- How confident were children at applying their problem-solving skills in this lesson?

# Lines of symmetry inside a shape

## Learning focus

In this lesson, children will explore reflective symmetry. They will identify lines of symmetry within regular and irregular polygons.

## Small steps

- Previous step: Deducing facts about shapes
- **This step: Lines of symmetry inside a shape**
- Next step: Lines of symmetry outside a shape

## NATIONAL CURRICULUM LINKS

**Year 4 Geometry – Properties of Shapes**

Identify lines of symmetry in 2D shapes presented in different orientations.

## ASSESSING MASTERY

Children can identify lines of symmetry in a range of 2D shapes. They can identify when a shape does not have reflective symmetry and explain why. They can identify when a shape has multiple lines of symmetry and explain what symmetry means.

## COMMON MISCONCEPTIONS

Children may think that if a shape can be folded in half, then it has symmetry. For example, an oblong rectangle can be folded along the diagonal, producing two similar triangles. However, they are not mirror images of each other. Ask:

- *Would the whole shape be shown if you put a mirror against the line of symmetry? If not, then is it symmetrical?*

## STRENGTHENING UNDERSTANDING

Encourage children to explore symmetry by folding shapes. Explain that the two halves need to match exactly when they are folded. You could also provide children with mirrors to identify lines of symmetry. This helps children understand that opposite sides of the line of symmetry are mirror images of each other.

## GOING DEEPER

Ask children to work in pairs. Give children squared paper and ask them to draw a vertical line of symmetry down the centre. Ask one child to draw half a polygon on the right side of the line. The other child then has to complete the left side so that it is symmetrical. Children can make the shape as complex as they like. This challenge can be further extended by drawing both a vertical and horizontal line of symmetry and then one child draws a quarter of a shape in the first quadrant.

## KEY LANGUAGE

**In lesson:** **reflective symmetry**, symmetrical, lines of symmetry, square, equilateral, triangle, rectangle, hexagon, isosceles, regular, octagon, irregular, circle

**Other language to be used by the teacher:** isosceles, scalene, 2D, polygon

## STRUCTURES AND REPRESENTATIONS

2D shapes

## RESOURCES

**Optional:** range of 2D shapes, mirrors

In the eTextbook of this lesson, you will find interactive links to a selection of teaching tools.

## Before you teach

- Do children have experience with symmetry?
- Are children secure identifying and describing a range of 2D shapes?

## Discover

**WAYS OF WORKING** Pair work

**ASK**

- Question 1 b): *What do you think symmetry means?*
- Question 1 b): *What shapes do you know that are symmetrical?*
- Question 1 b): *How do you know if you have found a line of symmetry?*

**IN FOCUS** Question 1 b) requires children to visualise the triangle in order to identify the lines of symmetry. Children will have to draw on their knowledge of equilateral triangles from previous lessons in order to solve this problem.

**PRACTICAL TIPS** Provide children with paper squares and triangles for them to investigate the lines of symmetry. They could use mirrors to check if the lines they have found are lines of reflective symmetry.

**ANSWERS**

Question 1 a): Max is incorrect. The square has four lines of symmetry.

Question 1 b): There are three lines of symmetry of symmetry in an equilateral triangle.

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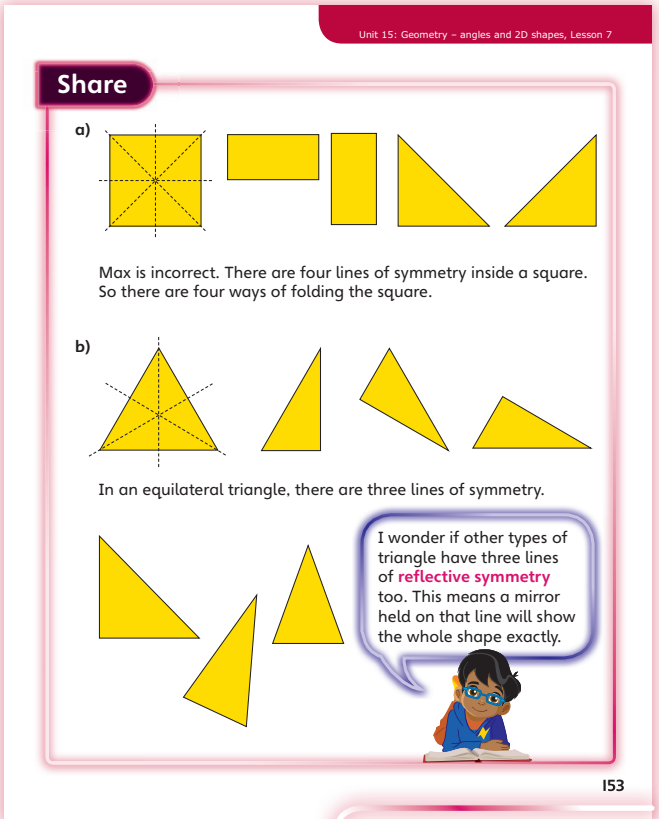
## Share

**WAYS OF WORKING** Whole class teacher led

**ASK**

- Question 1 a): *How can you prove that each line is a line of symmetry?*
- Question 1 a): *What do you notice about the number of lines of symmetry and the properties of the shape?*
- Question 1 b): *Does every triangle have a line of symmetry?*

**IN FOCUS** Ash's comment asks children to think about symmetry in other types of triangle. This could lead to a discussion about symmetry in regular and irregular polygons. Ask children to think about symmetry in other types of quadrilaterals. Ensure children understand the term 'reflective symmetry'. Explain that the shape on one side of a line of symmetry should be a mirror image of the shape on the other side.

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# Think together

**WAYS OF WORKING** Whole class teacher led (I do, We do, You do)

**ASK**

- Question 3: *How can you tell if a shape has symmetry?*
- Question 3: *Can you think of 2D shapes that do not have symmetry?*
- Question 3: *What shape do you think will have the most lines of symmetry?*

**IN FOCUS** Question 3 looks at symmetry within different types of quadrilaterals. The first parallelogram may raise the misconception that it has a line of symmetry between opposite corners as it produces two identical scalene triangles. Children need to understand that reflective symmetry means that one half is the mirror image of the other and not just the same shape rotated.

**STRENGTHEN** Give children the 2D shapes in the questions so that they can fold or explore them with mirrors. This will help children to identify any lines of symmetry.

**DEEPEN** Challenge children to find shapes with different numbers of lines of symmetry. Ask: *Can you find a shape that has one line of symmetry? Two lines? Three lines? Four lines? Five lines?*

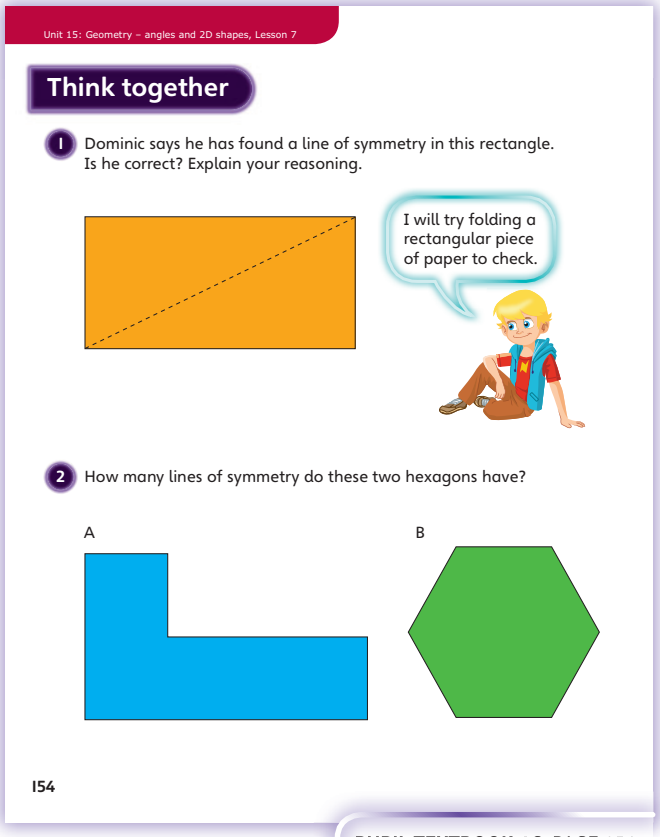
**ASSESSMENT CHECKPOINT** Question 1 will demonstrate whether children have an understanding of what symmetry means and question 3 will show whether children can identify symmetry in a range of quadrilaterals.

**ANSWERS**

Question 1: Dominic is not correct as the two halves are not mirror images of each other.

Question 2: The first hexagon has no lines of symmetry. The second hexagon has six lines of symmetry (because it is regular).

Question 3: The kite has one line of symmetry.
The parallelogram has no lines of symmetry.
The reflex kite has one line of symmetry.
The isosceles trapezium has one line of symmetry.
The oblong has two lines of symmetry.
The rhombus has two lines of symmetry.
The square has four lines of symmetry.
The right-angled trapezium has no lines of symmetry.

