Unit 12
Angles and properties of shapes

Mastery Expert tip! "When I taught this unit, I used examples I could refer to within the school environment – square or rectangular tiles, vertical and horizontal lines around the classroom, parallel and perpendicular lines marked on the school playground. We turned quarter, half, three-quarter and full turns, varying the starting positions."

Don't forget to watch the Unit 12 video!

WHY THIS UNIT IS IMPORTANT

This unit explores the concept of right angles. Right angles are linked to the concepts of parallel, perpendicular, vertical and horizontal lines and are linked with the angle properties of 2D shapes. Vertical and horizontal lines of symmetry are also explored and, finally, children describe and construct 3D shapes.

Angles are introduced to children as a measure of a turn, establishing that a right angle is a quarter turn, two quarter turns make a half turn, three right angles make a three-quarter turn and four right angles make a full turn. Children will learn that angles less than a right angle are called acute angles and angles greater than a right angle (but less than two right angles) are called obtuse angles. Children will revise the names of 2D shapes. These include triangles (right-angled and isosceles), quadrilaterals (square, rectangle, rhombus, trapezium, parallelogram and kite), pentagons, hexagons and octagons. Children will revise the names of 3D shapes: cube, cuboid, pyramid, prism, cylinder, sphere and cone. This unit will provide an important foundation for further development of the concept of geometry in later years, such as measuring and drawing angles accurately and describing properties of 2D shapes in more detail.

WHERE THIS UNIT FITS

- Unit 11: Time
- **Unit 12: Angles and properties of shapes**
- Unit 13: Mass

This unit builds on children's understanding of the names and some of the properties of 2D and 3D shapes. It extends children's basic comprehension of these shapes with an emphasis on identifying right angles, lines of symmetry, vertical and horizontal lines and parallel and perpendicular lines and edges.

Before they start this unit, it is expected that children:

- understand what is meant by a 2D shape and are able to recognise and name most of them
- understand what is meant by a 3D shape and are able to recognise and name most of them.

ASSESSING MASTERY

Children who have mastered this unit will understand that angles are a measure of a turn and will recognise acute and obtuse angles. Children will recognise and identify vertical and horizontal lines in diagrams and 2D shapes. Children will identify pairs of parallel or perpendicular lines in diagrams and 2D shapes. Children will begin to describe 2D and 3D shapes in terms of the properties of right angles, parallel and perpendicular edges and lines of symmetry.

COMMON MISCONCEPTIONS	STRENGTHENING UNDERSTANDING	GOING DEEPER
Children may not recognise right angles, symmetry or parallel lines when shapes are in different orientations.	Mark 2D shapes with their right angles and parallel/perpendicular lines and then turn them 45 degrees. Record both on squared paper.	Encourage children to consider 'always, sometimes, never' relating to right angles, and parallel and perpendicular lines in 2D shapes, especially in quadrilaterals. Children explore changing a pair of parallel lines into a pair of perpendicular lines and vice versa by turning one line a quarter turn.
Children mix up the terms parallel and perpendicular and horizontal and vertical.	Give plenty of opportunity to explore all these concepts in and around school.	

Unit I2: Angles and properties of shapes

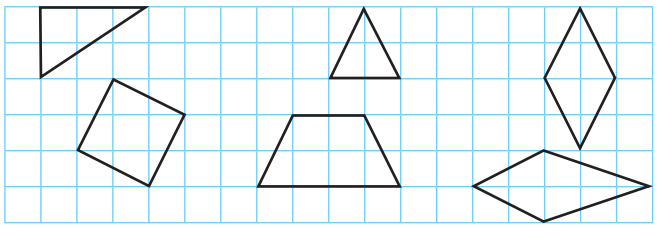
WAYS OF WORKING

Use these pages with the whole class to revise the names and some of the properties of 2D and 3D shapes introduced in KS1; use the actual shapes rather than just the images on the page. Do children recognise any of the key language? Discuss where they may have heard some of these words previously.

STRUCTURES AND REPRESENTATIONS

2D shapes:

right-angled triangle isosceles triangle rhombus



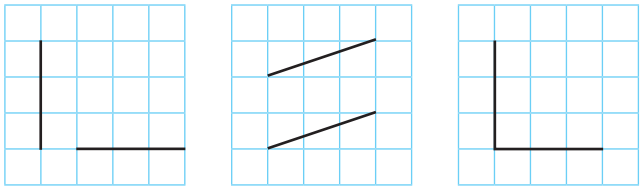
square trapezium kite

3D shapes:

cuboid triangular prism square-based pyramid

cylinder cone tetrahedron

vertical parallel lines perpendicular lines

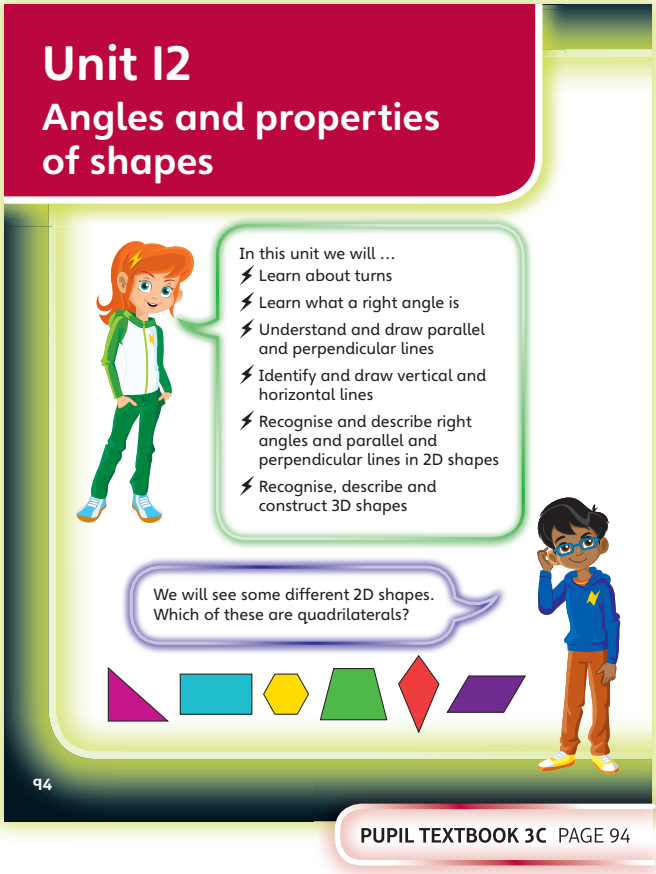


horizontal

KEY LANGUAGE

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

- right angle, quarter turn, half turn, acute angle, obtuse angle
- vertical, horizontal, parallel, perpendicular
- triangle, quadrilateral, square, rectangle, trapezium, rhombus, kite, pentagon, hexagon
- cube, cuboid, sphere, pyramid, prism, cylinder, cone, triangular prism, square-based pyramid, tetrahedron
- describe, property, 2D, 3D, draw accurately, construct



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Turns and angles

Learning focus

In this lesson, children understand angles as a measure of turn. Children learn that a right angle is a quarter turn, two right angles make a half turn, and four right angles make a whole turn.

Small steps

- Previous step: Measuring time in seconds
- **This step: Turns and angles**
- Next step: Right angles in shapes

NATIONAL CURRICULUM LINKS

Year 3 Geometry – Properties of Shapes

- Recognise angles as a property of shape or a description of a turn.
- Identify right angles, recognise that two right angles make a half turn, three make three quarters of a turn and four a complete turn; identify whether angles are greater than or less than a right angle.

ASSESSING MASTERY

Children can follow rotations in steps of a quarter turn, both clockwise and anticlockwise. Children can explain the effect of turning two quarter turns, and how many right-angle turns are equivalent to a full turn.

COMMON MISCONCEPTIONS

Children may not recognise turns if they are presented in different orientations. Ask:

- *Face the window. Face this corner. Where will you be facing after a quarter turn? After a half turn?*

Children may struggle to sense which way is clockwise and which is anticlockwise, especially when given different starting positions. Ask:

- *If you turn clockwise, is that to the left or the right? What do you see first when you turn anticlockwise?*

STRENGTHENING UNDERSTANDING

Give children the opportunity to turn themselves, physically. Practise as a class: start facing the walls but then turn at a diagonal, facing a corner. Then use toy figures on a simple map to enact the turns. Practise turning clockwise and listing the things children see in order. Repeat with a turn anticlockwise. Give children a clock face with moveable hands to place on the floor in front of them.

GOING DEEPER

Use a simple treasure map on a grid (or ask children to draw one with four or five features marked). Ask children to write instructions to get from one feature to another, using the language of turns.

KEY LANGUAGE

In lesson: angle, **right angle**, turn, direction, quarter turn, half turn, complete turn, clockwise, anticlockwise

Other language used by the teacher: three-quarter turn, right-angle turn, whole turn, north, south, east, west

RESOURCES

Optional: toy figures, diagrams of eight-point compass (or chalks so this can be drawn on the playground), an object to represent the rover

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

Before you teach

- Do children know the difference between clockwise and anticlockwise?
- Can children describe a half turn and a quarter turn?

Discover

WAYS OF WORKING Pair work

ASK

- Question 1 a): *What feature is the rover facing?*
- Question 1 a): *What will this button make the rover do?*
- Question 1 a): *Imagine you are the rover. Which way could you turn first?*
- Question 1 b): *Can you turn more than once?*

IN FOCUS The purpose of this activity is for children to develop an understanding of quarter turns in relation to half and whole turns.

Question 1 a) focuses on combining two quarter turns to make a half turn.

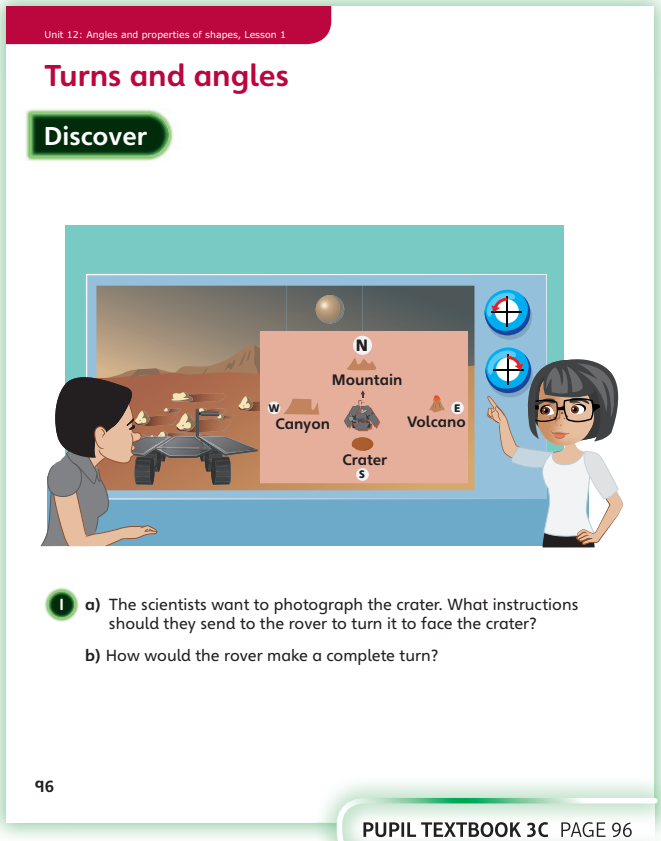
Question 1 b) develops an understanding that combining four quarter turns makes a whole (complete) turn.

PRACTICAL TIPS This could be enacted with a small toy vehicle, or toy robot. Alternatively, a child could take the place of the rover in a role play. There is an opportunity for taking this task into the hall or the playground, and labelling parts of the room according to the rover's environment, or drawing a 'map' for the rover on the playground in chalk. Children should experience turning two half turns in either direction to see that the end result is the same.

ANSWERS

Question 1 a): To face the crater, the rover needs to make two quarter turns. It can turn either clockwise or anticlockwise. The final direction will be the same for a half turn.

Question 1 b) To make a full turn, the rover should make four quarter turns in the same direction. It could turn clockwise or anticlockwise.



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Share

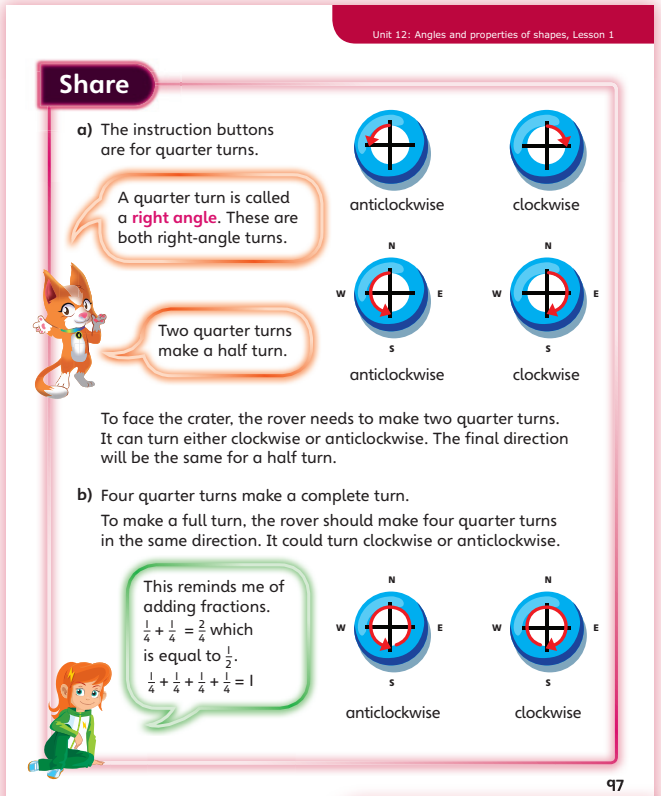
WAYS OF WORKING Whole class teacher led

ASK

- Question 1 a): *Can you show me what a right-angle turn clockwise would look like?*
- Question 1 b): *How many turns do you need to make before you get back to where you started?*
- Question 1 b): *Astrid has made a comment about adding fractions. Can you explain what she means?*

IN FOCUS Question 1 a) demonstrates how two right-angle turns are equivalent to a half turn.

Question 1 b) shows that four right-angle turns take you back to the original position.



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Think together

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

ASK

- Question 1: *Why are there two possible answers here?*
- Question 2: *What happens when the instruction is reversed?*
- Question 3: *Why is making a right-angle turn on this map trickier?*

IN FOCUS Question 1 shows that a quarter turn clockwise has a different result from a quarter turn anticlockwise.

Question 2 shows that a turn clockwise is reversed by the same turn anticlockwise.

STRENGTHEN Children could use a toy or make the turns themselves. They should practise making quarter turns, then two quarter turns in a sequence, then three and four turns in a sequence.

Children may struggle to remember and have a sense of which way a clockwise and an anticlockwise turn takes them. This should be practised from different starting positions. Place a clock face at their feet.

DEEPEN Challenge children to explain the relationship between a three-quarter turn in one direction, compared with a one quarter turn in the opposite direction. Ask them to explain how to reverse the turn instruction to get back to the start position. Question 3 challenges children to make and understand turns using right angles which do not use vertical and horizontal lines, but instead the compass points NE, SE, SW and NE.

ASSESSMENT CHECKPOINT Children should now understand the language of quarter, half and whole turns, realising that a quarter turn clockwise will have a different result from a quarter turn anticlockwise. Children will be beginning to understand how instructions can be reversed to get back to the original position.

ANSWERS

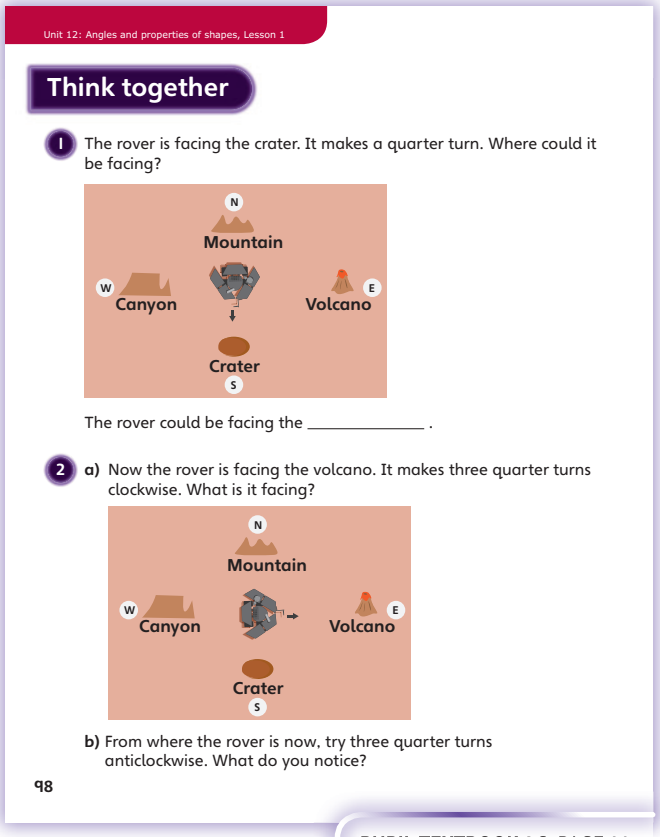
Question 1: The rover could be facing the volcano or the canyon.

Question 2 a): The rover is facing the mountain.

Question 2 b): The rover is now facing the volcano again. A turn anticlockwise reverses the same turn clockwise.

Question 3 a): The rover was facing the landing craft.

Question 3 b): Make a quarter turn anticlockwise or make a three-quarter turn clockwise.



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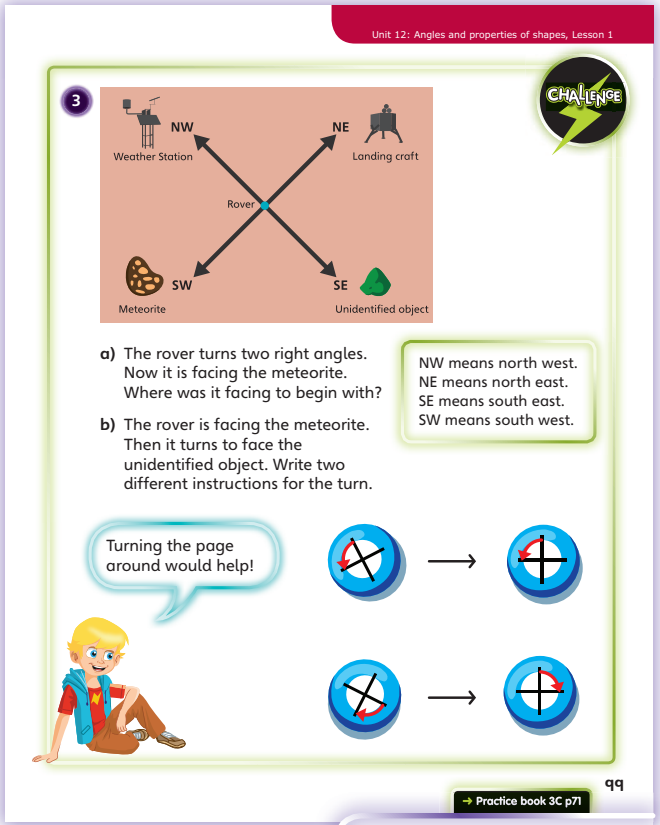

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Practice

WAYS OF WORKING Independent thinking

IN FOCUS Questions 1 and 2 focus on quarter turns in different contexts.

Question 3 demonstrates that a quarter turn clockwise is the same as a three-quarter turn anticlockwise.

STRENGTHEN Allow children to use a toy figure to move according to each question and act out the turns.

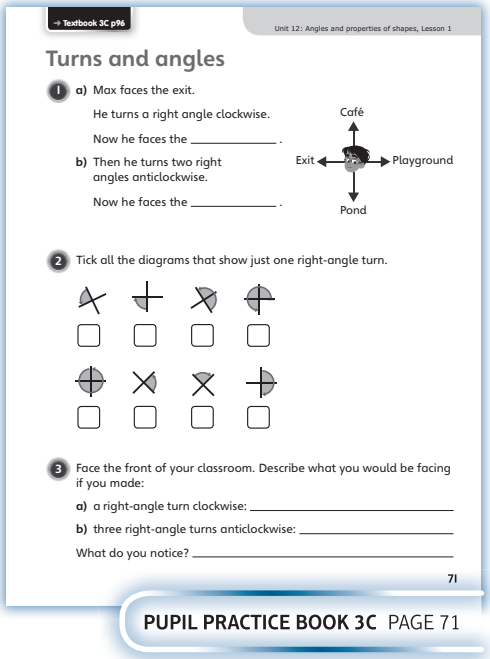
DEEPEN Ask children to discuss and explain to each other what types of turn need to include clockwise and anticlockwise and when it does not matter. In pairs, one child gives an instruction and the other reverses it.