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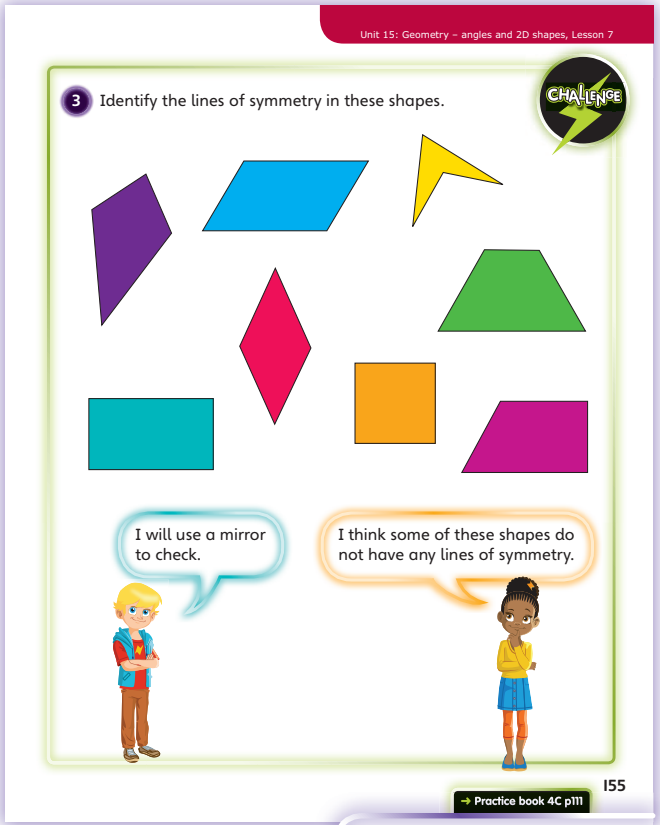


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## Practice

**WAYS OF WORKING** Independent thinking

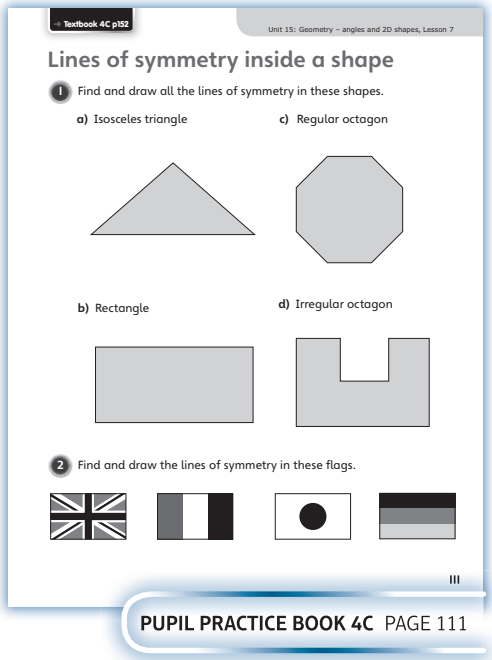
**IN FOCUS** Question 4 asks children to create a hexagon with two lines of symmetry. Children have to take care that there are **only** two lines of symmetry. Some children may start by drawing a random shape with six sides, while others may start with a regular hexagon. Children need to think about how to adapt a regular hexagon so that it becomes a shape with only two lines of symmetry.

**STRENGTHEN** Provide children with mirrors in order to investigate the symmetry of the shapes. For question 4, children could use a geoboard and an elastic band to try to solve the problem.

**DEEPEN** Challenge children to investigate the relationship between the number of lines of symmetry and the number of sides of regular 2D shapes. Ask: *What do you notice? Can you explain why?*

**ASSESSMENT CHECKPOINT** Question 3 will demonstrate whether children can sort shapes based on lines of symmetry and whether the shapes are regular or irregular, while question 5 will show whether children can create a shape with a given number of lines of symmetry.

**ANSWERS** Answers for the **Practice** part of the lesson appear in the separate **Practice and Reflect answer guide**.

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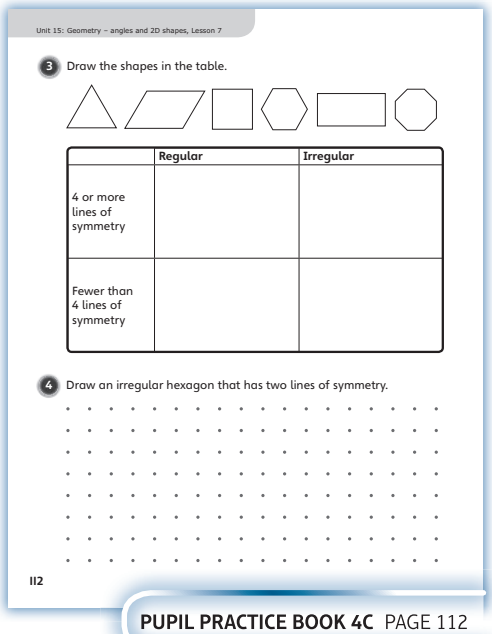


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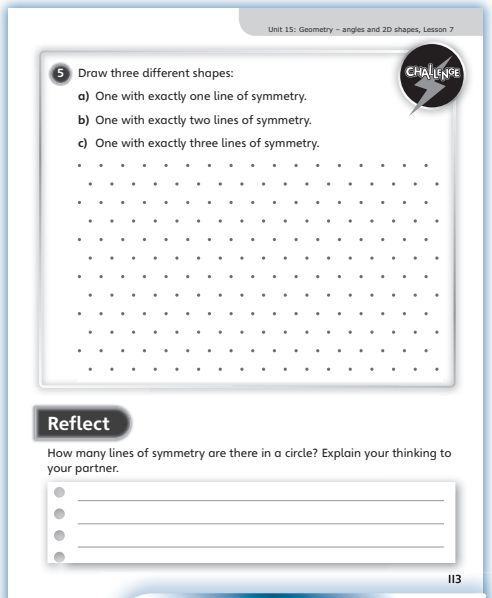
## Reflect

**WAYS OF WORKING** Pair work

**IN FOCUS** This section requires children to think deeper about symmetry in shapes. The closer a regular 2D shape gets to a circle, the more lines of symmetry it has.

**ASSESSMENT CHECKPOINT** This section will determine whether children understand symmetry and how to find symmetry in 2D shapes.

**ANSWERS** Answers for the **Reflect** part of the lesson appear in the separate **Practice and Reflect answer guide**.

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## After the lesson

- Did children identify all the lines of symmetry?
- Were children able to apply their knowledge from previous lessons on 2D shapes?
- Do children still need practical activities to support their understanding of symmetry?

# Lines of symmetry outside a shape

## Learning focus

In this lesson, children will identify symmetry within and outside shapes. They will learn to find symmetry within a range of patterns and designs.

## Small steps

- Previous step: Lines of symmetry inside a shape
- **This step: Lines of symmetry outside a shape**
- Next step: Completing a symmetric figure

## NATIONAL CURRICULUM LINKS

**Year 4 Geometry – Properties of Shapes**

Identify lines of symmetry in 2D shapes presented in different orientations.

## ASSESSING MASTERY

Children can identify lines of symmetry inside and outside of shapes and across a range of patterns and designs. They can identify when a shape has more than one line of symmetry and describe why a pattern is or is not symmetrical.

## COMMON MISCONCEPTIONS

Children may mistake a repeating pattern as symmetrical or may think that there is symmetry when the order of shapes are reversed but the shapes themselves are not reflected. Ask:

- *Is one side the mirror image of the other?*

## STRENGTHENING UNDERSTANDING

Provide children with mirrors to help them identify if or where a shape or design is symmetrical. Children may also benefit from a second copy of the pattern so they can make direct comparisons between the actual image and the image in the mirror.

## GOING DEEPER

Challenge children by providing them with a pattern that does not have symmetry and ask: *What would need to change in order for the pattern to have a vertical/diagonal/horizontal line of symmetry?*

## KEY LANGUAGE

**In lesson:** symmetry, vertical, diagonal, horizontal, continuous, reflective, sequence, symmetrical

**Other language to be used by the teacher:** polygon

## STRUCTURES AND REPRESENTATIONS

2D shapes

## RESOURCES

**Optional:** range of 2D shapes, mirrors

In the eTextbook of this lesson, you will find interactive links to a selection of teaching tools.

## Before you teach

- Are children confident finding lines of symmetry within a shape?
- Could you provide opportunities to find symmetry within the classroom?

# Discover

**WAYS OF WORKING** Pair work

**ASK**

- Question 1 a): *What do you look for when finding lines of symmetry?*
- Question 1 a): *What is the direction of the line of symmetry?*
- Question 1 b): *How do you know it is symmetrical?*

**IN FOCUS** Question 1 b) requires children to look closely at the shapes in the monster face. They may see the symmetry of the monster face as a whole but miss the symmetry of the individual shapes within the face.

**PRACTICAL TIPS** The use of mirrors will help children to explore the symmetry in the pictures. You could ask children to go on a symmetry hunt around the school to find items that have been arranged symmetrically.

**ANSWERS**

Question 1 a): A – The castle has a vertical line of symmetry.
B – The first pair of triangles have a diagonal line of symmetry.
C – The second pair of triangles have a vertical line of symmetry.
D – The title and pattern have a vertical line of symmetry. The individual shapes also have lines of symmetry.

Question 1 b): E – The monster's eyes have vertical and horizontal lines of symmetry; the mouth and nose have vertical lines of symmetry; the face as a whole has a vertical line of symmetry.