Question 5 challenges children to apply their understanding of turns to the rotation of simple shapes.

THINK DIFFERENTLY Question 4, with some compass points being on a 45 degree angle, tests understanding of right-angle turns from non-horizontal or non-vertical lines. It is usual to describe quarter, half or three-quarter turns as one instruction, rather than a half turn followed by a quarter turn, but accept these suggestions.

ASSESSMENT CHECKPOINT Children should now understand the language of quarter, half and whole turns, realising that a quarter turn clockwise will have a different result from a quarter turn anticlockwise. Children will be beginning to understand how instructions can be reversed to get back to the original position.

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



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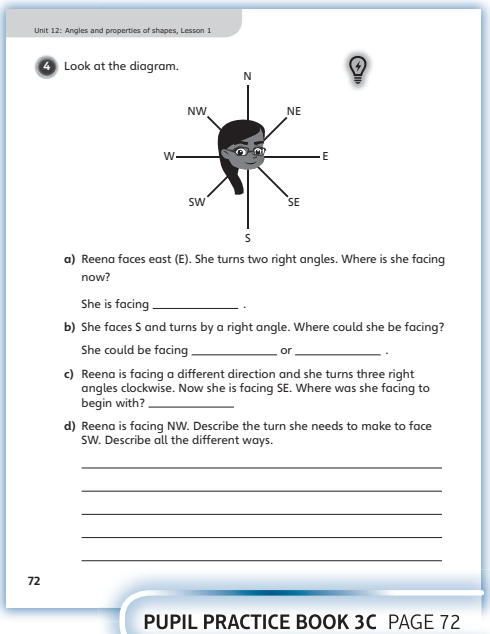

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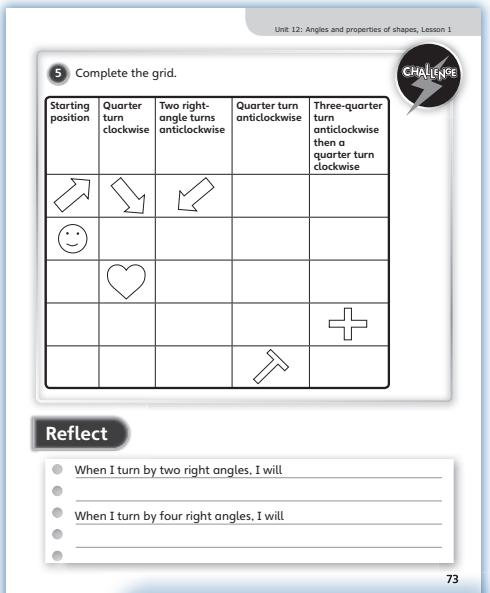
Reflect

WAYS OF WORKING Independent thinking

IN FOCUS This challenges children to recognise the difference between clockwise and anticlockwise for a single right angle and how this differs for a half turn or whole turn.

ASSESSMENT CHECKPOINT If children can explain accurately the need to include direction (clockwise and anticlockwise) when making a quarter turn but not when making a half or full turn, they will have a good understanding of the language of turns and angles.

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



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After the lesson

- How many right-angle turns are required for a whole turn?
- Do you have any advice for how to remember the difference between clockwise and anticlockwise?

Right angles in shapes

Learning focus

In this lesson, children develop their understanding of right angles to include the measure of an angle in a shape. They learn the symbol that indicates a right angle and are introduced to the idea of perpendicular lines.

Small steps

- Previous step: Turns and angles
- **This step: Right angles in shapes**
- Next step: Comparing angles

NATIONAL CURRICULUM LINKS

Year 3 Geometry – Properties of Shapes

- Recognise angles as a property of shape or a description of a turn.
- Identify right angles, recognise that two right angles make a half turn, three make three quarters of a turn and four a complete turn; identify whether angles are greater than or less than a right angle.

ASSESSING MASTERY

Children can recognise right angles in shapes in different orientations, and can draw a pair of perpendicular lines to create a right angle.

COMMON MISCONCEPTIONS

Children may struggle to recognise right angles that are oriented diagonally – where neither line is horizontal or vertical. Ask:

- *How can you check whether this is a right angle or not? Does it help to turn the paper round?*

Children may not understand how the measure of turn is linked to the measure of an angle in a shape. Ask:

- *How can you check whether this angle is the same as, greater than or less than a quarter turn?*

STRENGTHENING UNDERSTANDING

Encourage children to use their reasoning skills to predict if an angle is a right angle, greater than a right angle or less than a right angle; then support children to make right-angle measures, or to use the corner of a 2D square to check. Help children to understand how to orient and read the measure in order to check the angle.

GOING DEEPER

Challenge children to use the reasoning of a grid to justify whether or not an angle is a right angle, using the properties of the grid to support their reasoning, especially when two diagonal lines form the angle.

KEY LANGUAGE

In lesson: right angle, angle, **perpendicular**, angle measurer, curved, straight, shape

Other language used by the teacher: square, rectangle, arrow, right-angled triangle, reflex angle, greater than (>), less than (<), predict, prediction, diagonally, measure of turn, quarter turn, half turn

STRUCTURES AND REPRESENTATIONS

2D shapes

RESOURCES

Mandatory: right-angle measurer (folded paper, ruler or 2D square or rectangle)

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

Before you teach

- Can children find the angles in a shape?
- Do they know what right angle means?

Discover

WAYS OF WORKING Pair work

ASK

- Question 1 a): *How can you recognise a right angle?*
- Question 1 a): *Which parts of this shape could show a right angle?*
- Question 1 a): *Which shapes cannot show a right angle? Why?*
- Question 1 b): *What is the symbol for a right angle in a 2D shape?*

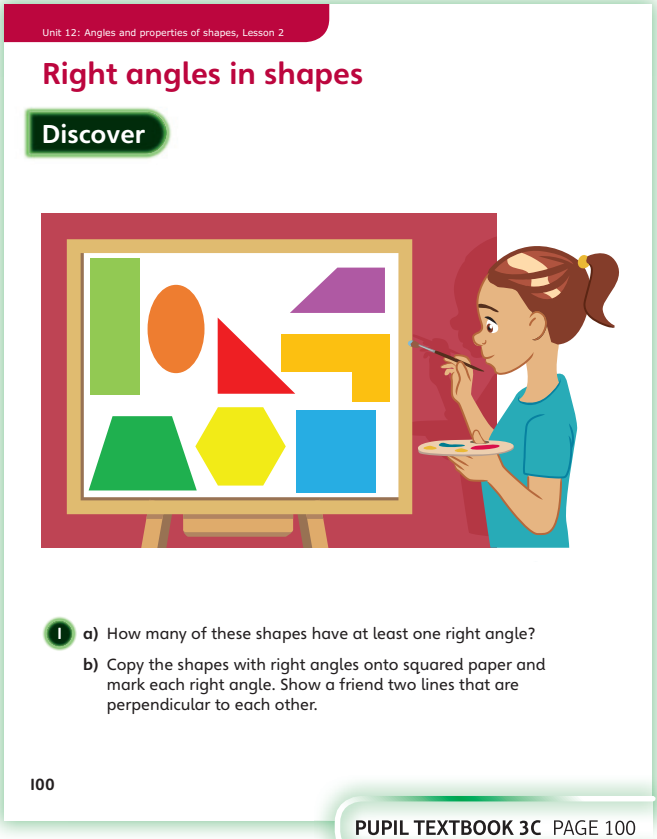
IN FOCUS This is the first time that children are asked to recognise right angles in a shape. Allow them to make a right-angle measurer by folding paper and show them how to use it to test which angles are right angles. Discuss together how children can tell that some of the angles are not right angles or that a shape will not contain right angles. Curved lines cannot make right angles.

PRACTICAL TIPS Use large 2D replicas of the shapes shown in the picture, allowing children to use the angle measurer to check these angles.

ANSWERS

Question 1 a): Five shapes have at least one right angle (rectangle – 4; purple trapezium – 2; square – 4; right-angled triangle – 1; irregular hexagon – 5).

Question 1 b): There should be squared angle marker in every right angle; lines meeting at a right angle are perpendicular.



Right angles in shapes

Discover

1 a) How many of these shapes have at least one right angle?

b) Copy the shapes with right angles onto squared paper and mark each right angle. Show a friend two lines that are perpendicular to each other.

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Share

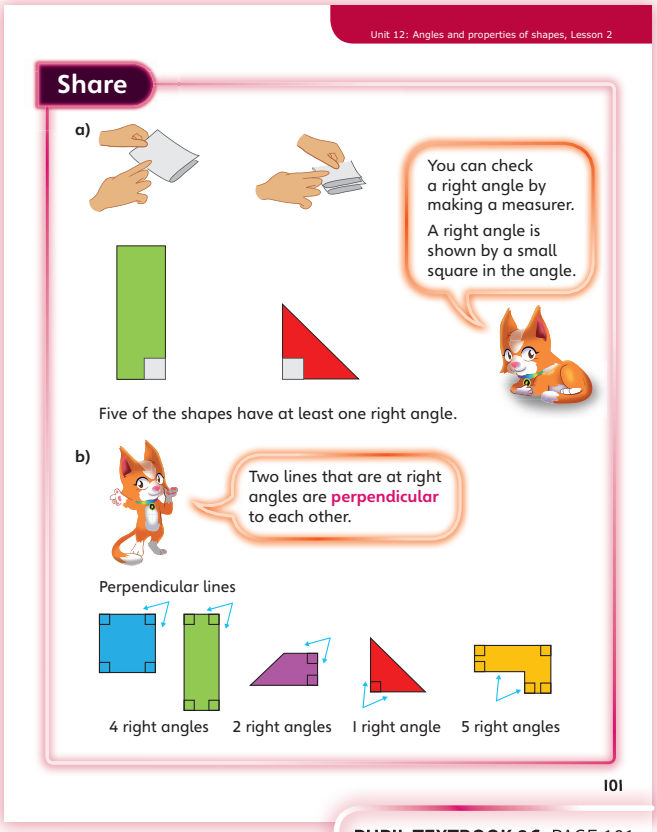
WAYS OF WORKING Whole class teacher led

ASK

- Question 1 a): *How can the measurer be used to check this angle?*
- Question 1 a): *How do you line up the measurer to check the angle accurately?*
- Question 1 a): *Can you predict whether any of these angles are not right angles before you check?*
- Question 1 b): *How many right-angle symbols do you need to show on the rectangle?*

IN FOCUS Question 1 a) shows children how to use an angle measurer and how to check whether an angle is a right angle, greater than a right angle or less than a right angle. Children should be given the opportunity to discuss how they know that the circle, hexagon and isosceles trapezium do not have right angles.

Question 1 b) shows children how to mark right angles using conventional notation.



Share

a)

Five of the shapes have at least one right angle.

b)

Perpendicular lines

4 right angles | 2 right angles | 1 right angle | 5 right angles

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Think together

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

ASK

- Question 1: *Can you measure the angle in a curve?*
- Question 2: *Should you measure the angles inside or outside the shape?*
- Question 4: *How could you use the pattern of the grid to decide where to draw the lines?*

IN FOCUS Questions 1 and 2 develop an understanding of recognising right angles in different orientations, and recognising non-examples (curved lines).

STRENGTHEN Encourage children to practise using a measurer, but also to make predictions before they measure so that the tool becomes a means of checking, and their predictions require some visual reasoning. Use large scale 2D shapes to make the task easier.

DEEPEN Challenge children to explain how to use a grid to find right angles in different orientations (diagonals). Question 4 challenges children to use the grid to decide where to draw right angles. This revisits the word perpendicular, introduced in the **Share** section and is covered more explicitly in a later lesson. The lines do not need to cross, and can be any length, but all should be drawn carefully, joining the dots not going between them.

ASSESSMENT CHECKPOINT Children should be able to use an informal paper angle measurer to check if an angle is a right angle, identify angles that are clearly not right angles and explain that curved lines cannot show right angles.

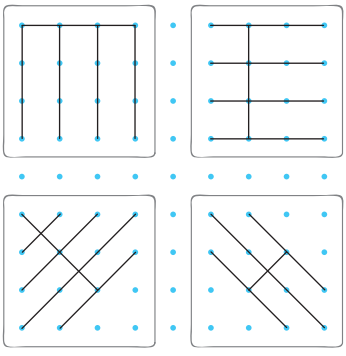
ANSWERS

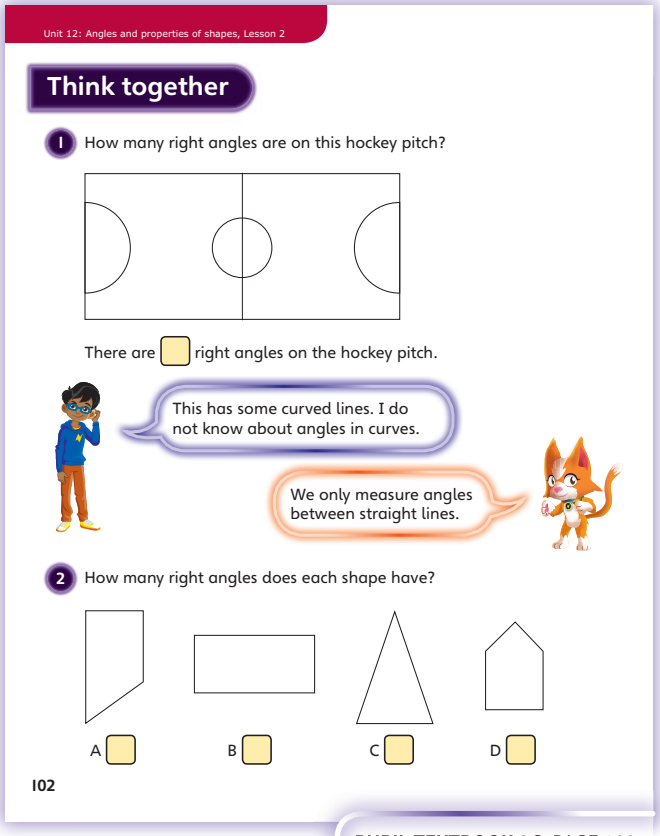
Question 1: There are 8 right angles on the hockey pitch.

Question 2: A 2; B 4; C 0; D 3

Question 3: Each shape has five internal right angles and one reflex angle that is a three-quarter turn. The external angle at the reflex is a right angle. It is more common to measure the internal angles of a shape.

Question 4: Solutions are as shown below. The lines can be shorter and they do not need to cross the given line.





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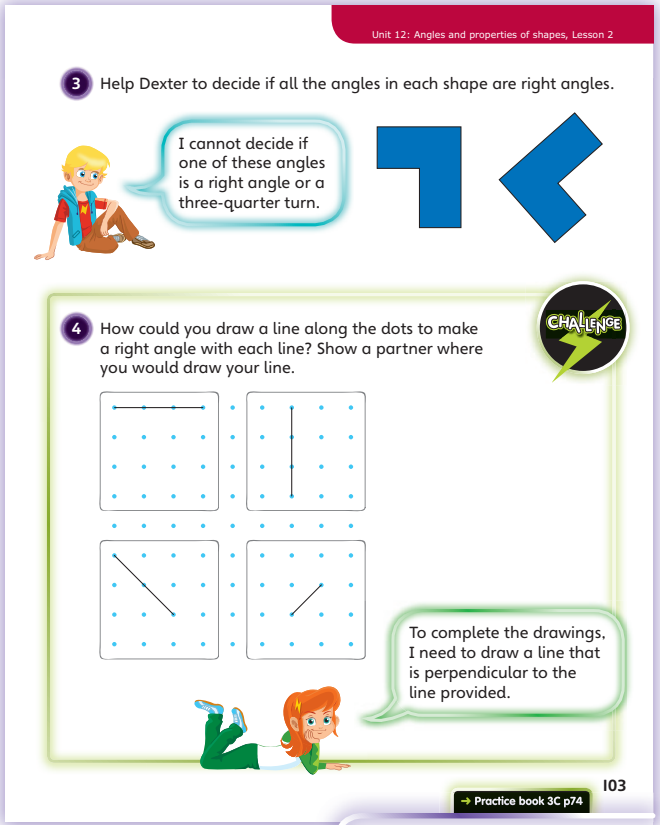

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Practice

WAYS OF WORKING Independent thinking

IN FOCUS Question 1 tests recognition of right angles, and the understanding that they cannot be formed by a curved line.

Question 2 focuses on right angles in 2D shapes that are oriented in different ways.

Question 4 focuses on forming pairs of perpendicular lines on a dotted grid when one line is given.

Question 6 is a logic puzzle with clues involving recognition of right angles.

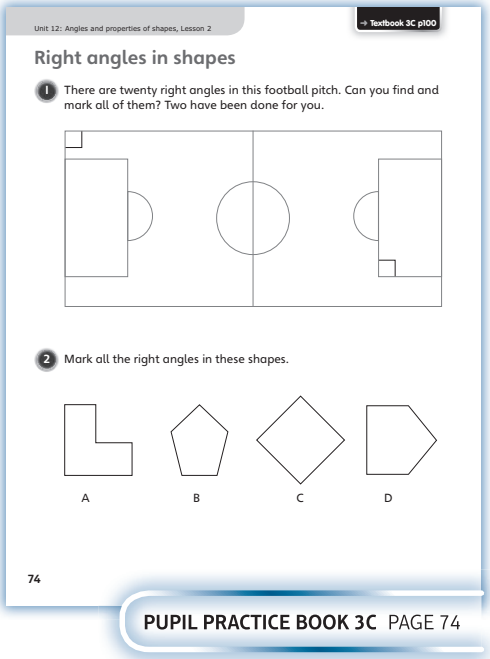
STRENGTHEN Encourage children to use visual reasoning and justify predictions before checking with an angle measurer. Examples on a slant could be turned to vertical/horizontal. Provide a variety of physical 2D shapes for children to identify the right angles in each. Ask: *Is this angle less than a right angle? Is it greater than a right angle?*

DEEPEN There are several solutions to question 4. Challenge children to find all the different solutions to each. There are a limited number if you insist the lines join the dots.

THINK DIFFERENTLY Question 3 challenges children to identify plausible misconceptions about right angles.

ASSESSMENT CHECKPOINT Children should be able to identify correctly the internal right angles of a variety of 2D shapes and be able to show pairs of perpendicular lines on a grid, including those on a diagonal. They will be beginning to identify angles within shapes that are greater than or less than a right angle and will know that right angles cannot be formed on curved lines.

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



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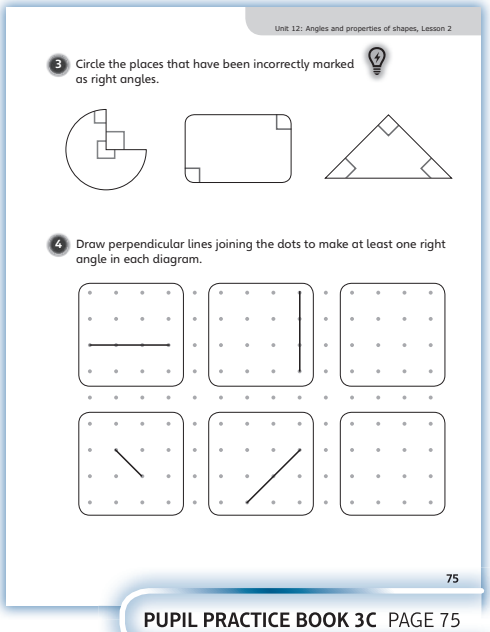

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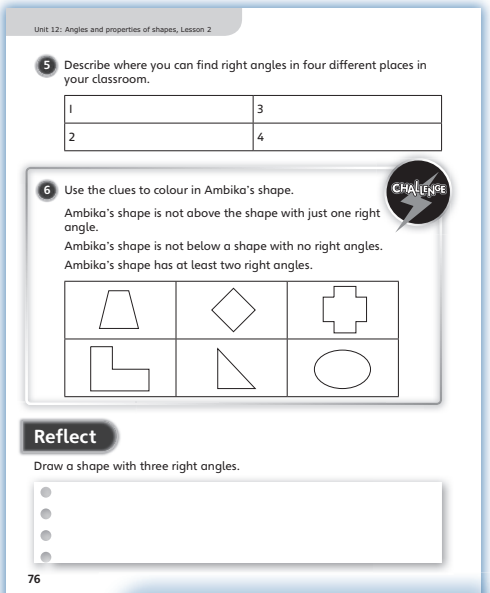
Reflect

WAYS OF WORKING Independent thinking

IN FOCUS This is an open opportunity for children to demonstrate their understanding. Once complete, they should share their shape with others, and use the right-angle notation to identify the three right angles.

ASSESSMENT CHECKPOINT Children accurately show a shape with exactly three right angles and use the correct notation to denote them.

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



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After the lesson

- Can children recognise right angles in different orientations?
- Can children explain the link between right angles and pairs of perpendicular lines?
- Can children use an angle measurer to check predictions made based on visual reasoning on grids?

Comparing angles

Learning focus

In this lesson, children learn how to recognise angles that are greater than, equal to or less than a right angle. They are introduced to the terms acute and obtuse.

Small steps

- Previous step: Right angles in shapes
- **This step: Comparing angles**
- Next step: Drawing accurately

NATIONAL CURRICULUM LINKS

Year 3 Geometry – Properties of Shapes

- Identify right angles, recognise that two right angles make a half turn, three make three quarters of a turn and four a complete turn; identify whether angles are greater than or less than a right angle.
- Recognise angles as a property of shape or a description of a turn.

ASSESSING MASTERY

Children can identify acute and obtuse angles in relation to a right angle in different orientations, using visual reasoning and checking with a right-angle measurer. They can use reasoning to predict or justify whether an angle is greater or less than a right angle.

COMMON MISCONCEPTIONS

Children may think that an angle is a measure of the size of the space between two lines, and so may think that a given angle is larger if the lines extend further. Ask:

- *How could you compare the size of these two angles to see which is smaller/larger?*

STRENGTHENING UNDERSTANDING

Children could use two rods hinged together at a point, or a folded piece of card, to create angles greater than, equal to or less than a right angle in different orientations. They should start with a right angle, and close the rods (or card) in for an acute angle and open them further out for an obtuse angle. Children could also demonstrate the angles by creating an angle between their arms, or they could move the hands on a clock face to form right angles first, then obtuse or acute angles.

GOING DEEPER

Challenge children to make reasoned predictions before checking with a measure. They could use the properties of a given background (such as squared paper or a clock face) to justify their reasoning.

KEY LANGUAGE

In lesson: compare, angle, right angle, **acute**, **obtuse**, greater than (>), less than (<), equal to (=), turn, measure

Other language to be used by the teacher: predict, space, size, straight line, half turn, quarter turn, complete turn

STRUCTURES AND REPRESENTATIONS

Geoboard

RESOURCES

Optional: clock faces with moveable hands, a pair of hinged rods, pipe cleaners, two rulers or folded card to make angles, squared paper, geoboards and bands or square dotted paper to represent geoboards

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

Before you teach

- Can children show you a right angle with their arms or a folded piece of paper?
- Do children know that a right angle is a quarter turn?

Discover

WAYS OF WORKING Pair work

ASK

- Question 1: *Which angle do you need to measure in order to answer the question?*
- Question 1: *Are you looking for roof angles less than or greater than a right angle?*
- Question 1: *How can you measure each angle?*
- Question 1: *Can you see any right angles?*

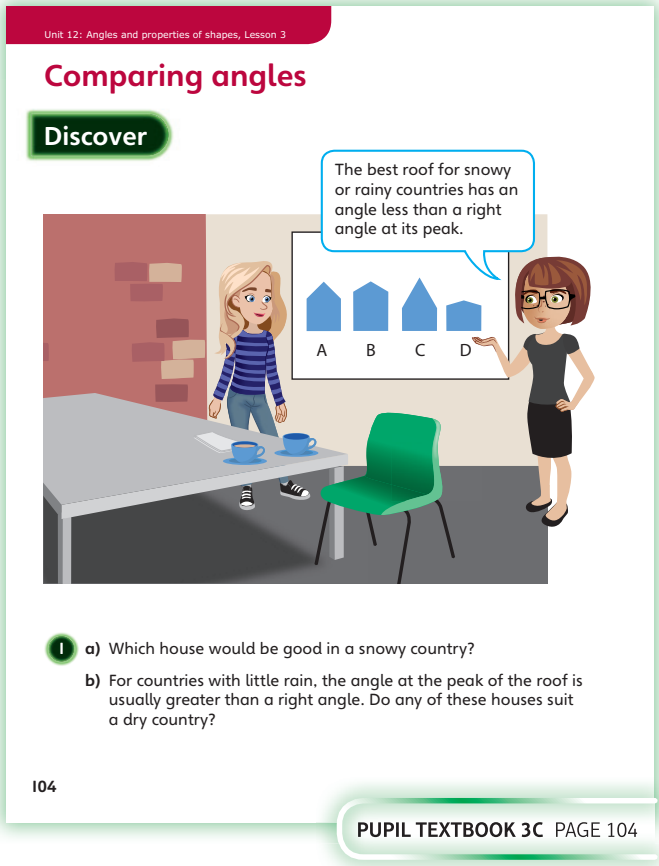
IN FOCUS Here, children's attention is drawn to the angle formed at the peak of the roof, and they consider how this angle relates to the pitch of the roof. Children may want to discuss the physical/engineering reasons that underlie the context, but should return to a comparison of the angle at the apex of each roof.

PRACTICAL TIPS Children could form the different angles of each roof by opening or leaning books to an approximation of the given angles. Alternatively, children could construct them from folded card, and place them above a box. This could form the basis of an interesting experiment in pouring water from a watering can to represent the rain.

ANSWERS

Question 1 a): House C would be good in a snowy country.

Question 1 b): Houses B and D would suit a dry country.



PUPIL TEXTBOOK 3C PAGE 104

Share

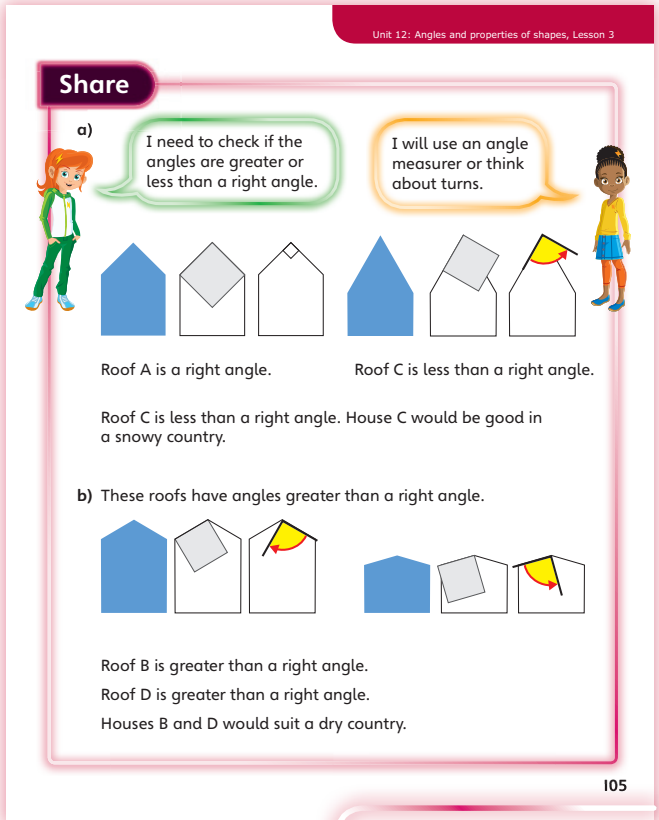
WAYS OF WORKING Whole class teacher led

ASK

- Question 1: *Can you predict which roof angle is less than a right angle just by looking?*
- Question 1: *How should you place a measurer to check your predictions?*
- Question 1: *Are you looking for roof angles less than or greater than a right angle for this part of the question?*

IN FOCUS Question 1 a) focuses on identifying the acute angle but without introducing this language.

Question 1 b) focuses on identifying the two obtuse angles, but once again the language will be formally introduced by Sparks in **Think Together**.



PUPIL TEXTBOOK 3C PAGE 105

Think together

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

ASK

- Question 1 : *Can you tell just by looking whether this angle is greater than or less than a right angle?*
- Question 1 : *Is an acute angle greater than or less than a right angle?*
- Question 2 : *Which numbers on a clock are at right angles to each other?*
- Question 2 : *Is the angle between two numbers next to each other on the clock less or more than a right angle?*

IN FOCUS Question 2 uses the angles between numbers on a clock face to identify acute and obtuse angles.

Question 3 asks children to show or make acute and obtuse angles on a geoboard.

STRENGTHEN Ask children to make predictions and check them using a right angle to compare with the given angle. Children should also practise forming different angles by opening the covers of a book, or pivoting their arms about a point. They could use geoboards to explore question 2 : it is helpful for children to see that the angles between 12 and 3, 3 and 6, 6 and 9, and 9 and 12 are all right angles. Link this with quarter turns and the fact that the angle between 12 and 6 is a half turn – as is the angle between all pairs of opposite numbers.

DEEPEN Challenge children to justify their reasoning about different or similar acute and obtuse angles represented on the geoboards in different orientations. Can children recognise when two angles are the same (rotations or reflections of one another)? Extend question 3 by asking children to start with the right angle in a different place on the board.

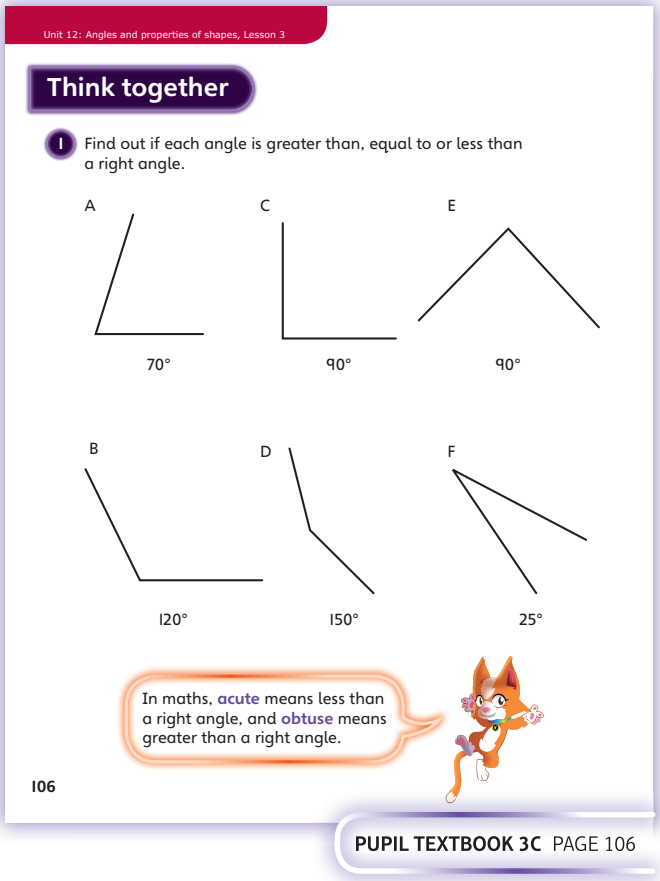
ASSESSMENT CHECKPOINT Children should be able to recognise, form or draw angles that are greater than, less than or equal to a right angle and explain the terms acute and obtuse in relation to a right angle.

ANSWERS

Question 1 : A and F are acute; B and D are obtuse; C and E are right angles.

Question 2 : A is a right angle; B is acute; C is acute; D is obtuse; E is a right angle; F is obtuse.

Question 3 : There are multiple solutions to this question. If children keep to the given right angle, then there are more acute than obtuse angles possible.



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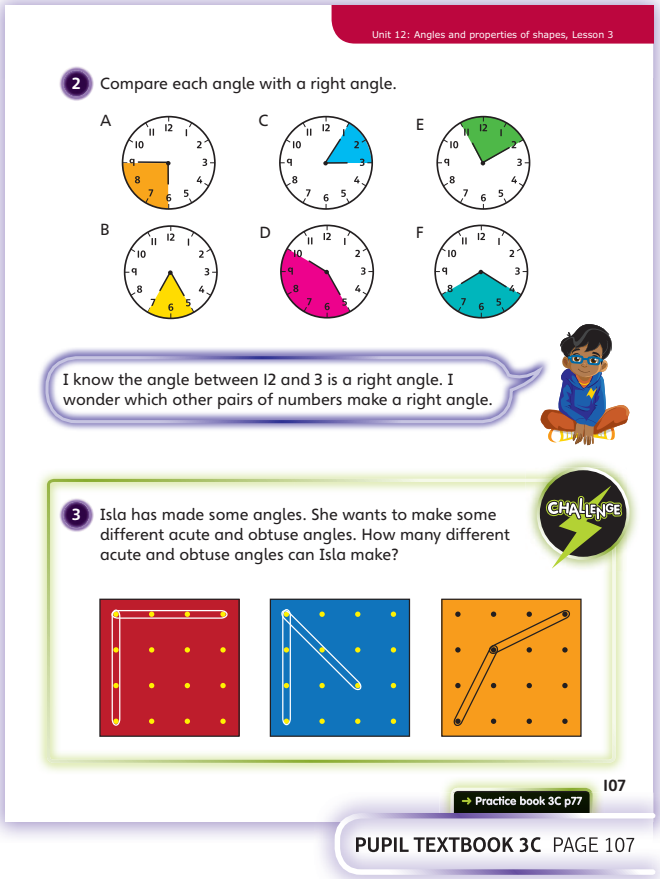


PUPIL TEXTBOOK 3C PAGE 107

Practice

WAYS OF WORKING Independent thinking

IN FOCUS The focus here is on recognising and drawing angles that are less than, greater than or equal to a right angle.

Question 5 asks children to make predictions about acute and obtuse angles and to justify their reasoning.

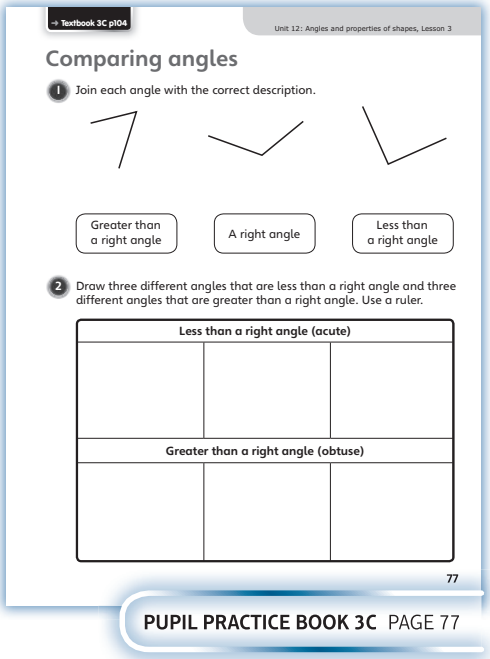
STRENGTHEN Encourage children to demonstrate acute and obtuse angles as turns, using pipe cleaners bent into the shapes or clock faces with moveable hands.

DEEPEN Challenge children to make generalisations about the angles between numbers on a clock face. For example: between consecutive/alternate numbers the angles are acute; between three numbers (1 and 4, 2 and 5 and so on) the angle is a right angle; between more than three numbers the angle is obtuse; opposite numbers are on a straight line, or a half turn.

THINK DIFFERENTLY Question 4 will require children to form angles in various orientations to ensure they draw three different angles of each type that are not simply rotations or reflections.

ASSESSMENT CHECKPOINT Children should be able to recognise, form or draw angles that are greater than, less than or equal to a right angle and explain the terms acute and obtuse in relation to a right angle.

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



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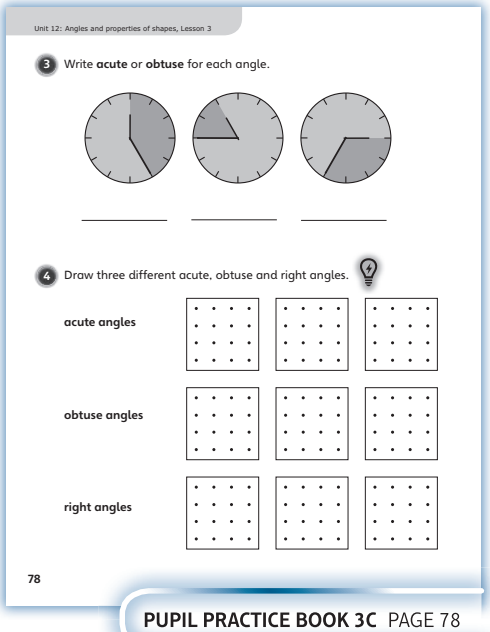


PUPIL PRACTICE BOOK 3C PAGE 78

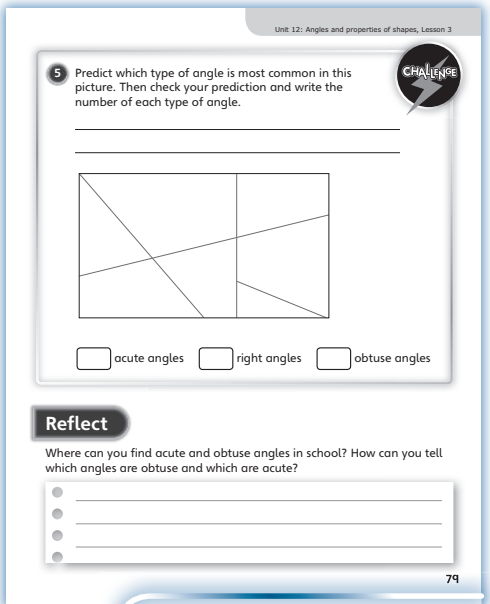
Reflect

WAYS OF WORKING Independent thinking

IN FOCUS This section asks children to explore their understanding of angles in the school environment. Some children may look around their classroom, while others may visualise angles that are in another part of the school.

ASSESSMENT CHECKPOINT Can children justify their suggestions by comparing the angles with a right angle?

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



PUPIL PRACTICE BOOK 3C PAGE 79

After the lesson

- Can children recognise angles that are greater than, less than or equal to a right angle in different orientations?
- Do children understand the terms acute and obtuse, explaining them in comparison to a right angle?

Drawing accurately

Learning focus

In this lesson, children develop their ability to draw and measure accurately in centimetres and millimetres, and apply this to reasoning about 2D shapes.

Small steps

- Previous step: Comparing angles
- **This step: Drawing accurately**
- Next step: Types of line (1)

NATIONAL CURRICULUM LINKS

Year 3 Geometry – Properties of Shapes

- Draw 2D shapes and make 3D shapes using modelling materials; recognise 3D shapes in different orientations and describe them.
- Identify horizontal and vertical lines and pairs of perpendicular and parallel lines.

ASSESSING MASTERY

Children can measure and draw accurately in centimetres and millimetres and use this skill to form and measure 2D shapes of given dimensions.

COMMON MISCONCEPTIONS

Children may not appreciate the importance of accuracy when drawing and measuring to form specific shapes. Ask:

- *Why is it important to measure the lines accurately when drawing a square?*

Children may not have mastered the ruler skills required. Ask:

- *Are you holding the ruler correctly to measure this line? Can you explain the mistake?*

STRENGTHENING UNDERSTANDING

Help children to measure single lines, and to mark accurately, by supporting their motor skills where necessary: for example, hold the ruler still once they have positioned it correctly.

GOING DEEPER

Challenge children to draw squares and rectangles of any given dimensions given as whole centimetres and millimetres.

KEY LANGUAGE

In lesson: measure, measurement, accurately, ruler, centimetre (cm), millimetre (mm), wide, width, length, predict, check, square, diagonal, opposite, corner

Other language to be used by the teacher: wide, long, rectangle, horizontal, vertical

STRUCTURES AND REPRESENTATIONS

2D shapes

RESOURCES

Mandatory: ruler, scissors, landscape A4 paper cut into 10 cm strips, squared paper

Optional: pre-cut 10 cm squares, plastic/wooden squares and rectangles

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

Before you teach

- Do children know any common mistakes made when measuring with a ruler?
- Can children explain the difference between centimetres and millimetres?
- Can children draw a line, for example, 3 cm 5 mm long?

Discover

WAYS OF WORKING Pair work

ASK

- Question 1 a): *Where should you place the ruler to start the measurement?*
- Question 1 a): *How do you measure exactly 10 cm?*
- Question 1 a): *How many whole 10 cm squares can be made?*

IN FOCUS Question 1 a) develops the skill of measuring accurately from Unit 8. Here, children are challenged to follow instructions to form a square, which requires accurate measurement.

PRACTICAL TIPS The dimensions of the paper strips are designed to match the width of an A4 piece of paper presented horizontally. Show a piece of A4 paper held horizontally and explain that what is shown in the book is a 10 cm strip cut from this size paper. Cut out an approximate strip of depth 10 cm to demonstrate. Give each child an accurately cut 10 cm deep strip of A4 paper. If the mixed units of 29 cm 7 mm is a distraction for children, then the strips could be pre-cut to a width of 25 cm, for example, and the instructions adapted accordingly.

ANSWERS

Question 1 a): You can make two 10 cm squares. Use a ruler to measure 10 cm accurately across the top and bottom of the strip, make markers, draw a line and cut out the square.

Question 1 b): The piece of paper left over is 9 cm and 7 mm wide.