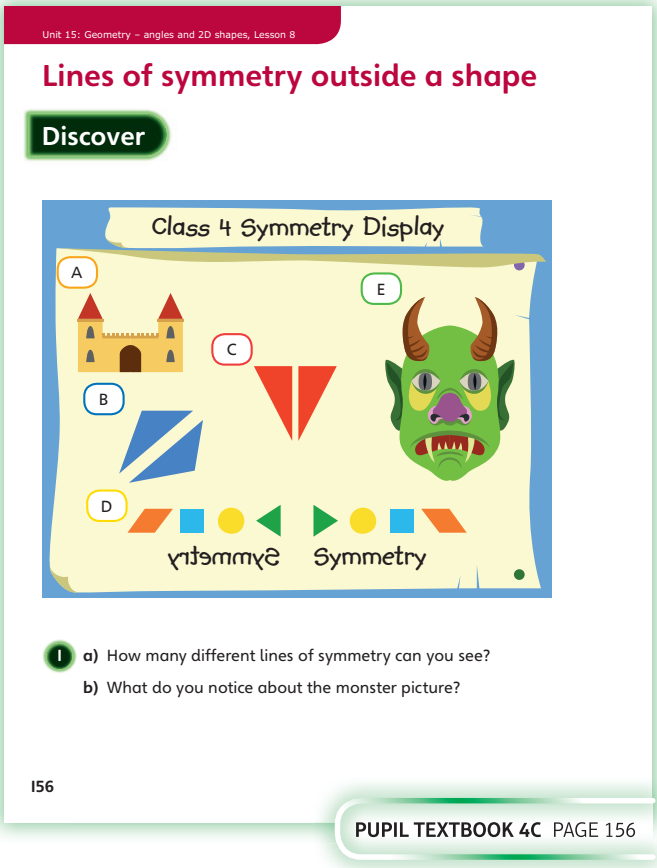
# Share

**WAYS OF WORKING** Whole class teacher led

**ASK**

- Question 1 a): *What lines of symmetry did you miss?*
- Question 1 a): *Does the pattern have a horizontal line of symmetry?*
- Question 1 a): *How could you change the border so that it had a horizontal line of symmetry?*

**IN FOCUS** In question 1 a), the symmetry of the title and the pattern D is the children's first introduction to symmetrical patterns. It is important to talk about how it is not only that the order of the shapes is reversed, but the shapes are also reflected, just as the title 'Symmetry' is reflected. The symmetry of the shapes is most evident from looking at the rhombus and triangle.




## Lines of symmetry outside a shape

### Discover



1 a) How many different lines of symmetry can you see?
b) What do you notice about the monster picture?

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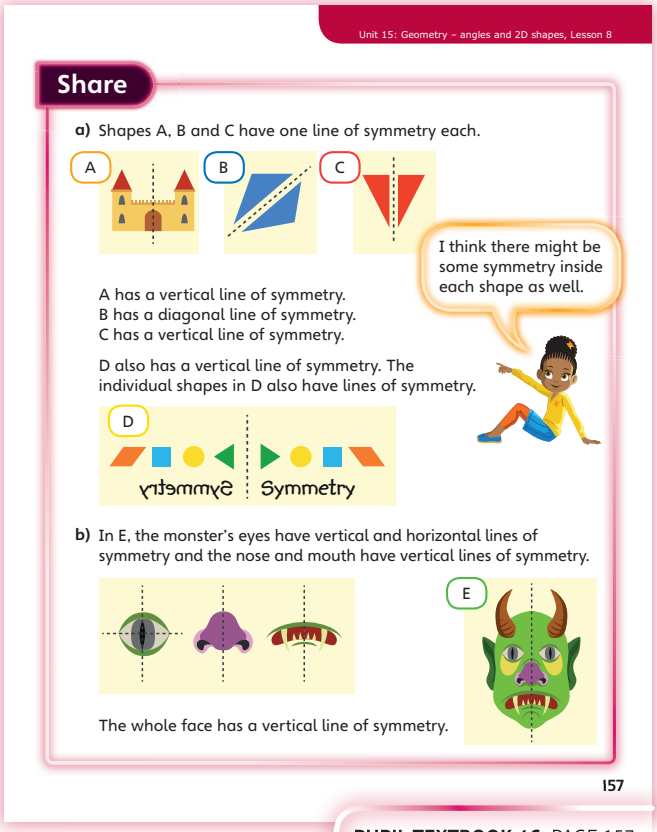


### Share

a) Shapes A, B and C have one line of symmetry each.



A has a vertical line of symmetry.
B has a diagonal line of symmetry.
C has a vertical line of symmetry.

D also has a vertical line of symmetry. The individual shapes in D also have lines of symmetry.





b) In E, the monster's eyes have vertical and horizontal lines of symmetry and the nose and mouth have vertical lines of symmetry.



The whole face has a vertical line of symmetry.

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# Think together

**WAYS OF WORKING** Whole class teacher led (I do, We do, You do)

**ASK**

- Question 1: *Describe how each monster is symmetrical.*
- Question 2: *Can you draw your own symmetrical monster?*
- Question 3: *What shapes would you include in a pattern to ensure that it had a horizontal line of symmetry?*

**IN FOCUS** Question 4 a) shows a pattern that has a number of possibilities for lines of symmetry. Children may find one vertical line of symmetry and stop there. However, the vertical line of symmetry could be drawn between any pair of rhombuses or down the centre of any hexagon as the pattern is continuous (repeating). The pattern also has a horizontal line of symmetry as the triangles are reflected along the central line and the other shapes have a horizontal line of symmetry.

**STRENGTHEN** Provide children with a mirror so they can explore the symmetry of each shape or pattern. You could provide the children with a simpler version of the patterns by presenting them with fewer shapes.

**DEEPEN** Challenge children to create a monster that has two lines of symmetry.

**ASSESSMENT CHECKPOINT** Questions 1, 2 and 3 will demonstrate whether children can identify symmetry in complex shapes and simple patterns while question 3 will demonstrate whether children are able to find all lines of symmetry in a repeating pattern.

**ANSWERS**

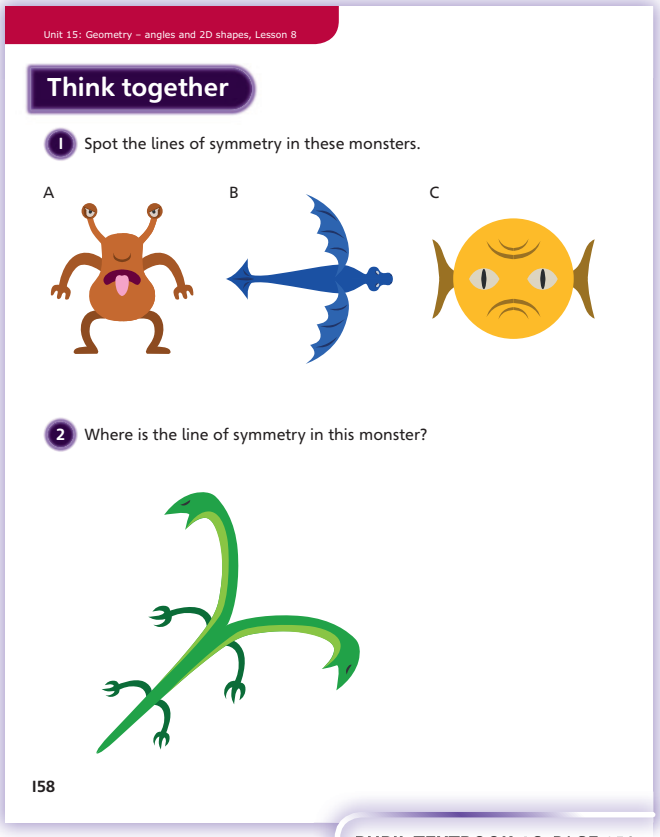
Question 1: A – the first monster has a vertical line of symmetry; B – the second monster has a horizontal line of symmetry; C – the third monster has vertical and horizontal lines of symmetry.

Question 2: The monster has a diagonal line of symmetry.

Question 3 a) Pattern A has a vertical line of symmetry between the two triangles and a horizontal line of symmetry.

Pattern B can have a vertical line of symmetry between any pair of rhombuses or down the centre of any hexagon. It also has a horizontal line of symmetry.

Question 3 b): Children should draw symmetrical border patterns.

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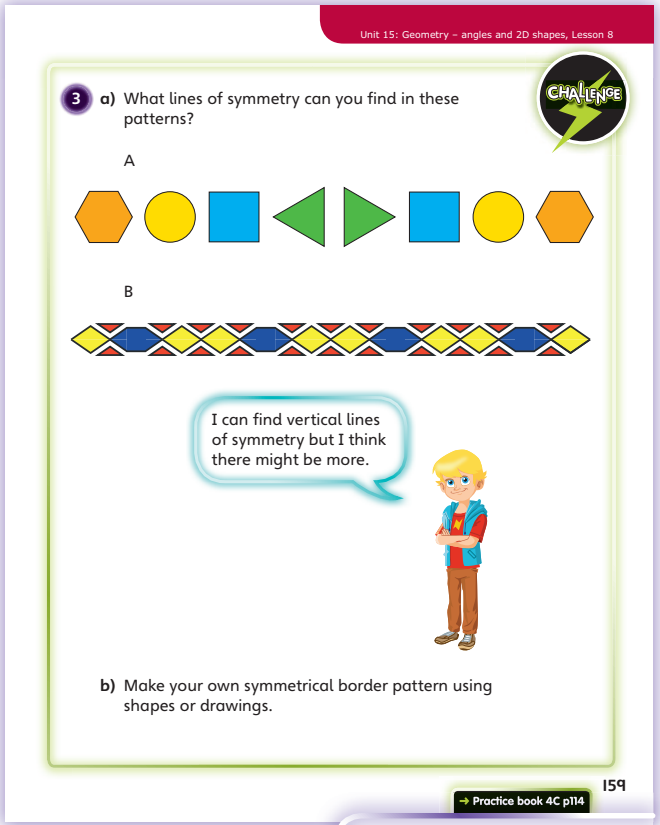


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## Practice

**WAYS OF WORKING** Independent thinking

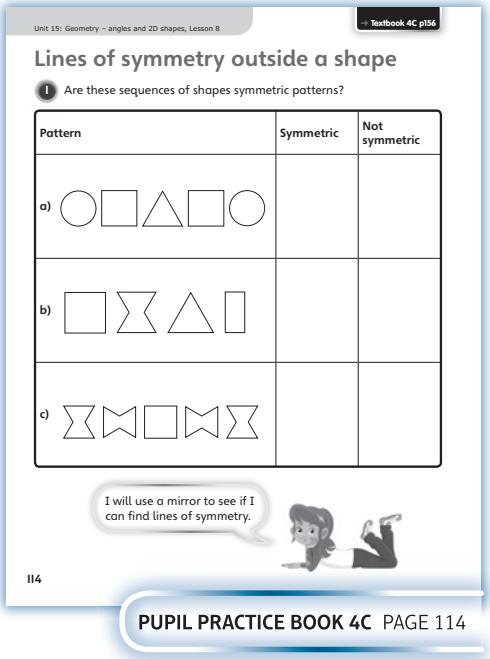
**IN FOCUS** Question 4 asks children to identify errors in a pattern that initially appears symmetrical. This addresses the misconception that if the shapes are repeated in reverse order, then the pattern is symmetrical. However, the shape itself also has to be reflected in the line of symmetry.