PUPIL TEXTBOOK 3C PAGE 108

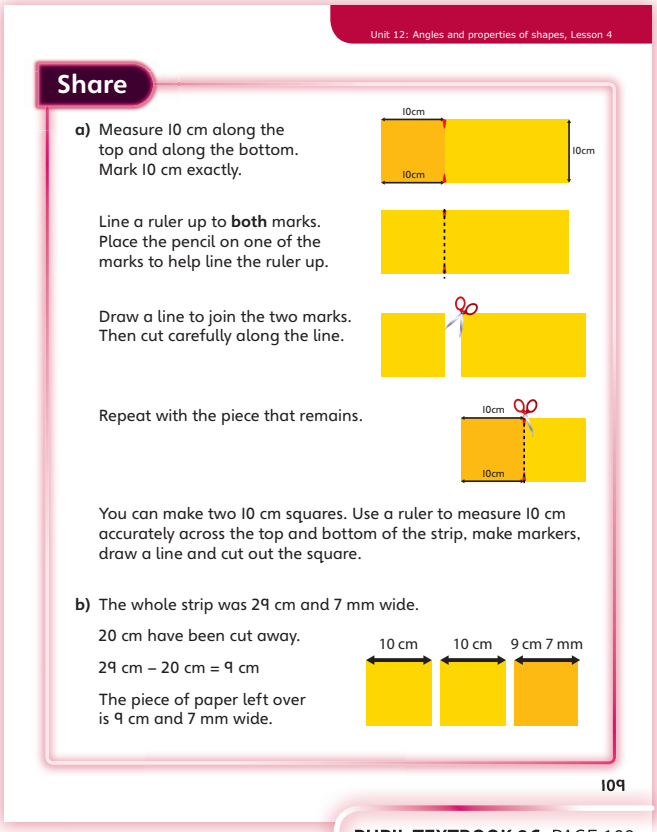
Share

WAYS OF WORKING Whole class teacher led

ASK

- Question 1 a): *Why do you need to measure and make a mark at the top and the bottom?*
- Question 1 a): *How can you make sure your square is 10 cm along each side?*
- Question 1 b): *How will you find out how wide the left over piece is?*

IN FOCUS This shows children a method for measuring accurately: make two opposing marks and then join them. This skill is transferable to other craft or design activities.



PUPIL TEXTBOOK 3C PAGE 109

Think together

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

ASK

- Question 1 : *Which line will you measure and draw first?*
- Question 2 : *Which line will you cut first?*
- Question 2 : *Do you need to cut out each shape separately?*
- Question 4 : *Is Astrid correct?*

IN FOCUS Questions 1 and 2 focus on accurate measuring. Both use one of the 10 cm squares that were made previously, so it is important that these are accurate. If necessary provide pre-cut 10 cm squares.

Question 4 provides an opportunity for reasoning about the relative lengths of diagonals of squares.

STRENGTHEN Support children with their motor skills where necessary. Children should focus on the skill of measuring accurately, but may need someone to support the ruler while they draw lines to join points. When using squared paper, encourage children to keep to the vertical and horizontal grid lines for relevant sides.

DEEPEN Challenge children to draw squares on squared paper to explore whether both the diagonals of a square are the same length or different lengths and whether the diagonals are always longer than the sides. Children could also explore diagonals in rectangles.

ASSESSMENT CHECKPOINT Children should realise that accurate drawing and measuring is an important skill. They should be able to use a ruler correctly to make the necessary markers to draw and measure the length of the sides of squares and rectangles accurately.

ANSWERS

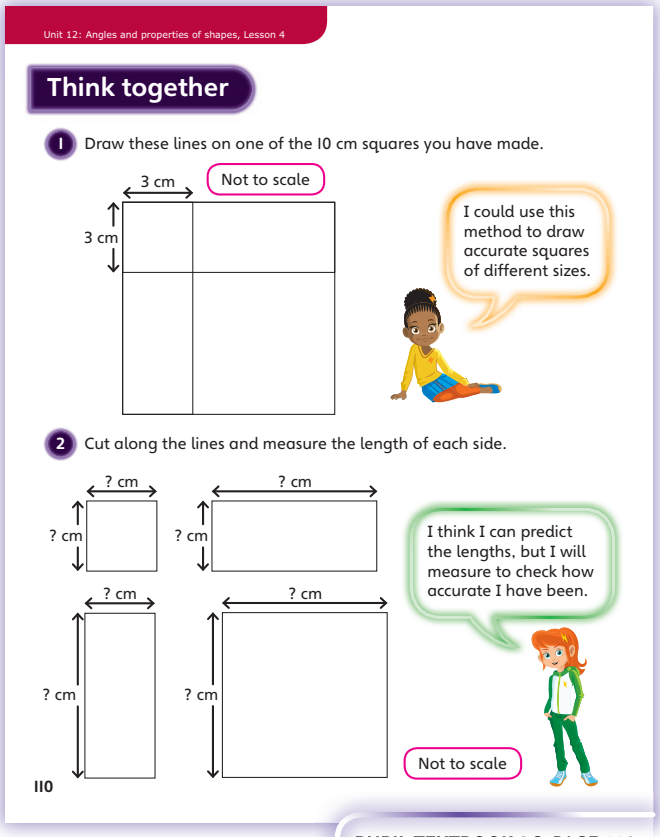
Question 1 : The lines (horizontal and vertical) should be measured and drawn accurately.

Question 2 : The cut-out shapes are: a 3×3 cm square; a 7×7 cm square; two 3×7 cm rectangles.

Question 3 : Triangle A: 5 cm, Triangle B: 3·6 cm.

Both triangles should be drawn accurately.

Question 4 : Square A: 4·2 cm, Square B: 9·9 cm.



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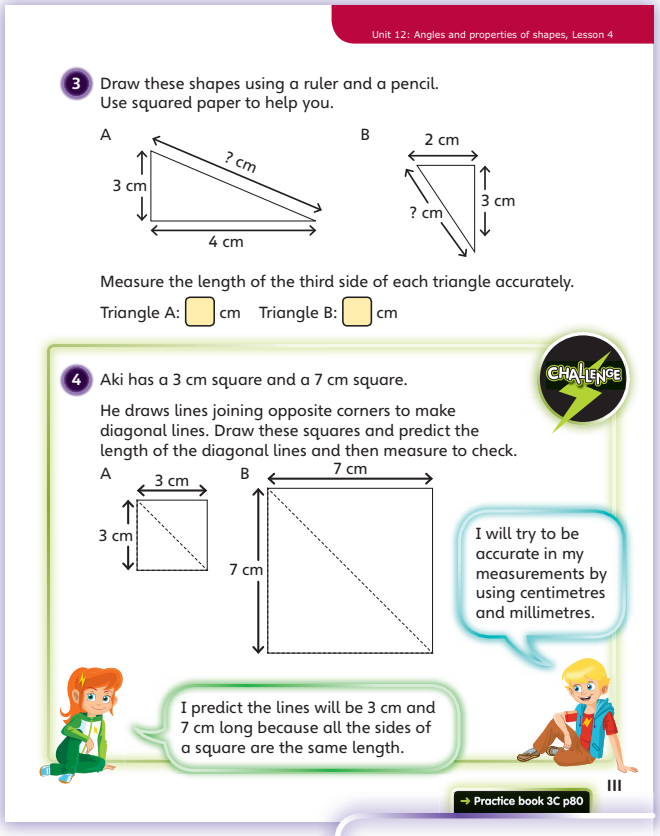


PUPIL TEXTBOOK 3C PAGE 111

Practice

WAYS OF WORKING Independent thinking

IN FOCUS Questions 1 and 3 focus on measuring and drawing in centimetres and millimetres.

STRENGTHEN Build children's confidence by measuring some given shapes or using given shapes as stencils, by marking a dot at each corner, and then joining the dots using a ruler; or keep to shapes with most lengths in whole centimetres. Children could measure the lengths of wooden/plastic squares and rectangles for further practice.

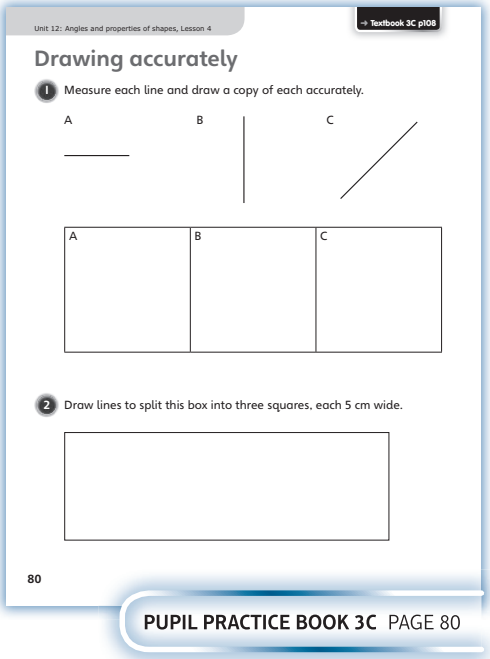
DEEPEN Question 3 challenges children to enhance their accuracy in measuring. Question 4 challenges children to form shapes of relative size to one another, using proportional reasoning.

For further practice, ask children to measure 2D squares and rectangles and then make accurate drawings of them. They could also explore right-angled triangles. Can children explain why they do not need to measure the diagonal side before they draw it?

THINK DIFFERENTLY In question 3, children will need to think about where to start for these diagrams as they cannot always begin as before with the vertical/horizontal from the left. If the copies are not accurate encourage children to explain why they think this has happened.

ASSESSMENT CHECKPOINT Children should realise that accurate drawing and measuring is an important skill. They are able to use a ruler correctly to make the necessary markers to draw and measure the length of the sides of squares and rectangles accurately.

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



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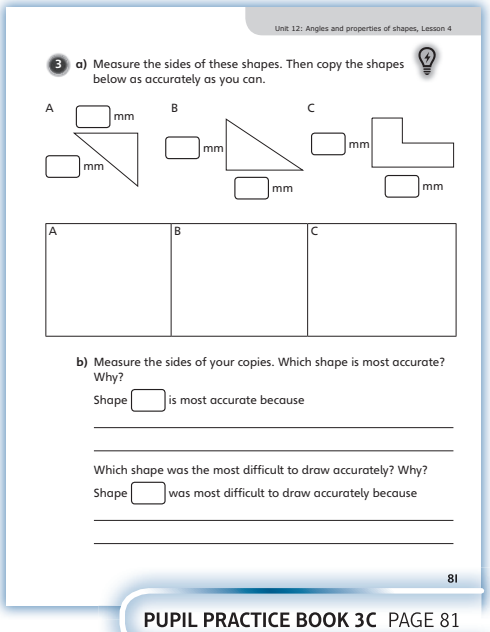


PUPIL PRACTICE BOOK 3C PAGE 81

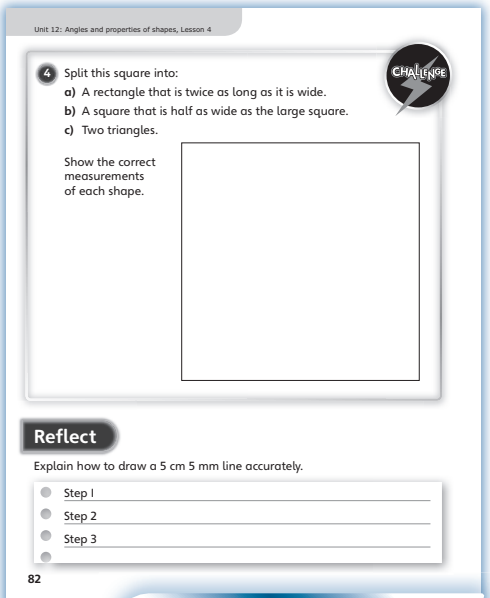
Reflect

WAYS OF WORKING Independent thinking

IN FOCUS Children need to use the correct words to break the skill down into its key steps.

ASSESSMENT CHECKPOINT Do children's explanations take into account common errors, such as letting the ruler slip or measuring from the wrong mark?

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



PUPIL PRACTICE BOOK 3C PAGE 82

After the lesson

- Can children measure and join two opposing marks to form a given line?
- Are children able to apply their understanding of millimetres and centimetres to drawing 2D shapes?
- Where children are unsuccessful, what is causing the inaccuracies (measuring, using a ruler or a different reason)?

Types of line (1)

Learning focus

In this lesson, children learn to identify and draw horizontal and vertical lines.

Small steps

- **Previous** step: Drawing accurately
- **This step: Types of line (1)**
- Next step: Types of line (2)

NATIONAL CURRICULUM LINKS

Year 3 Geometry – Properties of Shapes

Identify horizontal and vertical lines and pairs of perpendicular and parallel lines.

ASSESSING MASTERY

Children can identify horizontal and vertical lines, construct horizontal and vertical lines, and recognise where lines are neither vertical nor horizontal. They are able to explain the relevance of horizontal and vertical lines in examples relating to their environment.

COMMON MISCONCEPTIONS

Children may find it difficult to remember which term relates to which property. **Horizon**tal is flat, like the **horizon**; **vert**ical stands up straight like **vert**ebrae in your back. Children may use the terms 'flat' or straight' instead. Ask:

- *How could you describe the two types of line without using the words 'horizontal' or 'vertical'?*
- *Can a straight line be neither horizontal nor vertical?*

STRENGTHENING UNDERSTANDING

Children could use a range of equipment, such as string, metre sticks or PE benches, to explore the concepts practically. They could try to balance a ball or marble on a table or a plank to keep it still (either horizontally or vertically). Discuss words which have the same roots.

GOING DEEPER

Provide a set of horizontal and non-horizontal lines which have a base line (similar to the ground in the **Discover** picture). Ask children to label those which are horizontal and to measure using a ruler those which are not horizontal to see how far one end needs to be moved in order to make it horizontal.

KEY LANGUAGE

In lesson: **horizontal**, **vertical**, straight, lower, higher, height, level, raised, lowered, right angle, line of symmetry, mirror line

Other language to be used by the teacher: plumb line, balanced, metre (m), centimetre (cm)

STRUCTURES AND REPRESENTATIONS

squared paper

RESOURCES

Optional: plumb line, PE equipment, marbles, mirrors, clear pictures of a flat and straight horizon

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

Before you teach

- Do children know what it means to sit up straight?
- Do children know what the horizon is?

Discover

WAYS OF WORKING Pair work

ASK

- Question 1 a): *What is the same and what is different about the shelves?*
- Question 1 a): *Why are shelves designed to be a certain way?*
- Question 1 b): *How could the shelf be adjusted to make it work better?*

IN FOCUS Children will need to compare the shelves in the picture, and begin to search for an accurate way to describe the type of line they will come to know as horizontal.

PRACTICAL TIPS This context could be adapted in a number of ways. Children could explore horizontal surfaces by looking at when a ball balances motionless on a plank, or they could try walking around with a tennis ball balanced on a racket.

Alternatively, children could look at shelves in different parts of the school and judge why they are all level. Show children pictures of the horizon where there is a clear straight and level line between sea and sky, or land and sky; explain that this is called the horizon, which can help you remember that the word horizontal means level and flat, left to right (or right to left).

ANSWERS

Question 1 a): The books stand upright on the horizontal shelf but have fallen over on the other shelf.

Question 1 b): The shelf can be fixed by raising one end to 1 m 55 cm, or lowering the other to 1 m 50 cm.

PUPIL TEXTBOOK 3C PAGE 112

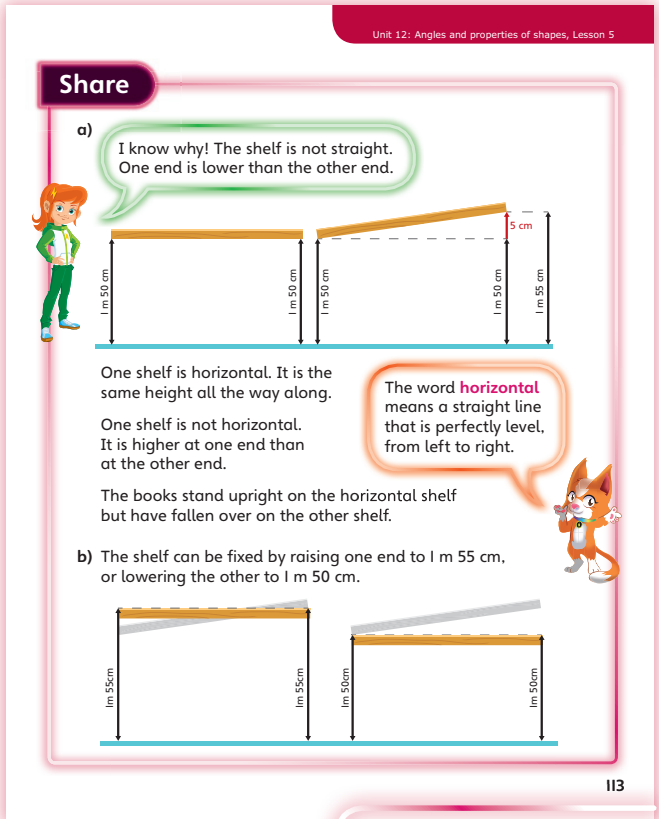
Share

WAYS OF WORKING Whole class teacher led

ASK

- Question 1 a): *How do know that one shelf is not horizontal?*
- Question 1 b): *In how many different ways could the shelf be fixed?*

IN FOCUS This might be the first time children have used the word horizontal. They may need to explore its meaning in terms of their experience of other level situations, such as balancing on a beam, climbing a hill, rolling down a hill or riding a bike.



PUPIL TEXTBOOK 3C PAGE 113

Think together

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

ASK

- Question 1 : *What do horizontal and vertical mean?*
- Question 1 : *Which are the horizontal parts of the fence? Which are the vertical parts of the fence?*
- Question 2 : *What causes a plumb line to hang vertically?*
- Question 3 : *Are lines of symmetry always vertical?*

IN FOCUS Question 2 demonstrates a method for testing for vertical lines in the environment, and deepens children's understanding of vertical as straight down due to gravity.

Question 3 applies the concept of vertical and horizontal lines to the context of symmetry in simple polygons. Note that if shapes were turned a quarter turn, then the vertical symmetry lines would become horizontal, and vice versa. This is picked up in **Practice** question 5 .

STRENGTHEN Explore the language of straight across and straight down in physical terms, by dropping or rolling a ball, and balancing objects.

DEEPEN Challenge children to explore the relationship between gravity and our understanding of horizontal and vertical lines. Ask children to find examples around school where objects that should be vertical or horizontal are not (fence falling down, bent netball post, pictures hung crookedly) and where objects are deliberately not vertical or horizontal for a particular purpose (ramps for example).

ASSESSMENT CHECKPOINT If children are able to recognise both horizontal and vertical lines of symmetry in question 3 and choose the correct term (vertical or horizontal) to describe the line of symmetry, then they will show good understanding.

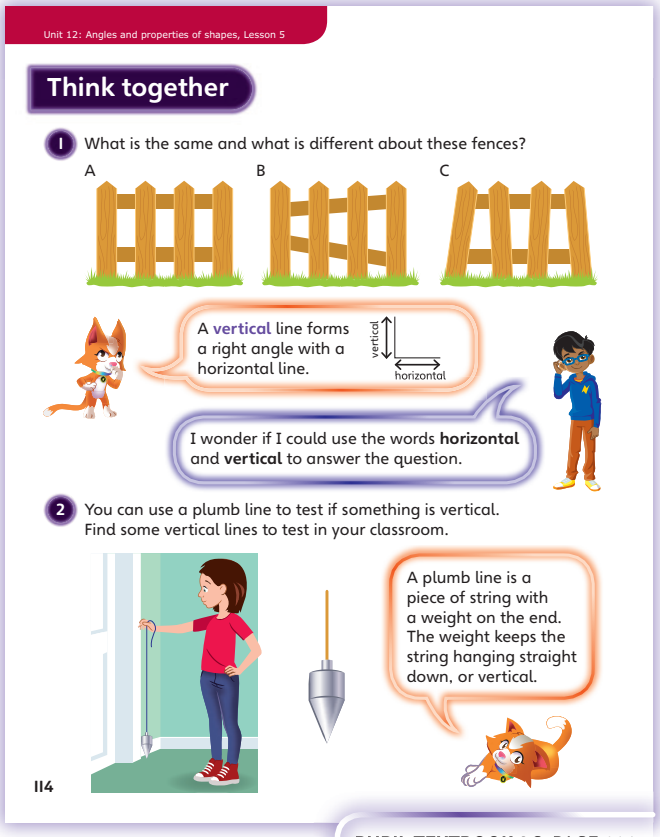
ANSWERS

Question 1 : Fence A has vertical posts and horizontal crosspieces; fence B has vertical posts but crosspieces are not horizontal; fence C has horizontal crosspieces but the posts are not vertical.

Question 2 : Explore and identify vertical and non-vertical lines using a plumb line around school; children could check door frames, table legs, the backs of chairs, whether walls are vertical, and so on.

Question 3 a): The triangle, the kite and the trapezium (A, E, F) have horizontal symmetry; the rectangle and the rhombus (B, D) have both vertical and horizontal symmetry; the parallelogram (C) has no lines of symmetry.

Question 3 b): Children will design different shapes with horizontal lines of symmetry.



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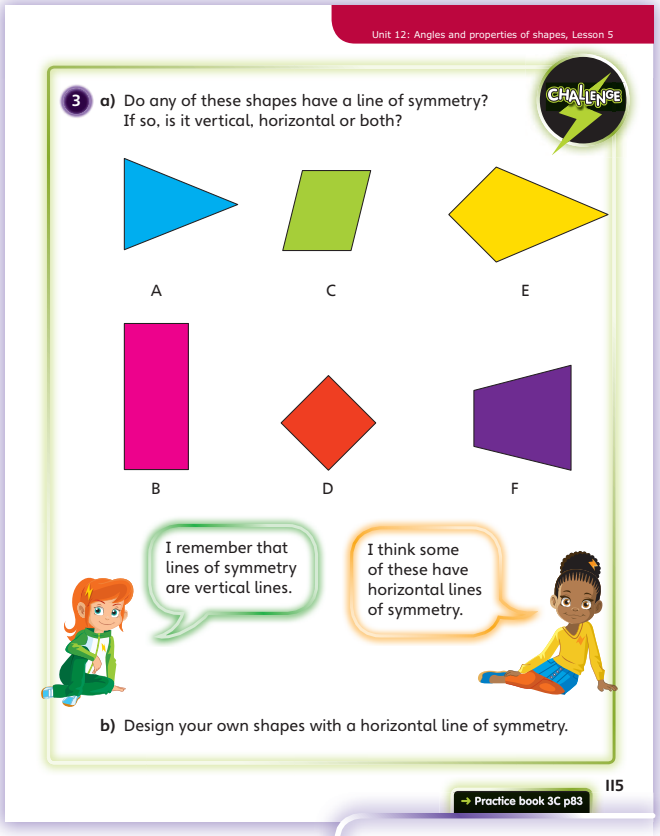


PUPIL TEXTBOOK 3C PAGE 115

Practice

WAYS OF WORKING Independent thinking

IN FOCUS Questions 1 and 2 are about recognising horizontal and vertical lines, and identifying lines which are neither.

Question 3 requires children to draw the given lines.

Question 4 looks for vertical and horizontal lines of symmetry.

Question 6 challenges children to use their measuring skills to show whether or not the lines are vertical or horizontal. Children could predict and then use measuring to test their predictions.

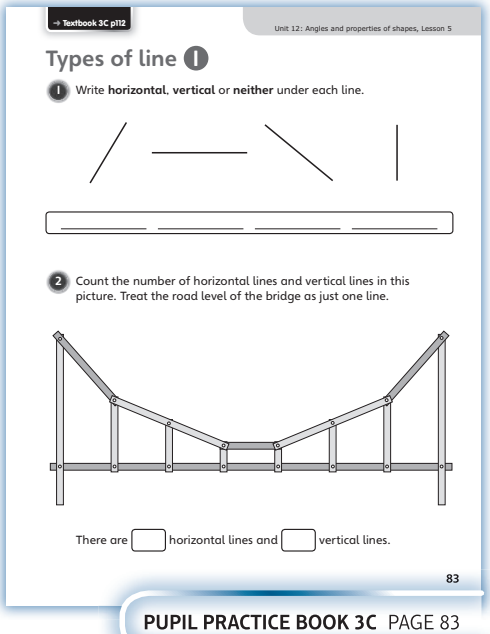
STRENGTHEN Explore horizontal and vertical lines with practical equipment such as string, metre rules, or by aligning PE benches.

DEEPEN Challenge children to apply their measuring skills to prove which lines are or are not vertical or horizontal by measuring from the top and bottom and from the left and right. Ask children to design artwork with vertical and horizontal lines and some lines that are neither horizontal nor vertical.

THINK DIFFERENTLY Question 5 challenges children to think back to the lesson on right-angle turns to change the mirror line from a horizontal to a vertical, or vertical to horizontal, by turning the shape a right-angle quarter turn clockwise or anticlockwise.

ASSESSMENT CHECKPOINT Children should now be able to draw and identify lines that are vertical, horizontal or neither and use this skill to describe lines of symmetry in simple polygons.

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



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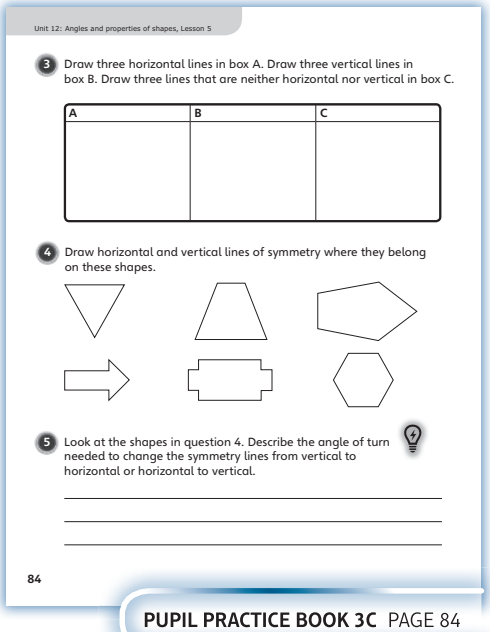


PUPIL PRACTICE BOOK 3C PAGE 84

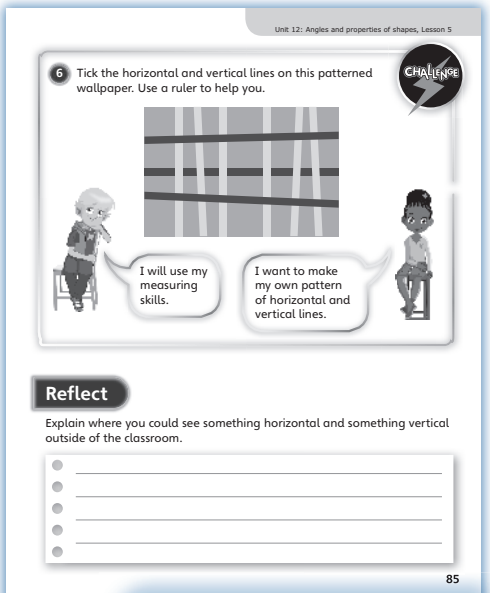
Reflect

WAYS OF WORKING Independent thinking

IN FOCUS Children should discuss and justify their ideas, based on reasoning about the physical properties of horizontal and vertical lines and surfaces. They could consider where it is necessary, helpful or not important for items to be vertical or horizontal.

ASSESSMENT CHECKPOINT Can children link the technical words to the properties of horizontal and vertical lines?

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



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After the lesson

- Have children developed a good understanding of the two types of line in relation to everyday experience?
- Can children apply their measuring skills to construct and identify horizontal and vertical lines?

Types of line 2

Learning focus

In this lesson, children learn to identify and construct parallel and perpendicular lines.

Small steps

- Previous step: Types of line (1)
- **This step: Types of line (2)**
- Next step: Recognising and describing 2D shapes

NATIONAL CURRICULUM LINKS

Year 3 Geometry – Properties of Shapes

Identify horizontal and vertical lines and pairs of perpendicular and parallel lines.

ASSESSING MASTERY

Children can explain that parallel lines are a constant distance apart, and even if the lines continued indefinitely they would never cross. Children can construct parallel lines that meet this property. They also understand that perpendicular lines intersect at right angles, and can construct a range of lines perpendicular to another line.

COMMON MISCONCEPTIONS

Children may assume that parallel lines must be of identical length. Ask:

- *How can you tell if these two lines are parallel?*

Children may assume that any two lines which do not intersect are parallel. Ask:

- *Would these two lines cross if they were continued?*

Children may confuse the two terms. Explain:

- *The word parallel has the letter 'l' twice in the middle, which itself shows a pair of parallel lines.*

STRENGTHENING UNDERSTANDING

Explore parallel and perpendicular lines through drawing, observing the environment around school, art activities such as weaving, and looking at pieces of modern art (for example, the work of Piet Mondrian).

GOING DEEPER

Can children form parallel lines by reasoning about a shape or a background; for example by measuring regular intervals or using the squares or dots on grid paper (especially for non-horizontal or non-vertical lines)?

KEY LANGUAGE

In lesson: **parallel**, perpendicular, right angle, distance, ruler, concertina, angle, sign, describe, diagram

Other language to be used by the teacher: measure, identical length, constant distance, construct, intersect, extend, extended

RESOURCES

Mandatory: ruler, paper for folding, square paper, square dotted paper

Optional: examples of modern art that contain parallel and perpendicular lines (Piet Mondrian); circles (see **Practice Book**, question 5) with 3–10 dots

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

Before you teach

- Can children use their hands or arms to show a right angle?
- Do children know how to measure the distance between two lines accurately?

Discover

WAYS OF WORKING Pair work

ASK

- Question 1: *How can the folds be made accurately?*
- Question 2: *What sorts of lines will the creases make?*

IN FOCUS Children will need to visualise what the creases will look like, before folding and checking for themselves. There may be a need for a discussion around why there could be differences, if some people fold more accurately than others.

PRACTICAL TIPS Children could fold their own sheets of scrap paper, trying to match the concertina Isla is folding. Challenge children to line up the bottom edge with the first fold so that the lines are equally spaced.

Alternatively, children could explore the situation by lining up pencils so they are all facing the same direction, or placing cones in a line so that they form stripes that would never cross.

ANSWERS

Question 1 a): When Isla unfolds the paper, she will see parallel lines made by the folds.

Question 1 b): When Max opens his paper, it will have parallel lines like Isla's, but also perpendicular lines where he has folded his paper in half.

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Share

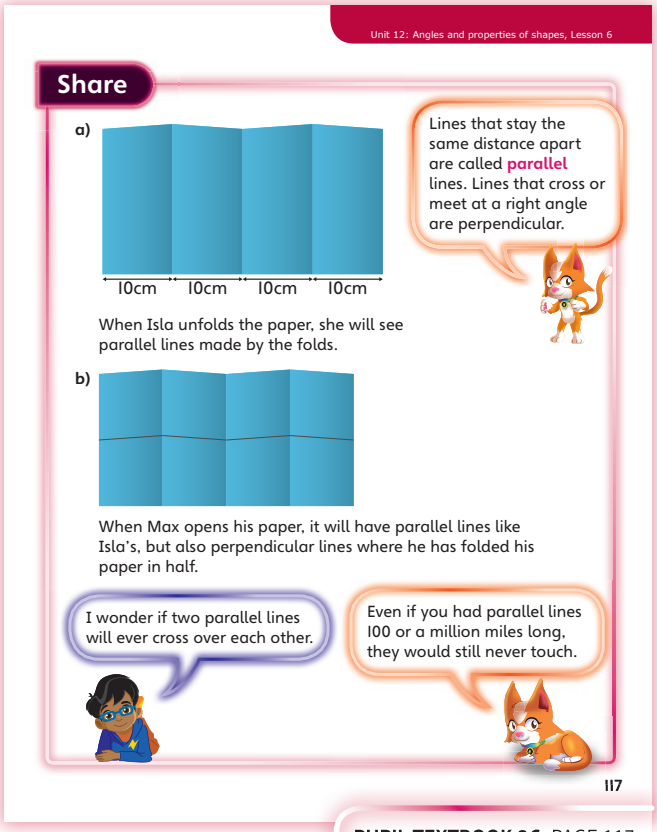
WAYS OF WORKING Whole class teacher led

ASK

- Question 1 a): *How could you use measuring to check if your creases are parallel?*
- Question 1 a): *Would these creases still be parallel if you turned the page a quarter turn?*
- Question 1 b): *How many horizontal/vertical lines will there be when the paper is opened up?*
- Question 1 b): *At what angle do the lines on Max's paper cross?*

IN FOCUS Children will need to understand that parallel lines are a constant distance apart and would never intersect (cross over), even if extended indefinitely.

Children will also need to understand that perpendicular lines are related to right angles. They either *meet* at a right angle (more often found in 2D shapes) or *cross over* each other at a right angle.



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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 line can you see in this picture?*
- Question 1: *How do you think the artist created this picture?*
- Question 3: *How can you tell if lines are parallel or perpendicular?*

IN FOCUS Question 1 shows vertical and horizontal parallel lines, which then form many pairs of perpendicular lines. By discussing this picture, children will learn that: pairs of parallel lines can be at different distances apart from other pairs; parallel lines can be vertical or horizontal; perpendicular lines can join in the middle of a line not just at the ends, and that perpendicular lines can cross.

Question 3 a) addresses several misconceptions: sometimes children think that parallel lines must be the same length; that if lines do not actually cross then they must be parallel; and that lines actually have to cross to be perpendicular.

STRENGTHEN Explore parallel lines in different orientations and of different lengths through drawing or lining up strips of paper or straight objects. In question 3 a), ask children to copy the lines onto squared paper, or use a pair of rulers or rods on the page to continue the lines as far as is necessary, to see if the pairs are parallel, perpendicular or neither.

DEEPEN Question 3 b) challenges children to use the grid to justify how to draw lines parallel to diagonal lines. Can children spot how to do this by either using the diagonals of the squares or by using the ratio of squares up to squares across?

ASSESSMENT CHECKPOINT Children should be able to use the images in this lesson to explain what they understand about parallel and perpendicular lines and know which word describes each pair of lines. Children should explain that lines can be parallel or perpendicular even when the lines are not vertical or horizontal.

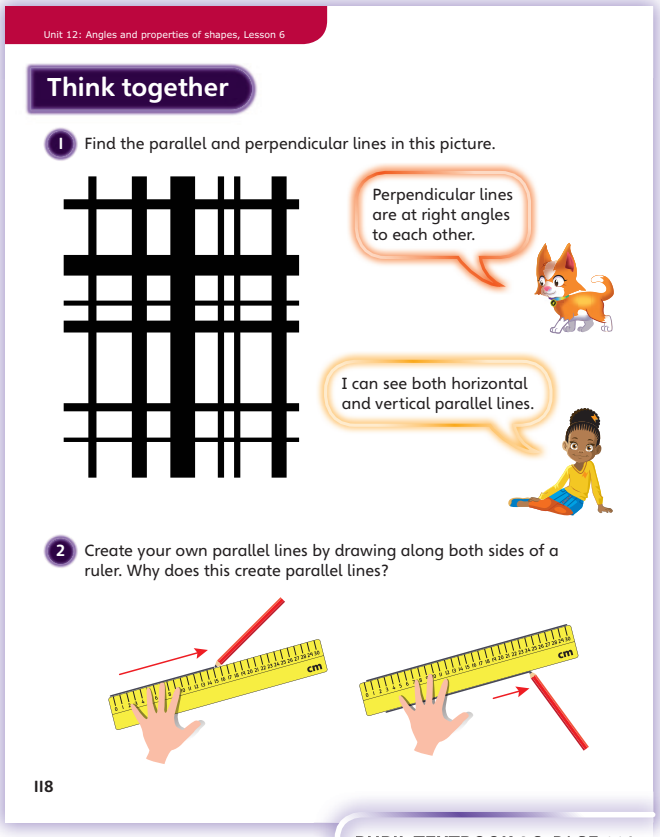
ANSWERS

Question 1: There are both vertical and horizontal parallel lines. The vertical lines are all perpendicular to the horizontal lines, and vice versa.

Question 2: A ruler has a constant width so will produce parallel lines that are a ruler width apart.

Question 3 a): A shows parallel lines (they can be on a diagonal)
B shows parallel lines (they need not be the same length)
C does not show parallel lines, as they would cross over if continued further
D shows perpendicular lines because they would cross at right angles if continued further.

Question 3 b): Various answers are possible. For example: Use the sides of a ruler; count the squares; use the diagonals of the squares.



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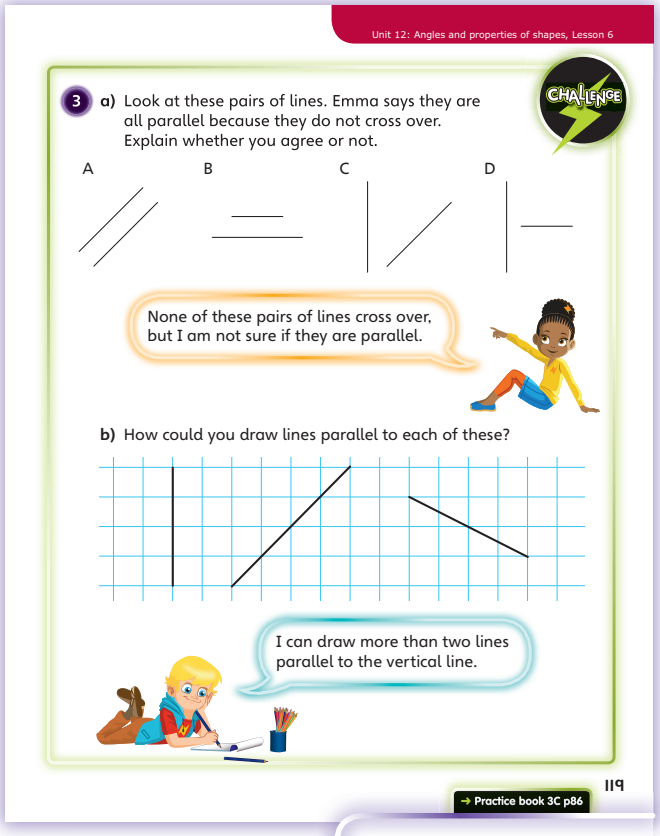

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Practice

WAYS OF WORKING Independent thinking

IN FOCUS Question 1 focuses on recognising and drawing parallel and perpendicular lines.

Question 2 focuses on the construction of parallel and perpendicular lines without a grid to support the drawing.

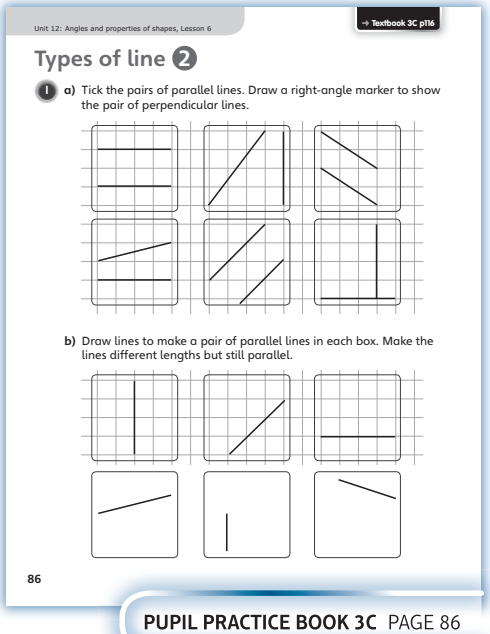
STRENGTHEN Explore parallel and perpendicular lines by using physical equipment (such as rods, rulers of the same and of different lengths, walking along lines of a football pitch or netball court), or lying down to make a pair of parallel or perpendicular lines with a partner.

DEEPEN Question 5 challenges children to explore parallel and perpendicular lines by joining dots around a circle. Challenge children to find as many possibilities as they can and to explain why perpendicular lines cannot be shown on the six-dot circle. Children could also explore circles with three, four, five, seven, nine and ten dots.

THINK DIFFERENTLY Question 4 tackles a problem where the distance between two lines is not measured accurately.

ASSESSMENT CHECKPOINT Answers to questions 1 b) and 2 will indicate the level of understanding of the difference between parallel and perpendicular lines.

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


Unit 12: Angles and properties of shapes, Lesson 6

→ Textbook 3C p116

Types of line 2

1 a) Tick the pairs of parallel lines. Draw a right-angle marker to show the pair of perpendicular lines.

b) Draw lines to make a pair of parallel lines in each box. Make the lines different lengths but still parallel.

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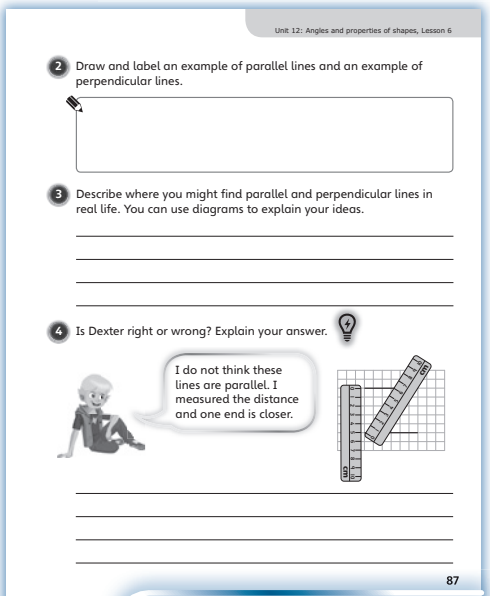
Unit 12: Angles and properties of shapes, Lesson 6

2 Draw and label an example of parallel lines and an example of perpendicular lines.

3 Describe where you might find parallel and perpendicular lines in real life. You can use diagrams to explain your ideas.