**STRENGTHEN** Create some simple symmetrical patterns using 2D shapes and ask children to identify the lines of symmetry. Provide the children with mirrors to help them explore the symmetry in the patterns.

**DEEPEN** Challenge children to think how they could adapt the pattern in question 4 so that it also had two diagonal lines of symmetry.

**ASSESSMENT CHECKPOINT** Questions 2 and 3 will demonstrate whether children can identify symmetry in a pattern with vertical, horizontal and diagonal lines of symmetry. Question 4 will demonstrate whether children can apply their knowledge of symmetry outside a shape to identify why a pattern is not symmetrical. It will also help to demonstrate if children have a secure understanding of what is required for a pattern to be symmetrical.

**ANSWERS** Answers for the **Practice** part of the lesson appear in the separate **Practice and Reflect answer book**.

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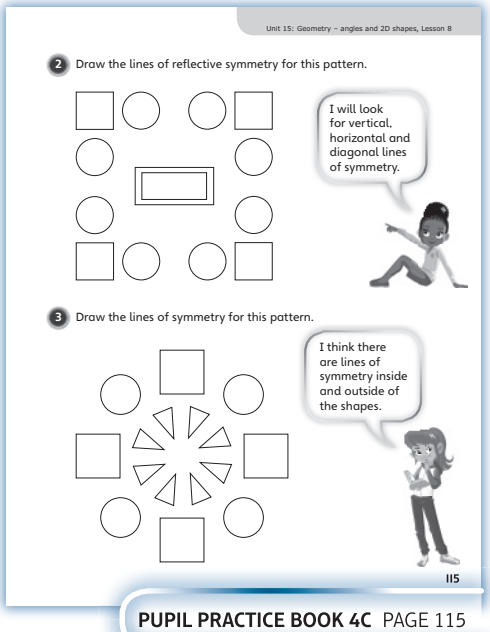


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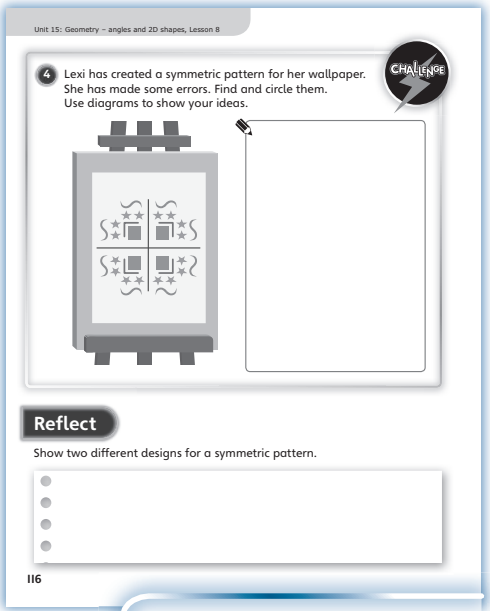
## Reflect

**WAYS OF WORKING** Independent thinking

**IN FOCUS** This section encourages children to consider the relationship between lines of symmetry and number of shapes. Children may reason that the number of times a shape appears will depend on whether or not the line of symmetry runs through a shape. This reasoning lays the foundations for reflection in the *x*- and *y*-axis in Year 5.

**ASSESSMENT CHECKPOINT** This part of the lesson will demonstrate whether children have a secure understanding of symmetry outside of a shape and symmetry in patterns.

**ANSWERS** Answers for the **Reflect** part of the lesson appear in the separate **Practice and Reflect answer book**.

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## After the lesson

- Were you able to provide practical opportunities to support children's learning, such as finding symmetry in their environment?
- How will you link the learning from this lesson to the next lesson on completing symmetrical patterns?

# Completing a symmetric figure

## Learning focus

In this lesson, children will complete symmetric patterns when the lines of symmetry are given. They will reason about how shapes are affected by different lines of symmetry.

## Small steps

- Previous step: Lines of symmetry outside a shape
- **This step: Completing a symmetric figure**
- Next step: Completing a symmetric shape

## NATIONAL CURRICULUM LINKS

**Year 4 Geometry – Properties of shapes**

Complete a simple symmetric figure with respect to a specific line of symmetry.

## ASSESSING MASTERY

Children can complete and add to symmetric patterns with two or more lines of symmetry. They can create their own symmetric patterns with increasing complexity. Children can describe how shapes will be affected by vertical, horizontal and diagonal lines of symmetry.

## COMMON MISCONCEPTIONS

When children try to complete a pattern they may forget to change the orientation of the shape according to the line of symmetry or they may make errors in the position of the reflected shape. Ask:

- *How will the shape look if it is reflected vertically/horizontally/diagonally?*

## STRENGTHENING UNDERSTANDING

Ask children to make their own symmetric patterns using a range of 2D shapes. In this way they can physically flip or rotate the shapes in order to create the mirror image.

## GOING DEEPER

Challenge children to come up with their own versions of the problems in the lesson for their partner to complete. They can make the challenge more difficult by adding more shapes, more lines of symmetry or by using more complex shapes.

## KEY LANGUAGE

**In lesson:** symmetric, symmetrical, vertical, symmetry, horizontal, diagonal, oblong

**Other language to be used by the teacher:** polygon

## STRUCTURES AND REPRESENTATIONS

2D shapes

## RESOURCES

**Optional:** A range of 2D shapes, mirrors, geoboards and elastic bands

In the eTextbook of this lesson, you will find interactive links to a selection of teaching tools.

## Before you teach

- What practical opportunities can you provide to strengthen children's understanding?
- How will you address misconceptions about how a shape's orientation changes when reflected?

## Discover

**WAYS OF WORKING** Pair work

**ASK**

- Question 1 a): *Can you identify the lines of symmetry? How do you know?*
- Question 1 a): *How do you know you have chosen the correct tile?*
- Question 1 b): *How is each design the same or different?*

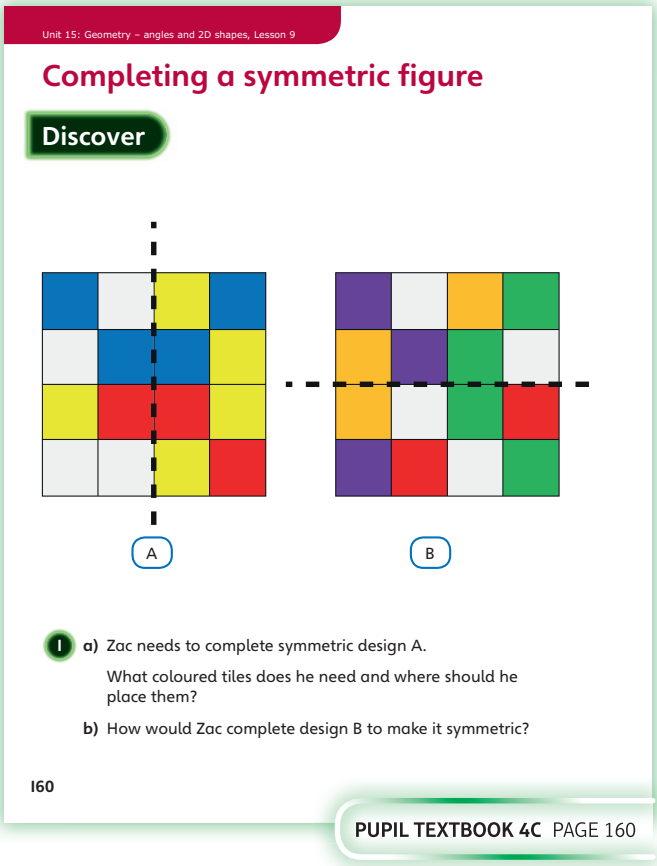
**IN FOCUS** Question 1 a) requires children to first identify the line of symmetry from an incomplete pattern. They have to reason about what information they have in order to do this. This question should promote a high level of discussion. Ensure that children are prompted to justify their choices throughout.

**PRACTICAL TIPS** Provide children with coloured squares so that they can replicate the designs. By having 'tiles' that they can move, they can try out their ideas, review and adapt if necessary.

**ANSWERS**

Question 1 a): Tiles needed in order from top to bottom, left to right are: yellow, yellow, red, yellow.

Question 1 b): Tiles needed in order from top to bottom, left to right are: red, red, purple, orange.

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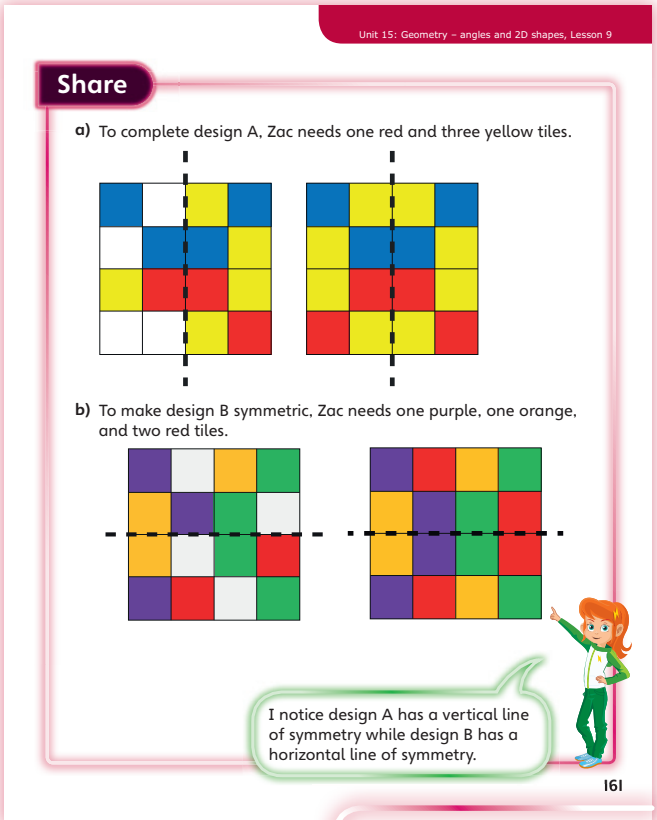
## Share

**WAYS OF WORKING** Whole class teacher led

**ASK**

- Question 1 a): *How do you know there is only one line of symmetry?*
- Questions 1 a) and b): *Could the tiles have been other colours?*
- Questions 1 a) and b): *What would have to change for the patterns to have three lines of symmetry?*

**IN FOCUS** Question 1 b) has a different line of symmetry than the pattern in question 1 a). This means that children have to adjust their thinking and how they visualise the pattern in order to complete it. Due to how the patterns are organised, it would be easy to make the error of thinking that they have diagonal lines of symmetry. Ask: *Identify why the patterns do not have diagonal symmetry?*

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# Think together

**WAYS OF WORKING** Whole class (I do, We do, You do)

**ASK**

- Questions 1 and 2: *How are the patterns here different from the patterns in the **Discover** section?*
- Question 1: *Is there more than one possibility?*
- Question 3: *Why doesn't it have diagonal lines of symmetry?*

**IN FOCUS** Question 4 asks children to come up with their own symmetric design. Due to the fact that there is an odd number of tables, children will have to place one in the centre. Children need to reason that the number of desks they have in one quadrant will have to be repeated in each of the quadrants. This question would be straightforward if the number of desks were divisible by four.

**STRENGTHEN** Provide children with mirrors so that they can test their ideas. Giving children coloured squares to manipulate allows them to test and adapt their ideas in a concrete way.

**DEEPEN** Challenge children to extend question 4. Ask: *How would your design change if you added one more table? How about if you had 13 tables? Is there a number of tables where it is impossible to have two lines of symmetry?*

**ASSESSMENT CHECKPOINT** Question 3 will demonstrate whether children are able to correctly identify the design and orientation of a tile to complete a symmetric design. In question 4, children demonstrate whether they are able to create their own symmetric designs.

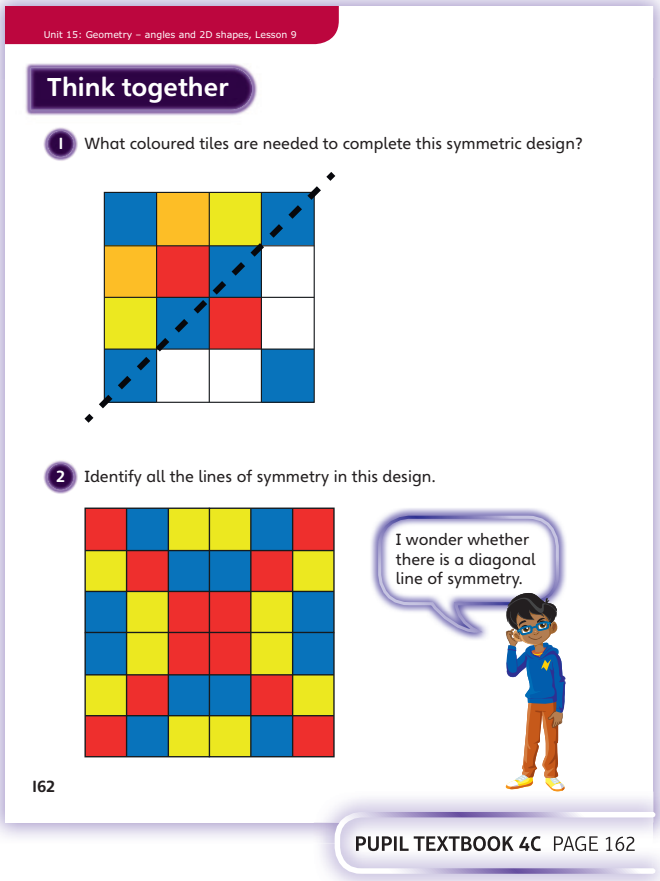
**ANSWERS**

Question 1: Tiles needed in order from top to bottom, left to right are: yellow, orange, yellow, orange.

Question 2: The design has vertical and horizontal lines of symmetry.

Question 3: Tile B is missing from the left side of the design.
Tile A is missing from the right side.

Question 4: Children should have a design using 11 rectangles with horizontal and vertical lines of symmetry.

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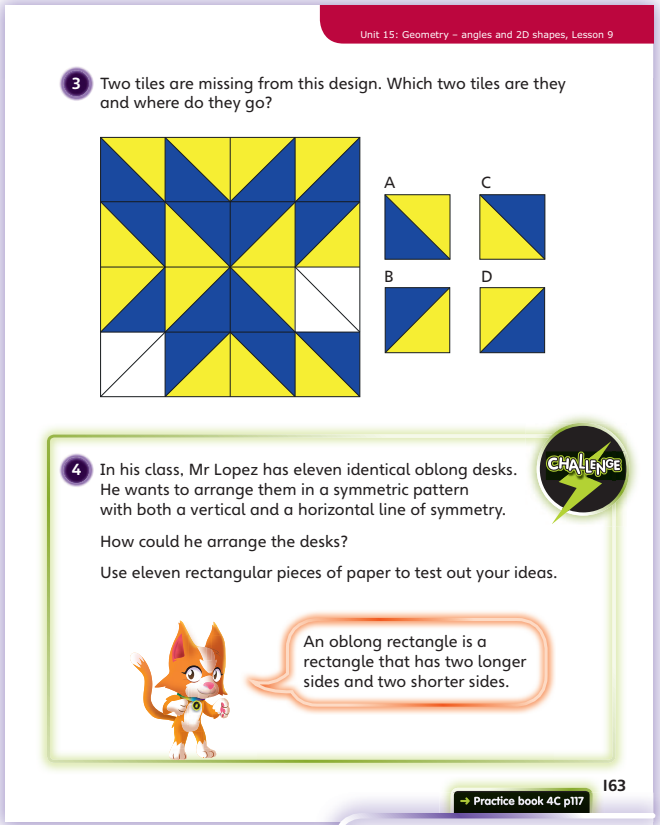


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## Practice

**WAYS OF WORKING** Independent thinking

**IN FOCUS** Question 7 requires children to reason about how the orientation of the shape changes with vertical, horizontal and diagonal lines of symmetry. Children need to visualise how the shape changes and describe the transformation. This question may expose misconceptions about how the orientations of shapes are changed by reflection.

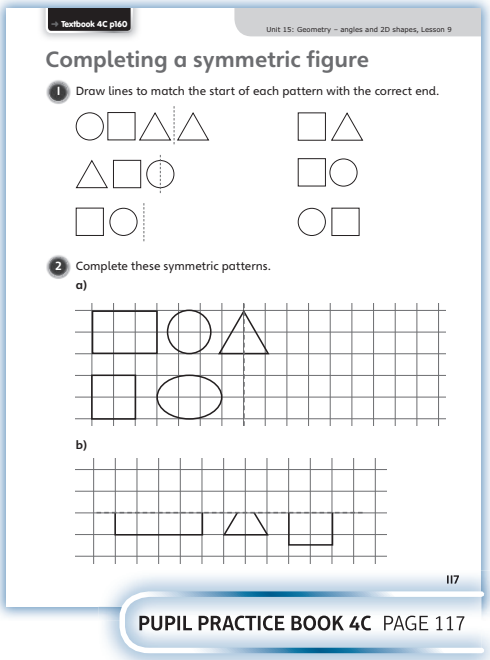
**STRENGTHEN** For questions 1 and 2, provide children with mirrors so that they can see how the completed design should look. For questions 4 and 5, allow children to explore using real geoboards so that they can easily review and adapt their designs.

**DEEPEN** Challenge children to work in pairs to create a symmetric design. Each child has a blank grid with a vertical and horizontal line of symmetry. The first child draws a shape on the right side of their design. The second child then draws the reflected image on the left side of their design. Then the second child then adds another shape on the left side and the first child draws the reflected shape on the right side of their design. Repeat for as long as required. The children then join their designs and check that they have created between them a design that has horizontal and vertical symmetry.