4 Is Dexter right or wrong? Explain your answer.

I do not think these lines are parallel. I measured the distance and one end is closer.

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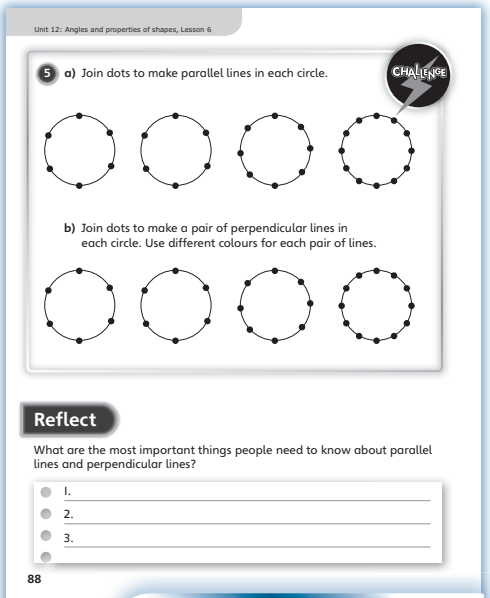
Reflect

WAYS OF WORKING Pair work

IN FOCUS Children should write their own responses and then compare these with those of their partner. Children could then try to justify their decision, or adopt their partner's reasoning if convinced.

ASSESSMENT CHECKPOINT Do children's responses demonstrate a clear understanding of the fundamental properties of both types of line and address some of the misconceptions?

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


Unit 12: Angles and properties of shapes, Lesson 6

5 a) Join dots to make parallel lines in each circle.

CHALLENGE

b) Join dots to make a pair of perpendicular lines in each circle. Use different colours for each pair of lines.

Reflect

What are the most important things people need to know about parallel lines and perpendicular lines?

1.

2.

3.

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After the lesson

- Are children able to explain clearly the difference between parallel and perpendicular lines?
- Can children construct both kinds of line with reasonable accuracy, and justify their method?
- What further opportunities will you give children to reinforce the language covered in this lesson?

Recognising and describing 2D shapes

Learning focus

In this lesson, children apply their understanding of types of line and angle to the properties of 2D shapes.

Small steps

- Previous step: Types of line (2)
- **This step: Recognising and describing 2D shapes**
- Next step: Recognising and describing 3D shapes

NATIONAL CURRICULUM LINKS

Year 3 Geometry – Properties of Shapes

Draw 2D shapes and make 3D shapes using modelling materials; recognise 3D shapes in different orientations and describe them.

ASSESSING MASTERY

Children can describe common 2D shapes using their angle and line properties, including an understanding of vertical and horizontal symmetry.

COMMON MISCONCEPTIONS

Children may rely on recognising common representations of shapes, and may not recognise a shape in a different orientation, or shapes which do not look like the regular versions they are used to. Ask:

- *What is true of all rectangles/hexagons/quadrilaterals? How can you check if this is a square?*

Children may think that if a shape has two pairs of parallel sides, then it must be a square or a rectangle. Ask:

- *Does this shape (rhombus or parallelogram) have two pairs of parallel sides? How can you tell that it is not a rectangle or a square?*

STRENGTHENING UNDERSTANDING

Explore polygons using constructions such as geoboards, stencils or tangible representations of the shape. Trace around 2D shapes by placing them in different orientations, marking the right angles in each and identifying the pairs of parallel or perpendicular sides.

GOING DEEPER

Challenge children to explore the properties of parallel and perpendicular lines in different polygons. Ask leading questions such as: *Do all quadrilaterals have a pair of parallel sides? Can you draw a trapezium with perpendicular sides? Can a triangle have parallel sides? Could the equal angles in a kite be right angles?*

KEY LANGUAGE

In lesson: 2D shapes, quadrilateral, pentagon, parallel, perpendicular, acute angle, line of symmetry

Other language to be used by the teacher: kite, parallelogram, trapezium, rhombus, symmetrical, obtuse angle, right angle, hexagon, polygon

STRUCTURES AND REPRESENTATIONS

2D shapes

RESOURCES

Mandatory: sticks or pencils of equal length

Optional: plastic or wooden 2D shapes, sorting table

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

Before you teach

- Can children draw four different triangles?
- Do children know what is the same and what is different about squares, rectangles and pentagons?

Discover

WAYS OF WORKING Pair work

ASK

- Question 1 a): *What is a quadrilateral? What are parallel lines?*
- Question 1 a): *How can you check whether any of the lines are parallel?*
- Question 1 b): *What could you do to check if this is true for all sizes of this shape?*

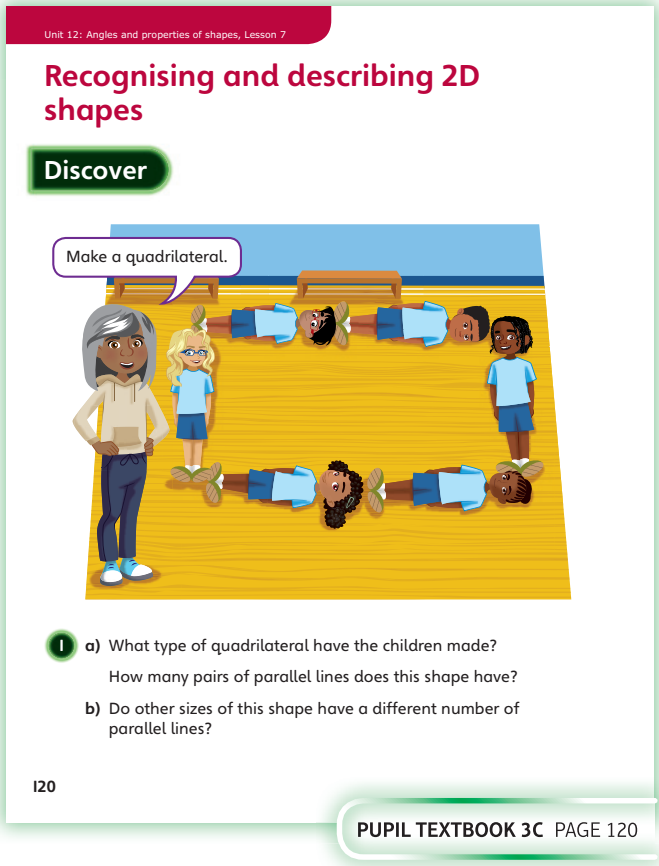
IN FOCUS Children are searching the picture for as many properties as they can, based on their understanding of types of 2D shape, types of line and types of angle. Recap on the meaning of the terms parallel, perpendicular, vertical and horizontal, and the names of quadrilaterals. Which properties prove that the shape being studied is a rectangle? Discuss what is the same and what is different about a range of rectangles to ascertain that all rectangles, including squares, always have two pairs of parallel and equal length sides, and that adjacent sides are perpendicular.

PRACTICAL TIPS This activity could be re-created as part of a PE lesson. The shapes could be modelled using matchsticks, lolly sticks or base 10 equipment, or rectangular shapes placed end to end.

ANSWERS

Question 1 a): The children have made a rectangle. It has two pairs of parallel sides.

Question 1 b): All rectangles, including squares, have two pairs of parallel lines..



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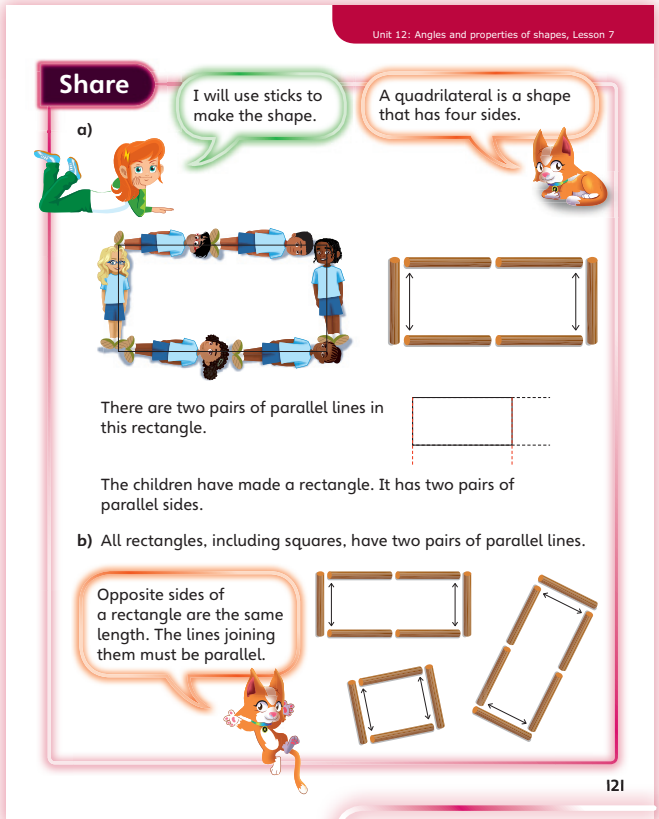
Share

WAYS OF WORKING Whole class teacher led

ASK

- Question 1 a): *Can you explain why a rectangle is a type of quadrilateral?*
- Question 1 b): *Would the opposite sides still be parallel if you turned the rectangle?*
- Question 1 b): *Would the opposite sides still be parallel if the rectangles were smaller or larger?*

IN FOCUS Children are exploring the idea that a rectangle must always have two pairs of parallel lines (sides). The justification is that opposite sides are of equal length, so the lines joining them must be a constant distance apart. It may also be worth discussing that, as all the angles are right angles, the adjacent sides are perpendicular.



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Think together

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

ASK

- Question 1: *How can you recognise and check for perpendicular lines?*
- Question 2: *How many sides does a quadrilateral have?*
- Question 3 a): *Can you make a quadrilateral with ten people, which has all sides of equal length?*
- Question 3 b): *What shape could be in this section of the diagram? Is this shape in the right place?*

IN FOCUS Question 2 focuses on quadrilaterals and identifying the one with no parallel or perpendicular sides. Six children could make a rectangle again, a kite, a right-angled trapezium, an isosceles trapezium or a parallelogram.

Question 3 b) requires reasoning about symmetry in shapes presented in a sorting table. Discuss the properties of the shapes that should be in each section.

STRENGTHEN Encourage children to explore making the different shapes using sticks. Remind children that they can make shapes with acute or obtuse angles. Provide 2D shapes for them to use as aids.

DEEPEN Encourage children to go one step further with questions 2 and 3: explore Ash's pondering in question 2, recording the possibilities on squared paper. Adapt the headings in the sorting table of question 3 b), to test for other properties such as: has no obtuse angles or has one pair of parallel lines. In question 3 b), ask: *Which shapes cannot be made with ten sticks?*

ASSESSMENT CHECKPOINT All questions will help to check that children are beginning to recognise the properties that make a shape distinct from other shapes. Ask children to explain how they know a shape is *not* a rectangle, is *not* a quadrilateral, *is* a rectangle, and so on.

ANSWERS

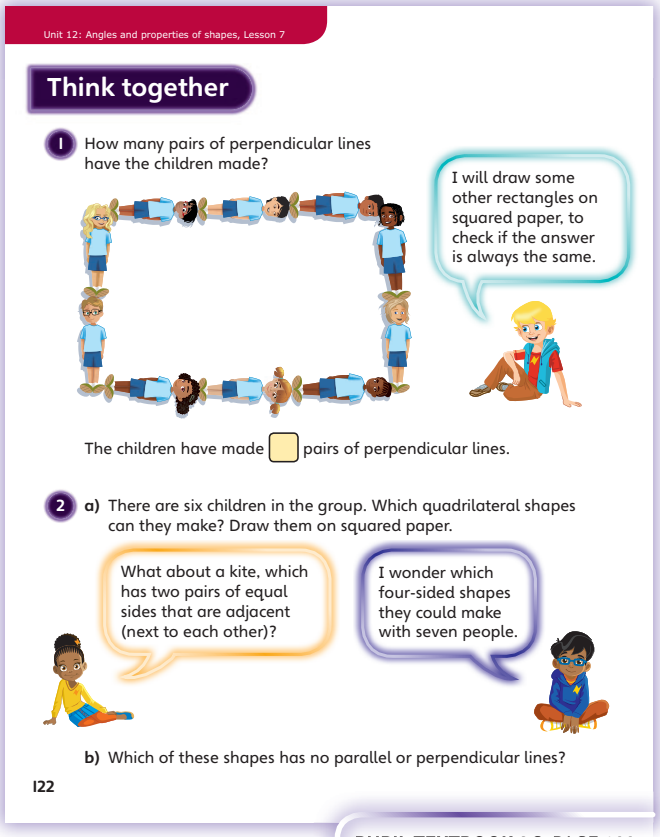
Question 1: There are four pairs of perpendicular lines (at the vertices).

Question 2 a): The children could make a: rectangle, kite (1, 1, 2, 2), trapezium (1, 1, 1, 3), and a parallelogram (1, 2, 1, 2).

Question 2 b): The kite has no parallel or perpendicular lines.

Question 3 a): Various answers are possible, the following are not possible: rectangles (no acute angles); squares (no acute angles and ten sticks cannot make four equal sides); rhombi (ten sticks cannot make four equal sides).

Question 3 b): Various answers are possible. A could be an irregular, symmetrical polygon with sides the same length but angles not all the same; B could be a non-isosceles trapezium; C could be a rhombus, square or other regular polygon; D could be an isosceles trapezium, an isosceles triangle or a kite.



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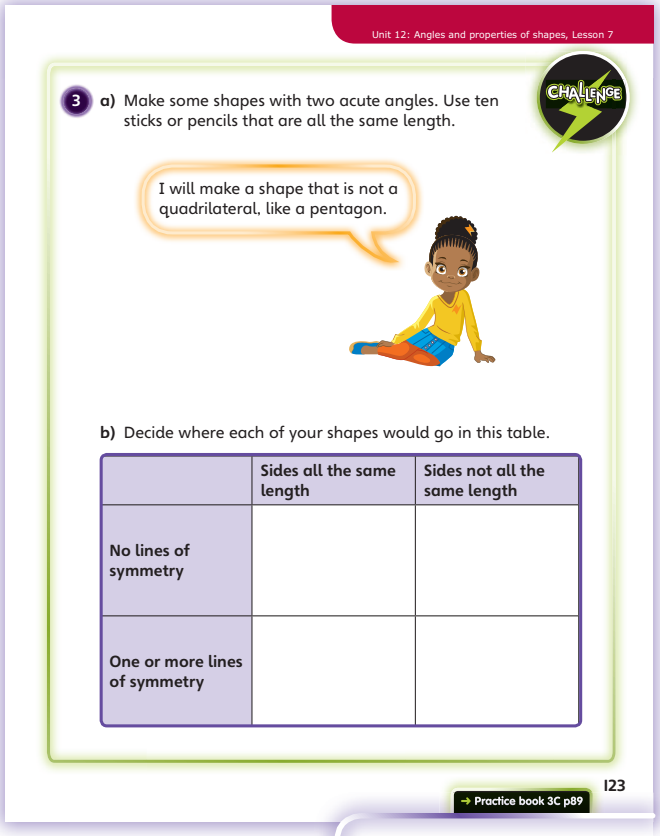

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Practice

WAYS OF WORKING Independent thinking

IN FOCUS Questions 1 and 2 focus on recognition of the names of common 2D shapes in different orientations and proportions, with a focus on quadrilaterals in question 2.

Question 3 focuses on symmetry in polygons. Most children will only draw vertical or horizontal lines and may not include them all but, at this stage, this is acceptable.

Question 5 requires logical reasoning using knowledge of the different properties of 2D shapes.

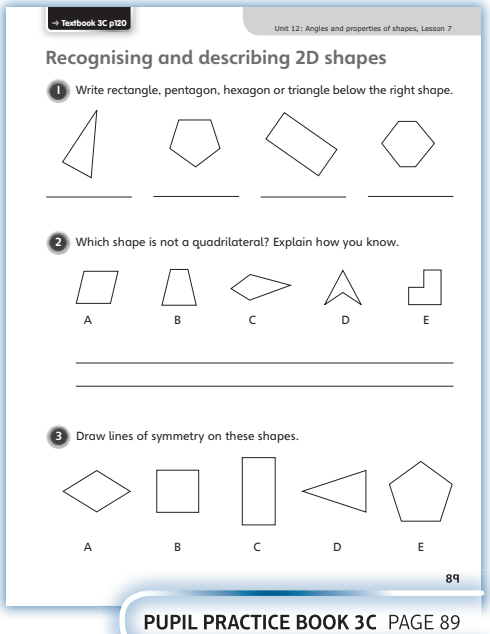
STRENGTHEN Explore the properties of shapes using geoboards or string to form the outline of the shapes.

DEEPEN Challenge children to invent their own properties puzzle, using clues similar to the ones in question 5.

THINK DIFFERENTLY Question 4 requires children to think about the properties of shapes as they design suitable but different shapes that will fulfil the given criteria. Ask pairs of children to check each other's work. Ask: *Are the shapes different or the same one turned? Do they all match the properties required?*

ASSESSMENT CHECKPOINT Children should be able to name many of the common 2D shapes covered in this unit and describe some of them in relation to their angle and line properties. Question 5 will support this assessment.

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



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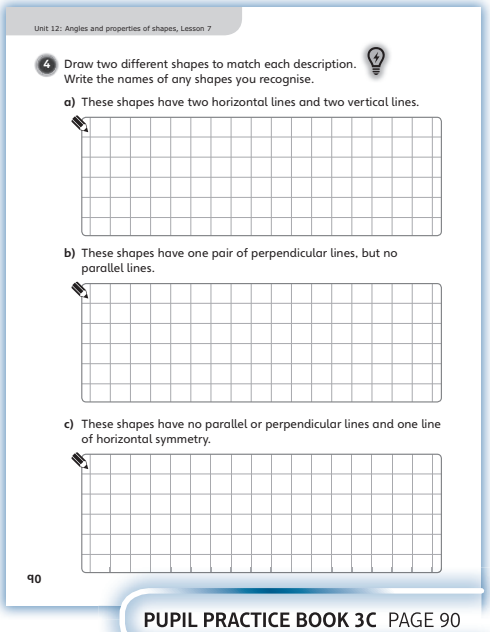

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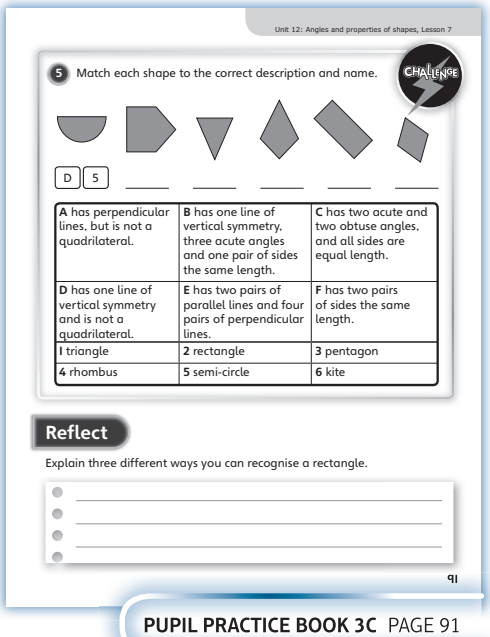
Reflect

WAYS OF WORKING Independent thinking

IN FOCUS Children should use this opportunity to show the depth of their knowledge of the properties of shapes, including reference to three of these properties: parallel lines, perpendicular lines, number of right angles, vertical/horizontal symmetry or the fact that it is a quadrilateral.

ASSESSMENT CHECKPOINT Do children apply their knowledge of types of lines and angles, and the correct names, to the properties of a rectangle?

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



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After the lesson

- Can children apply their knowledge of types of line, types of angle and symmetry to recognition and description of 2D shapes?
- How could you help children to reinforce the names of 2D shapes and their properties in curriculum areas such as art, DT and computing?

Recognising and describing 3D shapes

Learning focus

In this lesson, children identify and sort 3D shapes based on properties of faces, vertices and edges. They deepen their understanding of cubes and cuboids, and also describe the shapes and dimensions of faces of different 3D shapes.

Small steps

- Previous step: Recognising and describing 2D shapes
- **This step: Recognising and describing 3D shapes**
- Next step: Constructing 3D shapes

NATIONAL CURRICULUM LINKS

Year 3 Geometry – Properties of Shapes

Draw 2D shapes and make 3D shapes using modelling materials; recognise 3D shapes in different orientations and describe them.