**THINK DIFFERENTLY** In question 6, the lines drawn suggest that it is part of a square. However, by drawing two lines to make it a square, the end shape would have four lines of symmetry. Children need to create a convex (familiar kite shape) or concave ('arrowhead' kite shape) kite. It has a diagonal line of symmetry. That the shape has a diagonal line of symmetry may not be immediately obvious to children, so they have to apply what they know about the properties of quadrilaterals in order to solve this problem. You could prompt children by asking them to draw the line of symmetry first and then complete the shape.

**ASSESSMENT CHECKPOINT** Question 7 will demonstrate whether children have secure understanding of how shapes are transformed when reflected along vertical, horizontal and diagonal lines.

**ANSWERS** Answers for the **Practice** part of the lesson appear in the separate **Practice and Reflect answer book**.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Unit 15: Geometry – angles and 2D shapes, Lesson 9

Completing a symmetric figure

1 Draw lines to match the start of each pattern with the correct end.

2 Complete these symmetric patterns.

a)

b)

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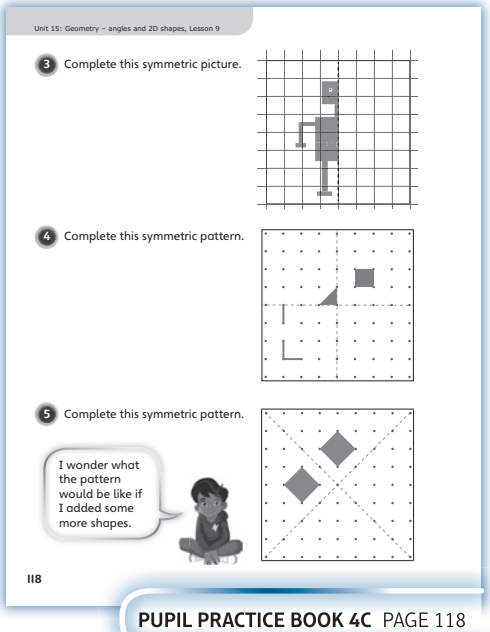
Unit 15: Geometry – angles and 2D shapes, Lesson 9

3 Complete this symmetric picture.

4 Complete this symmetric pattern.

5 Complete this symmetric pattern.

I wonder what the pattern would be like if I added some more shapes.

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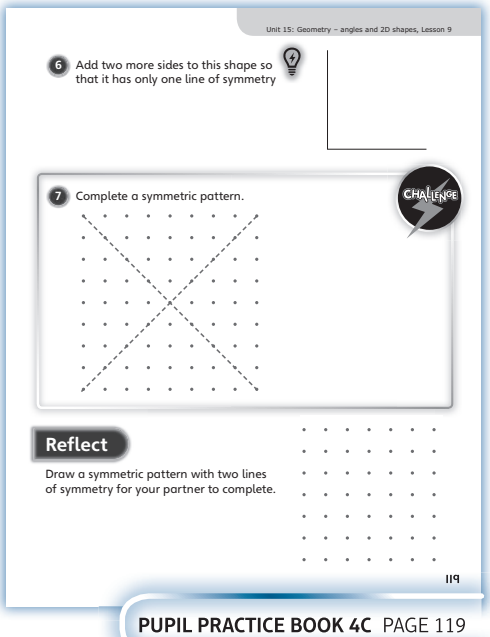
## Reflect

**WAYS OF WORKING** Pair work

**IN FOCUS** To create their own symmetry problems for each other, children need to have a good understanding of symmetry and how symmetric patterns work. They can challenge themselves appropriately by making the design as complex as they can.

**ASSESSMENT CHECKPOINT** This section will demonstrate whether children understand symmetry and how symmetric patterns work.

**ANSWERS** Answers for the **Reflect** part of the lesson appear in the separate **Practice and Reflect answer book**.


Unit 15: Geometry – angles and 2D shapes, Lesson 9

6 Add two more sides to this shape so that it has only one line of symmetry

7 Complete a symmetric pattern.

CHALLENGE

Reflect

Draw a symmetric pattern with two lines of symmetry for your partner to complete.

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## After the lesson

- Do children understand what happens to a shape when it is reflected along vertical, horizontal and diagonal lines?
- Could children contribute to a class or school display that allows them to apply the skills learnt in this lesson?

# Completing a symmetric shape

## Learning focus

In this lesson, children will continue to develop their understanding of symmetry by completing symmetric shapes using a given line of symmetry.

## Small steps

- Previous step: Completing a symmetric figure
- **This step: Completing a symmetric shape**
- Next step: Describing position (1)

## NATIONAL CURRICULUM LINKS

**Year 4 Geometry – Properties of Shapes**

Complete a simple symmetric figure with respect to a specific line of symmetry.

## ASSESSING MASTERY

Children can reliably complete a symmetric shape. They can confidently use a line symmetry, regardless of its orientation, to complete a shape.

## COMMON MISCONCEPTIONS

Children may need support to recognise how symmetry works when a line of symmetry is orientated at an angle other than vertical or horizontal (for example, at 45°). Ask:

- *What could you use to check what the shape should look like? What is different about this line symmetry to those you have seen before?*

## STRENGTHENING UNDERSTANDING

Children may benefit from having the opportunity to spot lines of symmetry inside shapes. This could be done by showing them shapes or pictures and asking them to identify where the lines of symmetry are inside the shape. Recapping this skill will help them in readiness for this lesson.

## GOING DEEPER

Encourage children to complete a pattern or shape where multiple lines of symmetry have been placed more haphazardly. Children should investigate how this affects the final shape or pattern. Ask: *Was this easier or trickier to complete? How did it affect the final shape or pattern?*

## KEY LANGUAGE

**In lesson:** symmetric, octagonal, symmetry, lines of symmetry, irregular, octagon, vertical, horizontal, pattern, obtuse

**Other language to be used by the teacher:** acute, right angle, symmetrical, polygon

## STRUCTURES AND REPRESENTATIONS

a range of 2D shapes and angles

## RESOURCES

**Mandatory:** lolly sticks

**Optional:** mirrors, 2D shapes

In the eTextbook of this lesson, you will find interactive links to a selection of teaching tools.

## Before you teach

- How confident are children in their learning from the previous lesson on symmetry?
- Are there any misconceptions you will need to tackle before moving forward in this lesson?

# Discover

**WAYS OF WORKING** Pair work

**ASK**

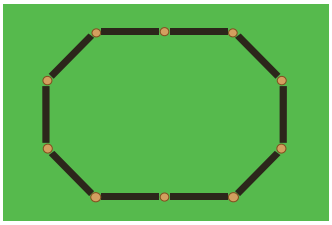
- Question 1 a): *What shape do you predict her chicken pen will be?*
- Question 1 b): *Is there a minimum amount of fence panels she needs to use?*
- Question 1 b): *Is there a maximum number she could use?*

**IN FOCUS** It will be important to use this opportunity to recap symmetry and the children's learning from the previous lesson to ensure speedy progress through this lesson.

**PRACTICAL TIPS** This activity could be carried out in class practically with lolly sticks. The activity could be extended by giving similar questions about different shaped pens.

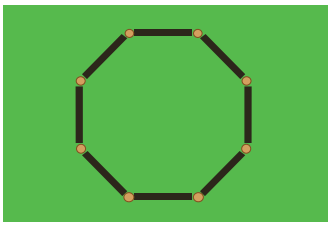
**ANSWERS**

Question 1 a):



The pen will have two lines of symmetry.

Question 1 b): The pen can be finished symmetrically using only three pieces of fence.



## Completing a symmetric shape

**Discover**



Isla is building a symmetric, octagonal pen for her chickens. She has used five pieces of fence so far.

1 **a)** She uses five more lengths of fence.

What does her chicken pen look like?

How many lines of symmetry does it have?

**b)** Could she complete the symmetric pattern with less than five pieces of fence?



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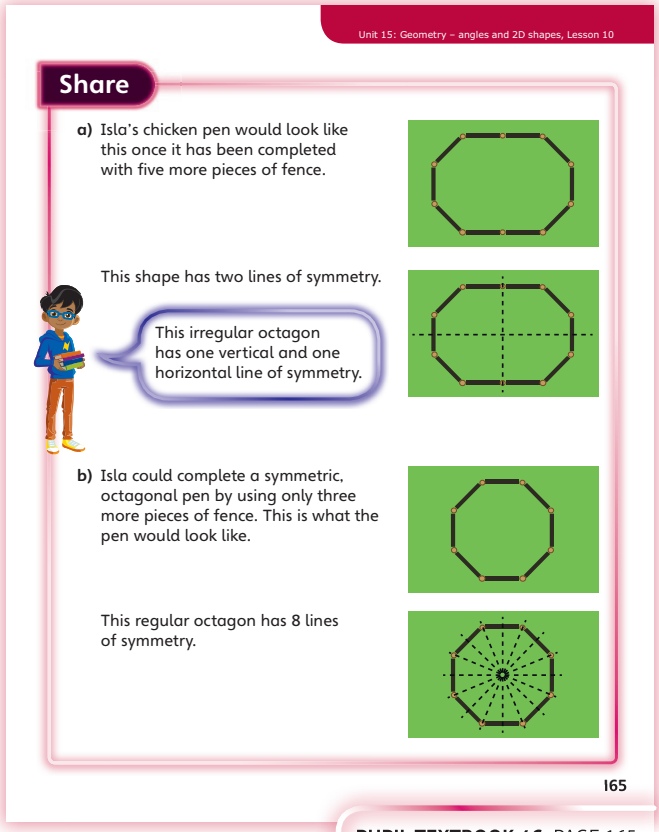
# Share

**WAYS OF WORKING** Whole class teacher led

**ASK**

- Question 1 a): *Did your octagon look like the one in the picture?*
- Question 1 a): *How was your shape the same as your partner's and how was it different?*
- Question 1 b): *Did you find another way of completing the shape?*
- Question 1 b): *What does the line of symmetry represent?*

**IN FOCUS** Discuss with children what tools they can use to help them predict what a symmetric shape will look like after it has been completed and to help check their work once they have completed it. Children should recognise that a mirror can help them predict and check their work.