ASSESSING MASTERY

Children can describe and visualise the faces of 3D shapes from 2D representations. They can name and describe a range of 3D shapes, including prisms and cuboids. Children can sort and classify shapes according to their properties.

COMMON MISCONCEPTIONS

Children may confuse prisms with pyramids. Ask:

- *What is the same and what is different about a triangular-based pyramid and a triangular prism?*

Children may find it difficult to visualise individual faces from a 2D representation of a 3D shape. Ask:

- *What shape is the face opposite to this one? What shape are the faces on a cuboid?*

STRENGTHENING UNDERSTANDING

Handling models of 3D shapes, and exploring them in different orientations, is essential. Use equipment to build 3D shapes that will unfold to reveal the faces. Explore prisms: all have rectangular faces and two identical end faces that give the prism its name. Define 3D as an object with three dimensions (such as height, width and length), as opposed to 2D, which has only two dimensions (width and length usually).

GOING DEEPER

Challenge children to describe similarities as well as differences when comparing different 3D shapes. Use a range of sorting circles or sorting tables to prompt reasoning about properties of 3D shapes.

KEY LANGUAGE

In lesson: cuboid, cube, prism, pyramid, vertices, face, edge, square, rectangle, shape, size, opposite, sorting circles, parallel, perpendicular, symmetrical

Other language to be used by the teacher: vertex, sphere, square-based pyramid, triangular-based pyramid, triangular prism, cone, cylinder, rectangular

STRUCTURES AND REPRESENTATIONS

3D shapes

RESOURCES

Mandatory: 3D shapes to handle (cuboid, cube, prisms, pyramids, sphere, cone, cylinder)

Optional: range of cardboard boxes in different proportions; 3D shapes that open out into nets, 3D shapes represented as solid shapes and as wireframe models

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

Before you teach

- Do children know the names of any 3D shapes?
- Can children find the faces/edges/vertices of a shape?

Discover

WAYS OF WORKING Pair work

ASK

- Question 1 a): *How could you describe the faces of a cube precisely?*
- Question 1 a): *What is the difference between a cube and a cuboid?*
- Question 1 b): *How can you check the properties of a 3D shape accurately?*

IN FOCUS Children explore the properties of cubes and cuboids in terms of the length of their edges and the shapes of their faces. They use careful measuring to identify these properties and find out whether a shape is a cube or a cuboid.

PRACTICAL TIPS Children could explore the faces of cardboard boxes in different proportions. This could be done with eyes closed, so children try to judge whether a box is cube or cuboid without looking. They could then check by measuring the edges of any faces that could be square. Measuring opposite faces will enable children to understand that opposite faces of a cuboid are identical.

ANSWERS

Question 1 a): Ambika can measure all the sides of her gift to find out if it is a cube.

Question 1 b): All the faces of Ambika's gift are rectangles. The opposite faces are exactly the same shape and size. Ambika's gift is a cuboid.

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Share

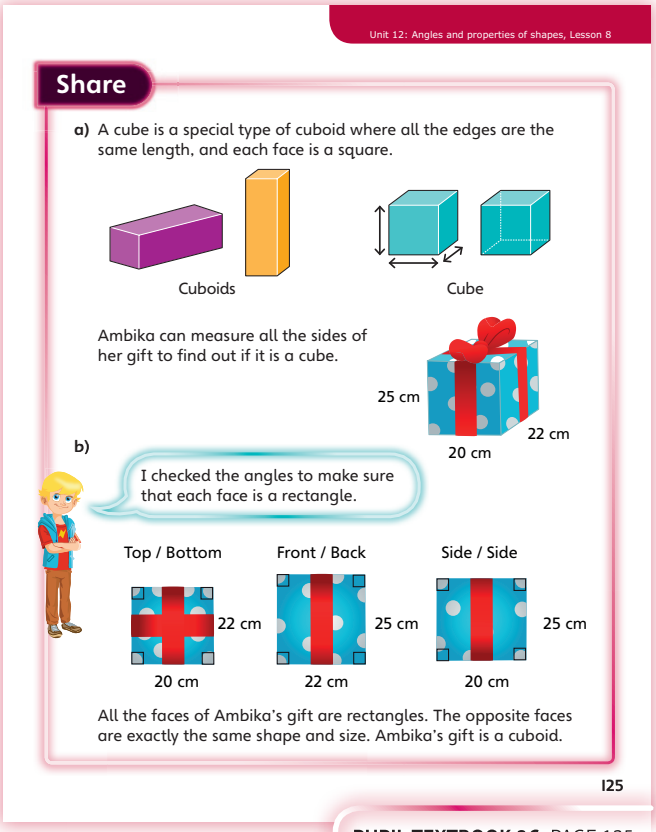
WAYS OF WORKING Whole class teacher led

ASK

- Question 1 a): *Why is it important to measure the edges?*
- Question 1 a): *What do you know about the length of the edges of a cube?*
- Question 1 b): *What shape are the faces of a cube/cuboid?*
- Question 1 b): *What is special about the opposite faces of a cuboid?*

IN FOCUS In question 1 a), children are deepening their understanding of a cube as having all edges the same length, and all faces as squares.

In question 1 b), children explore how to describe individual faces of a cuboid and recognise that opposite faces are identical.



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Think together

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

ASK

- Question 1 : *Do only cubes have square faces? What other shapes could have one or more square faces?*
- Question 2 : *How can you tell a prism from a pyramid?*
- Question 3 : *What is true of all prisms?*

IN FOCUS Question 1 focuses on the faces of a cuboid where two opposite faces are squares. This tackles a misconception that only cubes have square faces.

Question 3 covers a range of common 3D shapes, and prompts children to sort them in to the sorting circles based on their properties. Children should be taught that shapes that do not fit into either circle must be put outside, but still within the rectangle that surrounds the sorting circles.

STRENGTHEN Children should handle models of the common 3D shapes in order to fully explore the properties in a concrete way, but should be encouraged to do so after reasoning from the 2D representations. Some children may need to use stickers to keep track of the faces/edges/vertices as they count them. Some children will need support in question 3 to realise that cubes, cuboids and cylinders are also classed as prisms.

DEEPEN Challenge children to sort shapes in different ways by altering the headings of the sorting circles in question 3, using properties such as Has an odd number of rectangular faces or Has no parallel edges.

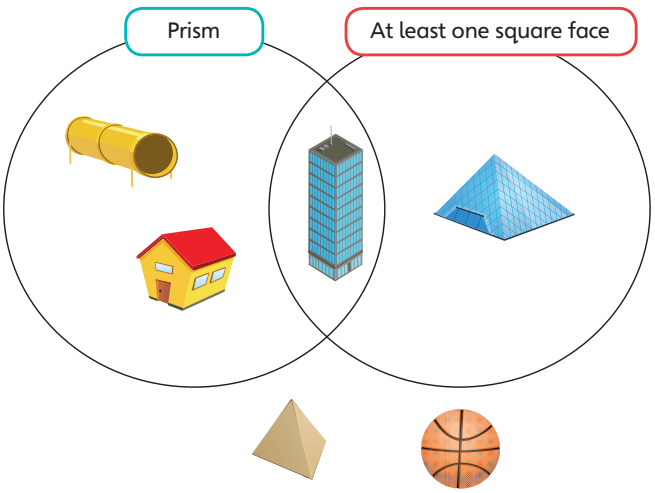
ASSESSMENT CHECKPOINT Responses to question 3 should indicate a good level of understanding of a range of 3D shapes and their properties, recognising that cubes, cuboids and cylinders are also classed as prisms.

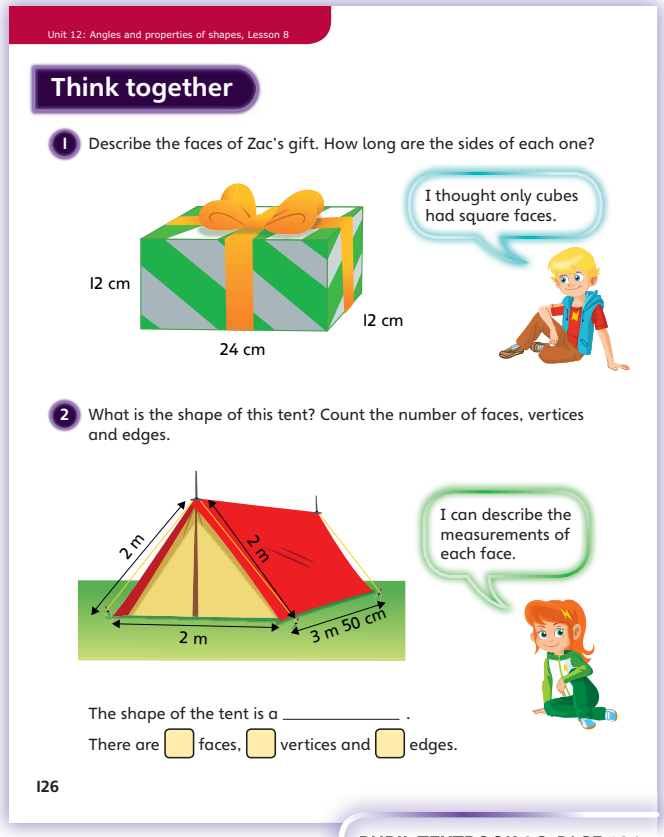
ANSWERS

Question 1 : There are four 12×24 cm faces and two 12×12 cm square faces.

Question 2 : The shape is a triangular prism. There are five faces, six vertices and nine edges.

Question 3 :





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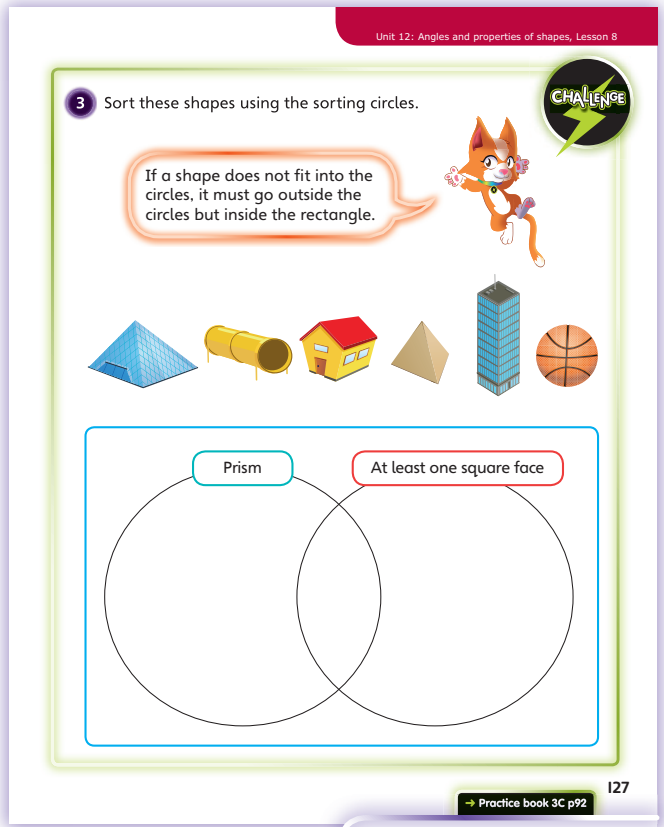

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Practice

WAYS OF WORKING Independent thinking

IN FOCUS Question 4 requires children to complete a table based on properties of prisms. It should show that all prisms have more than one rectangular face (the exception being cylinders). Take the opportunity to discuss the differences between prisms and pyramids, as both non-prisms in this question are actually pyramids. Only a truncated pyramid has more than one rectangular face, and not every pyramid has a rectangular face. Children may need reminding that a square is a special type of rectangle. None of the common shapes would fit into the Not a prism / Has more than one rectangular face section.

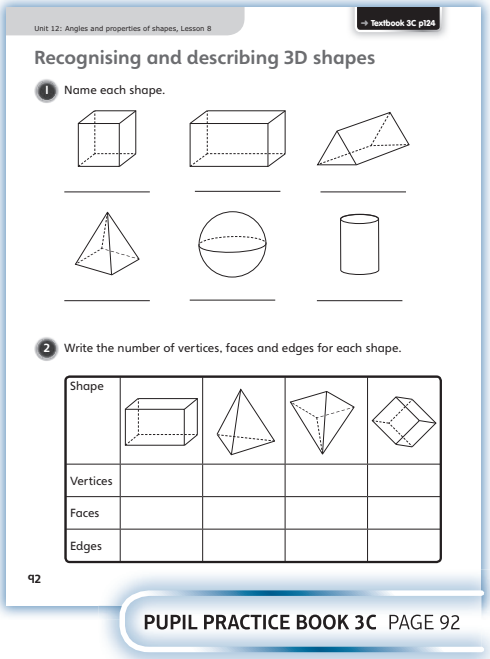
STRENGTHEN Encourage children to make reasoned predictions about given faces and properties of shapes, before checking the predictions by handling 3D models or by measuring edges.

DEEPEN Challenge children to sort shapes into different sorting circles or tables by choosing their own headings. Extend question 5 to compare other shapes. Ask: *What is the same? What is different?*

THINK DIFFERENTLY Question 3 requires children to use reasoning skills to match the cuboids to the correct set of faces.

ASSESSMENT CHECKPOINT Responses to these questions will assess whether children can name common 3D shapes, describe them using the shape and number of their faces, and sort them according to their properties.

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



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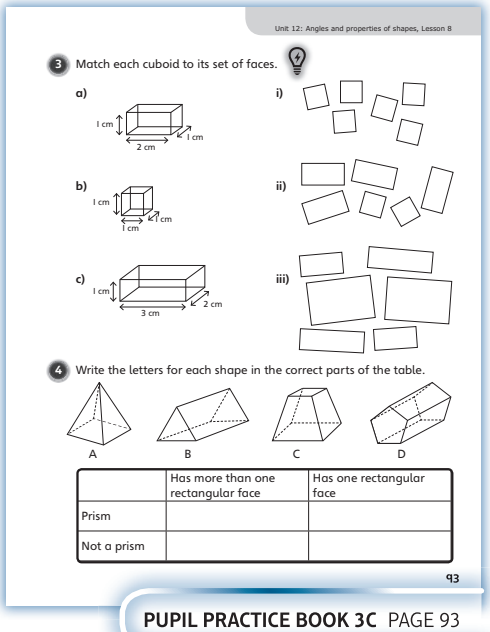

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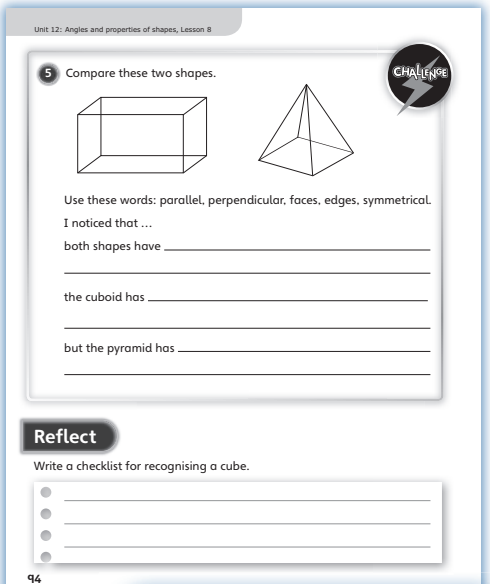
Reflect

WAYS OF WORKING Independent thinking

IN FOCUS This task looks simple, but children will need to make sure that their checklist includes enough information so that it does not also encompass other shapes. For example, a shape with six faces and edges all the same length could be a pentagon-based pyramid.

ASSESSMENT CHECKPOINT Can children use the properties of a cube to identify it definitively?

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



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After the lesson

- Are children able to describe individual faces of a 3D shape?
- Can children explain the properties of a cuboid that is not a cube, including reference to opposite faces?
- Are children confident in sorting 3D shapes according to different criteria relating to their properties?

Constructing 3D shapes

Learning focus

In this lesson, children learn to construct 3D shapes by considering their properties in relation to different construction materials.

Small steps

- Previous step: Recognising and describing 3D shapes
- **This step: Constructing 3D shapes**
- Next step: Measuring mass (1)

NATIONAL CURRICULUM LINKS

Year 3 Geometry – Properties of Shapes

Draw 2D shapes and make 3D shapes using modelling materials; recognise 3D shapes in different orientations and describe them.

ASSESSING MASTERY

Children can describe different ways to construct 3D shapes from different construction materials, by reasoning about their properties.

COMMON MISCONCEPTIONS

Children may not recognise that the same cuboid could be represented in different orientations. Ask:

- *Which cuboid is the same as this one, but has been turned around?*

Children may not understand that different construction materials are based on different properties. Ask:

- *What features of a 3D shape are sticks and marshmallows good at representing? Why is it not possible to make a cone, cylinder or sphere with these construction materials?*

STRENGTHENING UNDERSTANDING

All children would benefit from having access to the different construction materials in order to build the different shapes. Children should be shown how to make connecting edges with sticks and vertices with the marshmallows..

GOING DEEPER

Challenge children to think of innovative ways to construct, for example, a cylinder. Children should not be pushed to formal consideration of nets, but their inventiveness should be encouraged.

KEY LANGUAGE

In lesson: cube, length, direction, angle, features, vertices, faces, edges, sphere, pyramid

Other language to be used by the teacher: cuboid, prism, cone, cylinder, sphere, vertex

STRUCTURES AND REPRESENTATIONS

3D shapes

RESOURCES

Mandatory: multilink cubes, construction materials

Optional: sticks and marshmallows, modelling clay, snap-together construction materials, wireframe models

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

Before you teach

- Which 3D shapes can children construct?
- What materials have children used before to make 3D shapes?

Discover

WAYS OF WORKING Pair work

ASK

- Question 1 a): *How many cubes does each child have?*
- Questions 1 a) and 1 b): *What do you need to think about before you start using the multilink cubes?*
- Question 1 a): *How can you identify a cube?*
- Question 1 b): *Would this be the same shape if I turned it around like this?*

IN FOCUS Question 1 a) challenges children to form a larger cube from the limited numbers available to Lee or Bella. Some children may mistakenly identify a 1x4 arrangement as a cube.

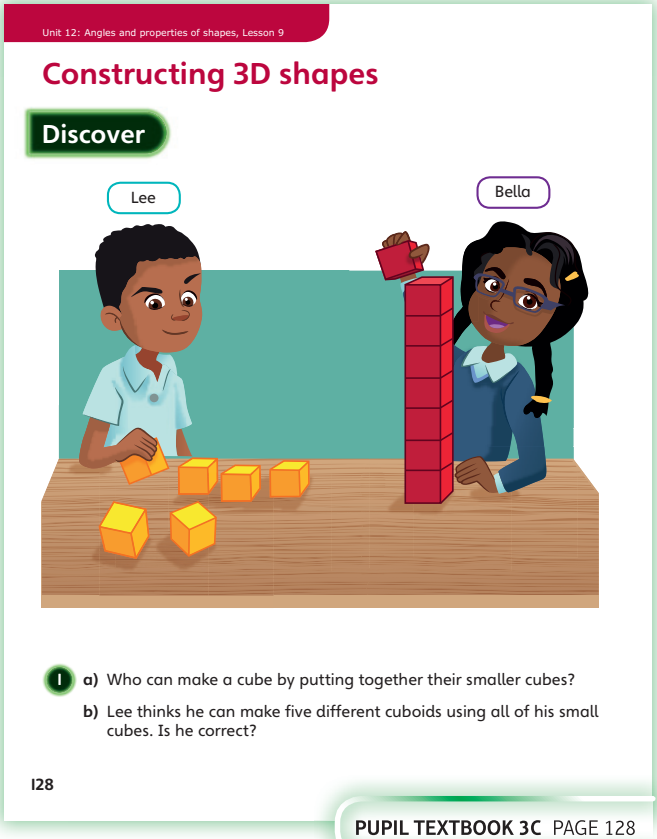
Question 1 b) pushes children to consider how the same cuboid can be represented in different orientations, and to distinguish which properties of two cuboids make them distinct or identical.

PRACTICAL TIPS Ideally, all children should have access to linking cubes, so that they can test out their ideas. However, in this case, it is also important that children have a chance to consider their ideas before trying out the materials.

ANSWERS

Question 1 a): Bella can make a cube by using all of her smaller cubes. It has a length of 2 units in every direction.

Question 1 b): Lee is not correct: he can only make two different cuboids.