**Share**

**a)** Isla's chicken pen would look like this once it has been completed with five more pieces of fence.

This shape has two lines of symmetry.

This irregular octagon has one vertical and one horizontal line of symmetry.

**b)** Isla could complete a symmetric, octagonal pen by using only three more pieces of fence. This is what the pen would look like.

This regular octagon has 8 lines of symmetry.



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# Think together

**WAYS OF WORKING** Whole class teacher led (I do, We do, You do)

**ASK**

- Questions 1 and 2: *What is similar and what is different about the lines of symmetry?*
- Questions 1 and 2: *How will you complete the shapes?*
- Questions 1 and 2: *How can you check the symmetric shapes?*
- Question 3: *How can you prove or disprove the conjectures?*

**IN FOCUS** For question 2 in particular, it will be important to focus on the lines of symmetry that are not horizontal or vertical. Encourage children to investigate what happens when a shape is mirrored across a line of symmetry that is set to a 45° angle. Ask: *How is this line of symmetry similar and how is it different to those you have seen before? How can you predict and check what the shape should look like?*

**STRENGTHEN** To help children prove or disprove the conjectures made in question 3, ask: *What could you do to test your ideas?* You could also ask: *Are there any resources you could use to help you investigate?*

**DEEPEN** Challenge children to come up with their own conjectures, as in question 3. Ask: *Can you come up with a conjecture about how angles change across a line of symmetry? What do you think might happen if you mirror a shape across two lines of symmetry?*

**ASSESSMENT CHECKPOINT** At this point children should be able to complete a symmetric shape across lines of symmetry of different orientations.

**ANSWERS**

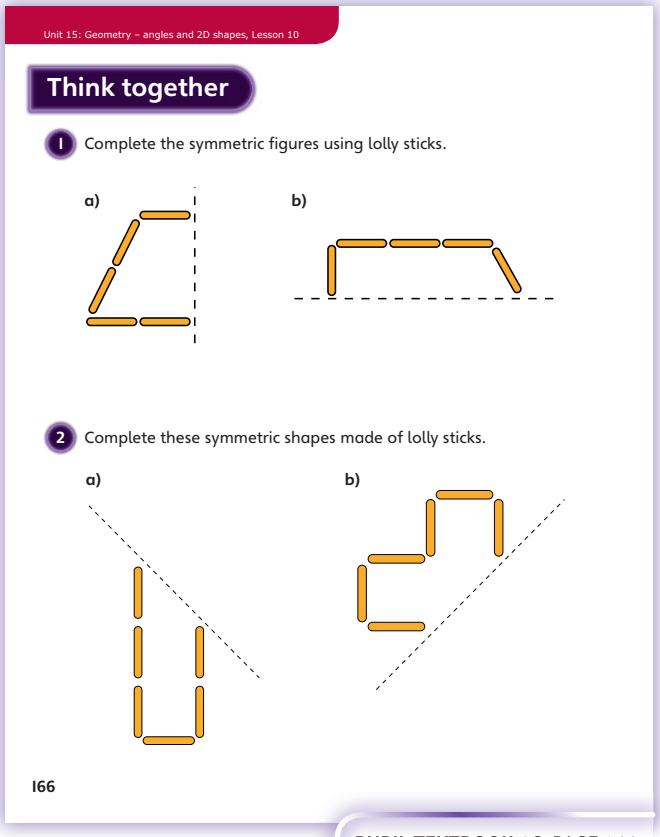
Question 1 a): Children should have completed the shape correctly using 5 sticks.

Question 1 b): Children should have completed the shape correctly using 5 sticks.

Question 2 a): Children should have completed the shape correctly using 6 sticks.

Question 2 b): Children should have completed the shape correctly using 6 sticks.

Question 3: 1. True – you can draw a right angled trapezium, for example.
2. False – it will depend where the line of symmetry is.
3. False – it will depend where the line of symmetry is.

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## Practice

**WAYS OF WORKING** Independent thinking

**IN FOCUS** The questions in this part of the lesson help children to become more fluent and flexible in their use of lines of symmetry. Be sure to help children realise that the lines of symmetry appear at different angles, both on and between the gridded dots, and in differing numbers.

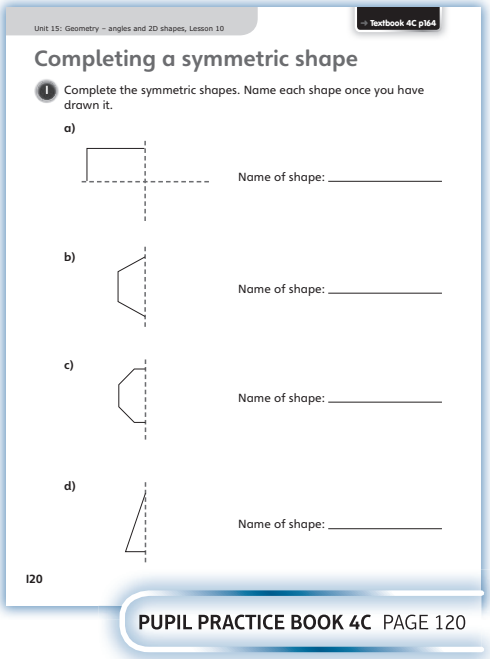
For question 5, encourage children to consider what shapes they know of that would fit the properties given in the question. They may neglect to consider irregular shapes and only investigate regular ones. Ask: *Is that the only type of pentagon (or other shape with an odd number of sides) you can draw?*

**STRENGTHEN** It may help children to have visual reminders around the classroom or at their workspaces to help scaffold their work. Ask: *Now that you have completed the symmetric shape, can you find a similar one on the in the classroom?*

**DEEPEN** Challenge children to create their own symmetry challenges for their partner. Ask: *Can you create a symmetric shape or pattern for your partner to finish? Remember to consider: where the lines of symmetry will go; how many lines of symmetry; what type of gridded paper to use.* Children could also be encouraged to investigate how a line of symmetry would work if it was placed through a shape.

**ASSESSMENT CHECKPOINT** Children should be able to confidently mirror any shape across a line of symmetry of any orientation.

**ANSWERS** Answers for the **Practice** part of the lesson appear in the separate **Practice and Reflect answer book**.

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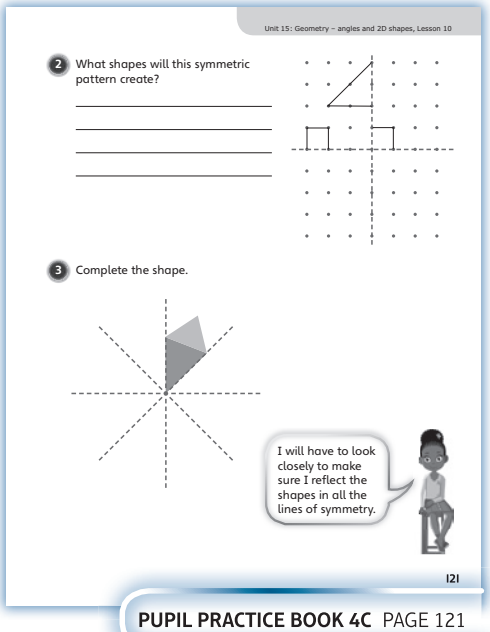


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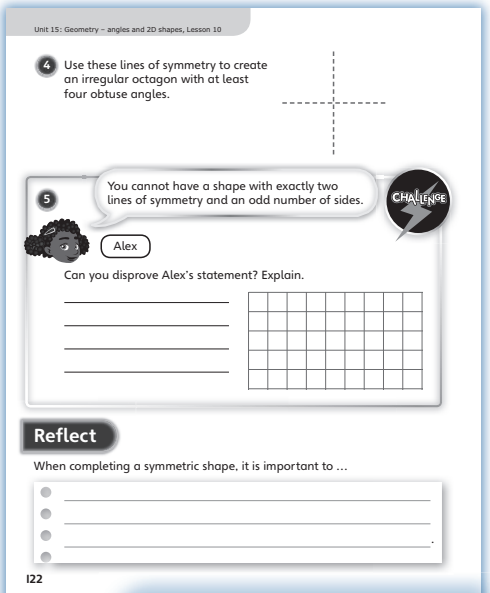
## Reflect

**WAYS OF WORKING** Independent thinking

**IN FOCUS** Give children time to formulate their own reasoning to finish the given sentence starter. Once they have written their ideas, share in partners and with the class. Children should compare their ideas. Do they agree on what is important? Can they convince their partner of their ideas?

**ASSESSMENT CHECKPOINT** Look for children's ability to explain the process of finishing symmetric shapes and patterns. They may mention how mirrors can be used to predict and check a symmetric shape.

**ANSWERS** Answers for the **Reflect** part of the lesson appear in the separate **Practice and Reflect answer book**.

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## After the lesson

- Are children confident with lines of symmetry at all orientations?
- How were children's reasoning skills supported and developed in this lesson?