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Share

WAYS OF WORKING Whole class teacher led

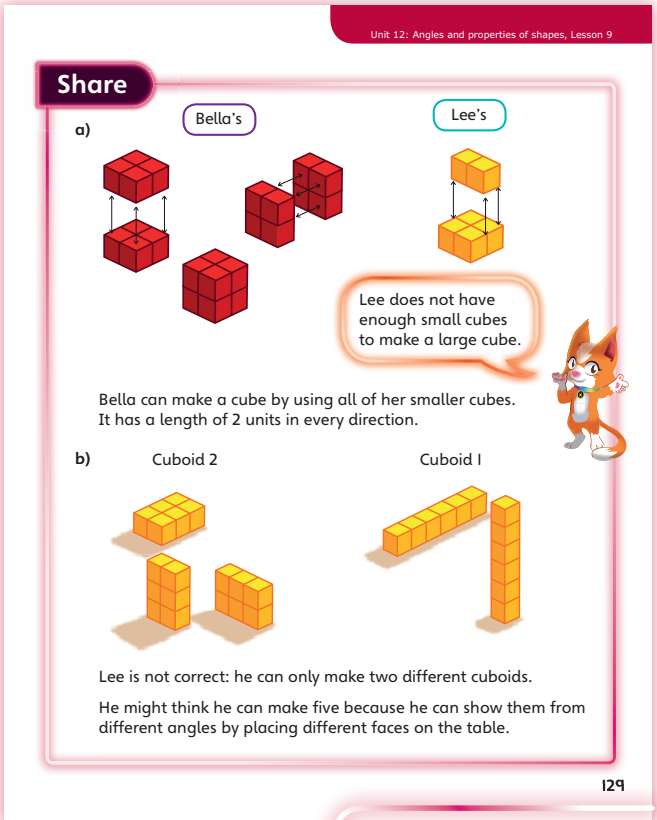
ASK

- Question 1 a): *Can you prove that Bella's shape is definitely a cube?*
- Question 1 b): *Why are some of Lee's shapes not really different?*

IN FOCUS Question 1 a) focuses on the property that a cube has edges of equal length.

Question 1 b) focuses on how cuboids can be represented in different orientations.

Some children may argue that Lee could make many different cuboids if he did not have to use all six cubes every time. This is an interesting point to clarify and a good extension for children to explore.



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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 the same and what is different about these sets of construction materials?*
- Questions 1 , 2 and 3 : *What is the same about the shapes that you cannot make from these materials?*

IN FOCUS All questions focus on the different ways of building shapes using different materials. Children are asked to consider which materials are appropriate and which are not when constructing specific 3D shapes. The marshmallows are used to connect the sticks to form edges and vertices. Small balls of modelling clay could replace the marshmallows.

STRENGTHEN Give children access to different types of construction materials to build and experiment with.

DEEPEN Challenge children to produce a list or table identifying which 3D shapes can and cannot be made from the different construction materials shown or available in class.

ASSESSMENT CHECKPOINT Are children able to explain which materials can be used to construct a prism and why cubes cannot be used for this purpose? Can they explain the difficulty in constructing shapes that have any curved surfaces?

ANSWERS

Question 1 : You need 6 squares to make the faces of a cube.

You need 12 sticks to make the edges of a cube.

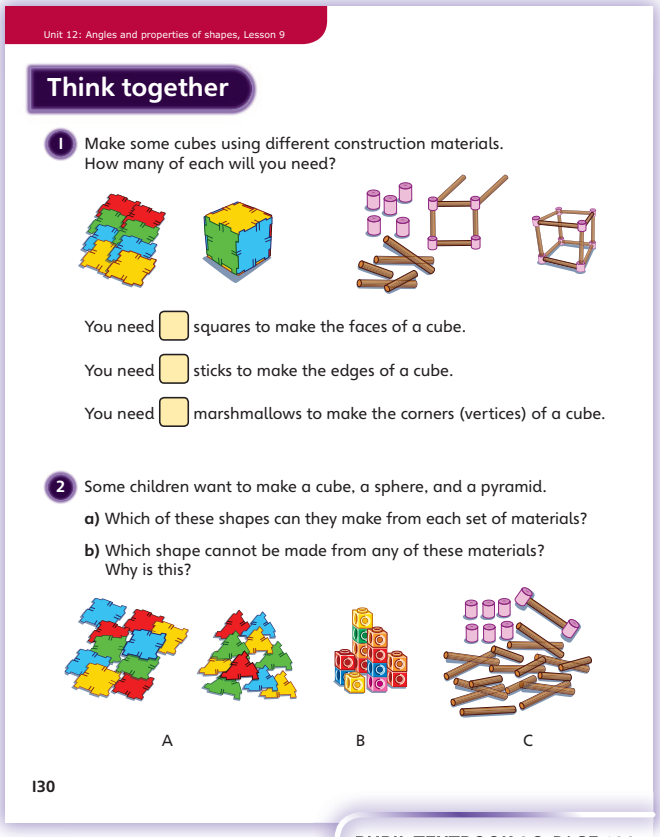
You need 8 marshmallows to make the vertices of a cube.

Question 2 a): The children can make a cube with every set; a pyramid can be made from snap-together construction materials and sticks/marshmallows; a pyramid cannot be made from multilink cubes.

Question 2 b): A sphere cannot be made from any of the materials due to its curved surface.

Question 3 a): The triangular prism can be made from snap-together construction materials or sticks and marshmallows; the cylinder cannot be made from any of these materials because of its curved edge; the linking cubes cannot make either shape.

Question 3 b): The answer depends on the length of the prism: a triangular prism needs two triangles and three (or six or nine, etc.) squares; or at least nine sticks and six marshmallows. Other answers are possible.



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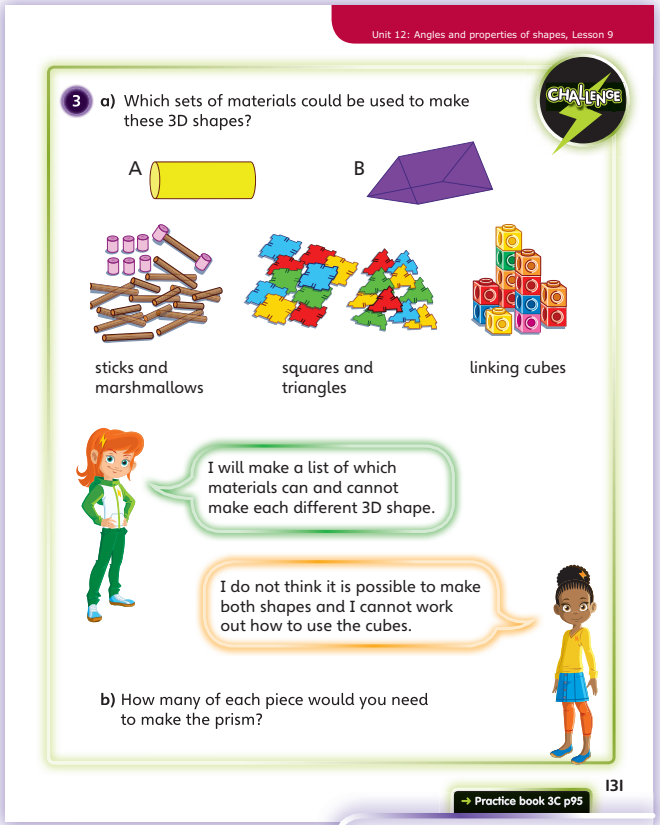

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Practice

WAYS OF WORKING Independent thinking

IN FOCUS Question 1 focuses on recognising how many cubes have been used to build a 3D shape given as a 2D representation.

Question 3 requires children to link the number of edges and vertices to the amount of construction material they will need.

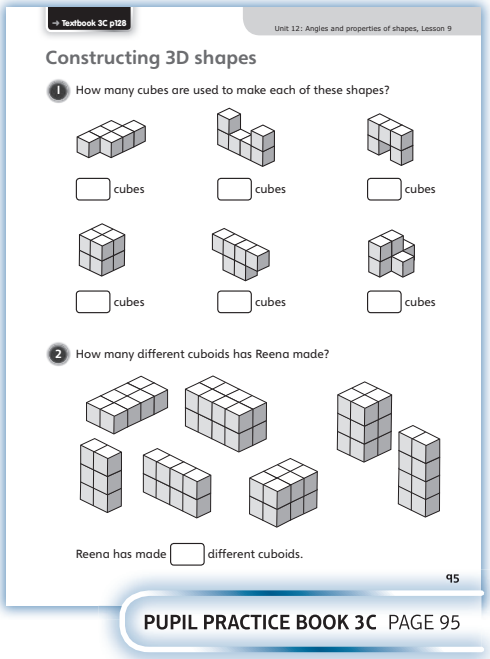
STRENGTHEN Encourage children to form an idea of how to build shapes before trialling their ideas with construction materials.

DEEPEN Question 6 challenges children to explain the pattern that appears in the table, based on a comparison of the shapes. The answers will depend on the length of each prism, but the number of sticks should be a multiple of the number of sides on the end piece, assuming each end piece has equal length sides.

THINK DIFFERENTLY Question 5 requires children to use the language and terminology of edges and vertices to describe a construction. As all sides are not the same length, they will have to think about how many short and how many long sticks they will need.

ASSESSMENT CHECKPOINT Are children able to explain which materials can and cannot be used to construct specific shapes? Can they explain the difficulty in constructing shapes that have any curved surfaces?

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



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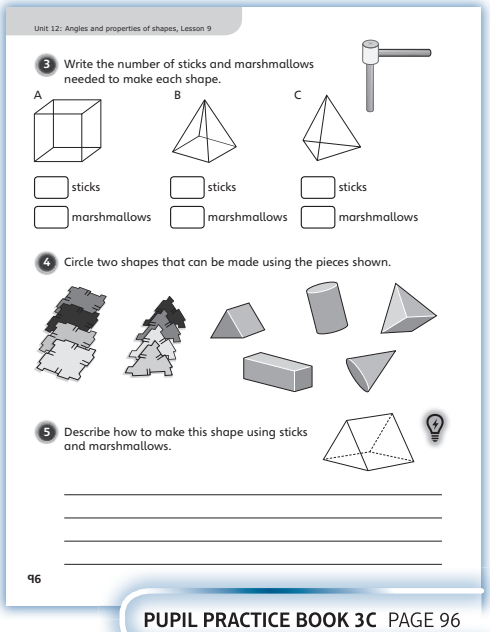

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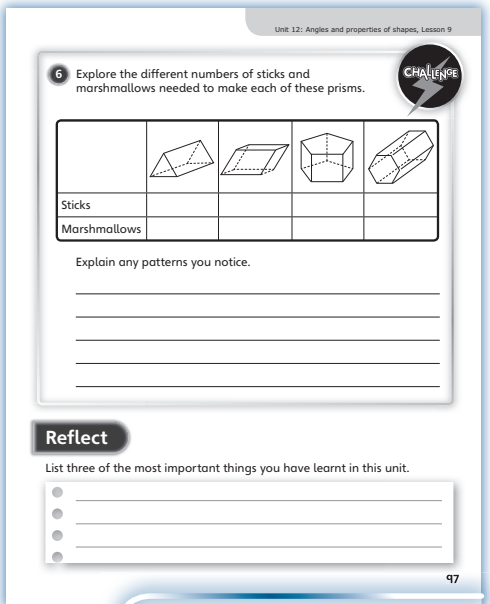
Reflect

WAYS OF WORKING Pair work

IN FOCUS Children should discuss and compile a list by looking back through the unit. Children should then decide individually which three things they feel are the most important.

ASSESSMENT CHECKPOINT Are children able to pick out the concepts they understood well, and concepts they may need to do more work on? Did children pick out new concepts or concepts they were already comfortable with?

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



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After the lesson

- Can children justify decisions about how to construct 3D shapes, based on the properties of the shapes and of the materials?
- Are children able to recognise shapes when they are presented in different orientations?
- What did children learn in this unit that could be useful in DT, science or art?

End of unit check

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

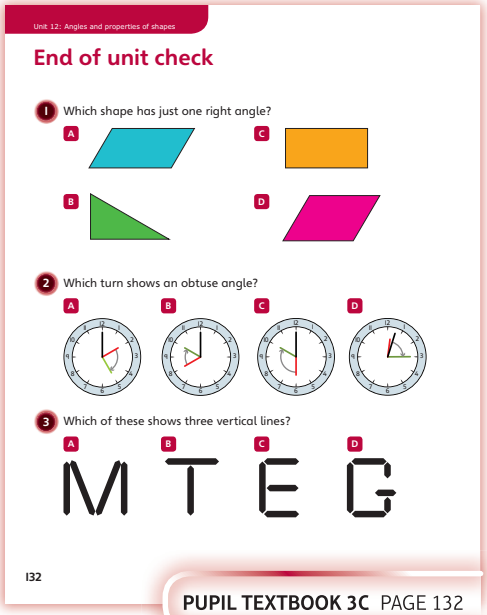
WAYS OF WORKING Group work adult led

IN FOCUS

- Question 1 assesses children's ability to identify a shape with just one right angle.
- Question 2 assesses children's ability to identify an obtuse angle shown using the hands of a clock face.
- Question 3 assesses children's ability to identify the vertical lines in letter shapes.
- Question 4 assesses children's ability to identify vertical or horizontal lines of symmetry in order to identify the shape that does not have a line of symmetry.
- Question 5 assesses children's ability to identify the shape with no pairs of parallel sides.
- Question 6 is a SATs-style question relating to the faces of a cuboid.

ANSWERS AND COMMENTARY

Children who have mastered the concepts in this unit will be able to define these terms: right angle, parallel lines, perpendicular lines, vertical and horizontal. Children will be able to use these terms to describe some of the properties of 2D and 3D shapes.



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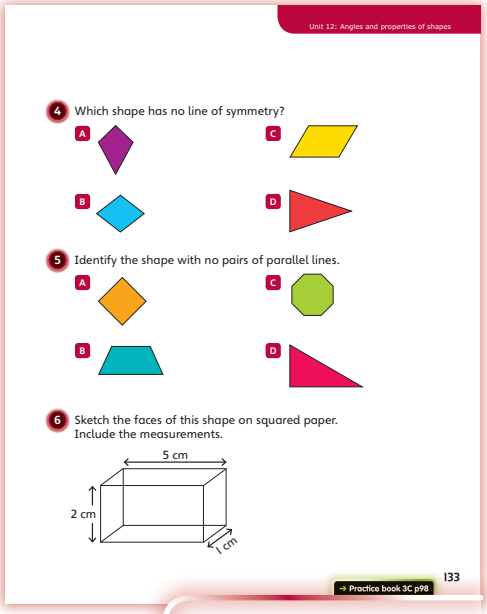

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Q	A	WRONG ANSWERS AND MISCONCEPTIONS	STRENGTHENING UNDERSTANDING
1	B	A or D suggest that the child is not sure how to identify right angles; C suggests that the child did not read the question carefully as C has more than one right angle.	Many of the misconceptions in this unit will be because children cannot remember which word is which. Help them to remember with these tips: • acute, obtuse or right angle? (Acute contains the word cute which usually describes something small, so it is the smallest type of angle; right angles can stand up*right*); • horizontal or vertical? *Horizont*al is flat like the *horizon*; *vert*ical stands up straight like *vert*ebrae in your back; • parallel or perpendicular? The word parallel has double *ll* in the middle, which looks like a pair of parallel lines; parallel lines are like train tracks – they will never touch or cross; perpendicular lines can be made from a pair of parallel lines by turning one line a quarter turn.
2	C	A or D suggest that the child does not know that the angle between three numbers on a clock face is exactly 90 degrees. B suggests confusion between acute and obtuse angles.	
3	D	A suggests that the child has not counted accurately, or confusion between vertical and diagonal lines. B or C suggest confusion between horizontal and vertical lines.	
4	C	A, B or D suggest that the child is not able to recognise vertical or horizontal lines of symmetry.	
5	D	A, B or C suggest confusion between parallel and perpendicular lines.	
6		Have children drawn six faces in three pairs?	

My journal

WAYS OF WORKING Independent thinking

ANSWERS AND COMMENTARY

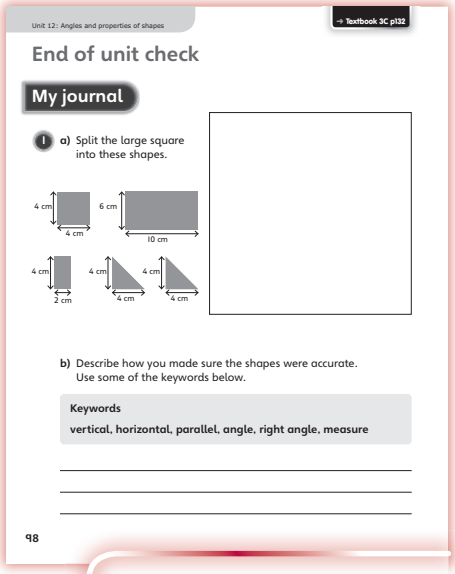
Question 1 a) and b): Ensure children think about which shape to start with and whether they could make some shapes on a different rotation to the ones shown. Ensure children explain how they lined up the ruler.

Question 2 a): Children could use the grid lines to draw diagonals.

Question 2 b): Children could use the vertical and horizontal grid lines to create a right angle or simply use the end of their ruler.

Question 2 c): Children should draw a right-angled trapezium.

Question 2 d): Children should draw a pentagon with one right angle.


Unit 12: Angles and properties of shapes

→ Textbook 3C p132

End of unit check

My journal

1 a) Split the large square into these shapes.

4 cm, 4 cm; 6 cm, 10 cm; 4 cm, 2 cm; 4 cm, 4 cm; 4 cm, 4 cm

b) Describe how you made sure the shapes were accurate. Use some of the keywords below.

Keywords

vertical, horizontal, parallel, angle, right angle, measure

98

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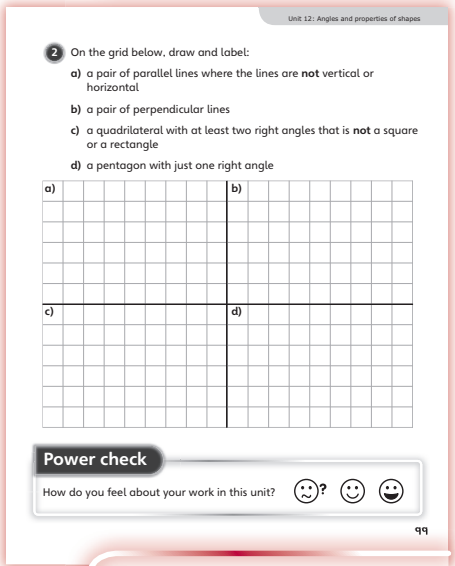
Power check

WAYS OF WORKING Independent thinking

ASK

- *Can you explain the difference between parallel and perpendicular lines?*
- *Are you confident describing 2D and 3D shapes?*
- *Can you draw a right-angled triangle?*


Unit 12: Angles and properties of shapes

2 On the grid below, draw and label:

a) a pair of parallel lines where the lines are **not** vertical or horizontal

b) a pair of perpendicular lines

c) a quadrilateral with at least two right angles that is **not** a square or a rectangle

d) a pentagon with just one right angle

a) b) c) d)

Power check

How do you feel about your work in this unit?

99

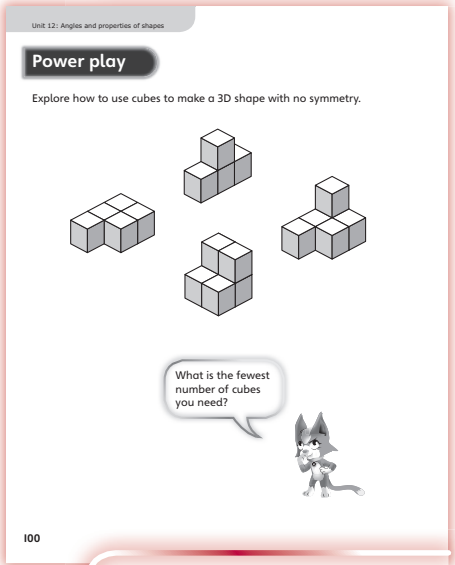
PUPIL PRACTICE BOOK 3C PAGE 99

Power play

WAYS OF WORKING Pair work

IN FOCUS Children should explore whether a shape can be split physically into two identical halves. Children may suggest slicing through to make identical halves, which would represent a plane of symmetry. This is acceptable, and an interesting discussion point, but this concept is not introduced until KS3.

ANSWERS AND COMMENTARY This puzzle is open-ended as there are many possibilities, especially if you allow the idea of slicing through the cubes horizontally or vertically. Most T shapes cannot be physically split, but they are all vertically symmetrical. A squared C or U shape can only be physically split where there is an even number of cubes in the middle section, but, again, they are still symmetrical. Asymmetrical shapes are easily constructed where there is a different number of cubes on each layer, as in the shape at the far right of the page.


Unit 12: Angles and properties of shapes

Power play

Explore how to use cubes to make a 3D shape with no symmetry.

What is the fewest number of cubes you need?

100

PUPIL PRACTICE BOOK 3C PAGE 100

After the unit

- What will you do differently next time you teach this unit?
- How well did children respond to the new words introduced in this unit? How can you continue reinforcing these words in future lessons?

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