# End of unit check

**Don't forget the *Power Maths* unit assessment grid on p26.**

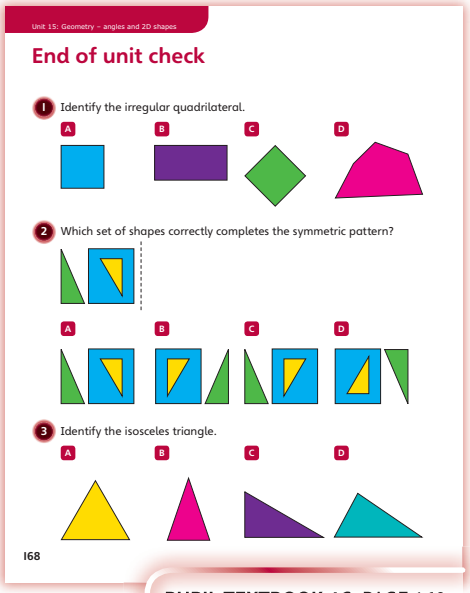
**WAYS OF WORKING** Independent work

**IN FOCUS**

- This end of unit check will allow you to focus on children's understanding of angles and 2D shapes including symmetry, and whether they can apply their knowledge to solve problems.
- Questions 1 and 3 ask children to identify particular types of irregular and regular shapes.
- Question 2 and 5 assess children's ability to recognise and complete a symmetrical pattern and identify lines of symmetry.
- Question 4 assesses children's understanding of different types of angles.
- Question 6 is a SAT-style question and assesses children's recognition of angles and types of triangles.

**ANSWERS AND COMMENTARY**

Children who have mastered the concepts in this unit will be able to confidently recognise and order acute, obtuse and right angles, and explain how right angles can help them to do so. They will be able to name and describe the different types of triangles and quadrilaterals, and explain the similarities and differences. They will be able to point out where a quadrilateral may fit under more than one heading. Children will be able to confidently complete shapes and patterns across lines of symmetry in different orientations and will be able to apply their knowledge and understanding to solve problems.


Unit 15: Geometry – angles and 2D shapes

End of unit check

1 Identify the irregular quadrilateral.

A B C D

2 Which set of shapes correctly completes the symmetric pattern?

A B C D

3 Identify the isosceles triangle.

A B C D

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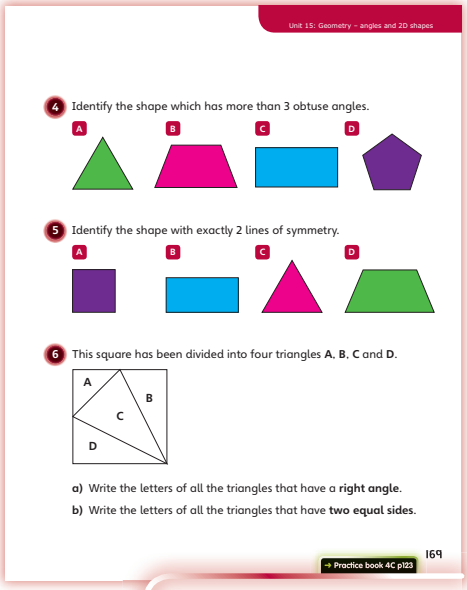
Unit 15: Geometry – angles and 2D shapes

4 Identify the shape which has more than 3 obtuse angles.

A B C D

5 Identify the shape with exactly 2 lines of symmetry.

A B C D

6 This square has been divided into four triangles **A**, **B**, **C** and **D**.

A B C D

a) Write the letters of all the triangles that have a **right angle**.

b) Write the letters of all the triangles that have **two equal sides**.

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| Q | A | WRONG ANSWERS AND MISCONCEPTIONS | STRENGTHENING UNDERSTANDING |
|---|---|---|---|
| 1 | B | A indicates a lack of understanding about what irregular means. | **Symmetry:** Give children a mirror to help them check the lines of symmetry inside and outside of the shapes. **Angles:** Remind children about how they can use a right angle to help them judge whether an angle is acute or obtuse. |
| 2 | B | A indicates children have just repeated the first shape, not mirrored it. C and D indicate that children have not fully understood how symmetrical patterns and lines of symmetry alter shapes. | |
| 3 | B | A, C or D indicate children are unsure about types of triangle. | |
| 4 | D | A, B, or C indicate children are unsure about types of angle. | |
| 5 | B | A indicates children have neglected diagonal lines of symmetry. C or D indicates that children are unsure about lines of symmetry in 2D shapes. | |
| 6 a) | A, B, D | Not identifying them all may suggest that children fail to identify right angles in unfamiliar orientations. | |
| 6 b) | A, C | B and/or D suggests that children have compared lengths of sides incorrectly. | |

## My journal

**WAYS OF WORKING** Independent thinking

**ANSWERS AND COMMENTARY** Question 1: For this question, look for children's ability to visualise the types of triangles and quadrilaterals that may be possible to create using the interior of a regular hexagon. Ask:

- *What types of quadrilaterals and triangles are there?*
- *Can you see how any of those shapes might fit into the hexagon? Can you make any of those shapes by drawing two lines across the hexagon?*

**Answer:** There are two correct answers. (6 vertices numbered from 1st to 6th clockwise around a hexagon.)

1. Draw a line from the 1st vertex to the 4th vertex and a second line from the 2nd vertex to the 5th vertex.
2. Draw a line from the 1st vertex to the 4th vertex and a second line from the 3rd vertex to the 5th vertex.

Children may represent these ways of dividing the hexagon but in a different orientation.

Question 2: When solving this question, look for children to be experimenting and finding evidence. When solving the question and providing their ideas, encourage children's reasoning by asking:

- *How have you proven your ideas?*
- *What is it about obtuse angles that means Greg cannot be correct?*
- *How many obtuse angles could he have? Why?*

**Answer:** Greg cannot be correct because if you draw two lines that meet to create an obtuse angle, in order to join them with a third line to create a triangle, the other two angles have to be acute so two angles in a triangle cannot be obtuse. Children may support their argument with a picture.

## Power check

**WAYS OF WORKING** Independent thinking

**ASK**

- *How confident are you at recognising acute and obtuse angles?*
- *Could you name and identify all types of triangle?*
- *Can you identify different quadrilaterals and their properties?*
- *Do you think you can complete any symmetrical shape or pattern now?*

## Power play

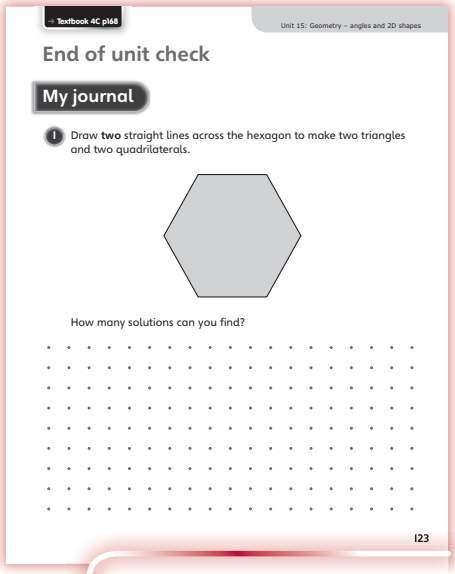
**WAYS OF WORKING** Pair work

**IN FOCUS** This activity will help you see if children are able to identify different quadrilaterals and triangles. Discuss with children the properties of the shapes they are making and ask them to justify how they know what shape they have made.

**ANSWERS AND COMMENTARY** If children are able to create the different shapes and justify what they have done, then this shows they have a good understanding of the properties of quadrilaterals and triangles. If they are unsuccessful, then this suggests that the children need support in comparing angles and sides of 2D shapes.

## After the unit

- Can children find quadrilaterals and triangles in the environment in the classroom? How could you link the learning from this unit with the next?

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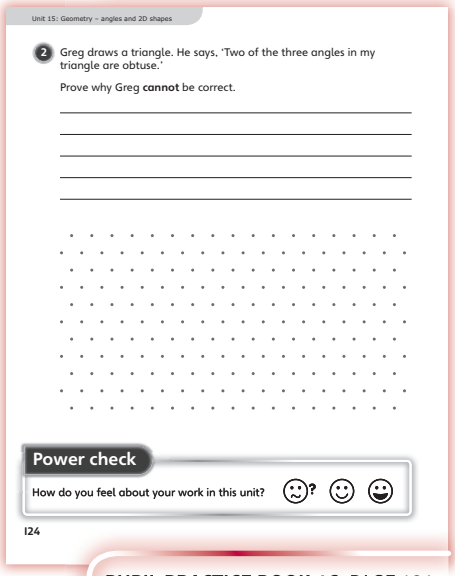


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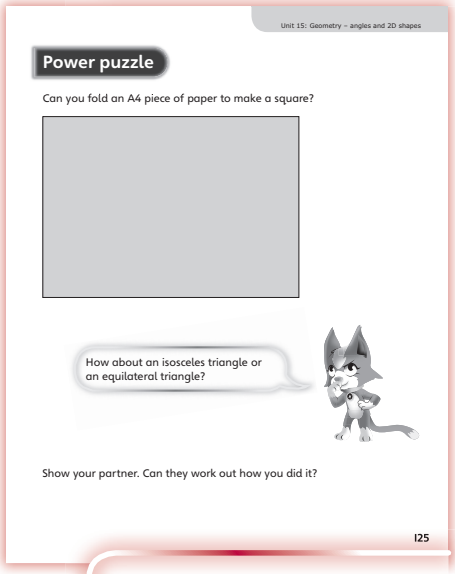


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**Strengthen** and **Deepen** activities for this unit can be found in the *Power Maths* online subscription.