Chapter 8 Area, perimeter and volume

Specification

FS coverage and range	Find area, perimeter and volume of common shapes
FS exemplification	Perimeter and area of triangles and rectangles
	Circumference and areas of circles
	Volume of cuboids and cylinders
	Formulae will be given
	Composite shapes may be used

GCSE

GCSE specification	**GM x**	Calculate perimeters and areas of shapes made from triangles and rectangles **and other shapes**
	GM z	Find circumferences and areas of circles
	GM aa	Calculate volumes of right prisms and shapes made from cubes and cuboids
Edexcel GCSE course	**Specification A:**	
	Foundation 14.1–14.4, 17.1–17.3, 20.4–20.5	
	Higher Chapter 10, 23.1–23.2, 23.8–23.9	
	Specification B:	
	Foundation Unit 2: 18.1–18.3, 19.3–19.4; **Unit 3:** 8.1–8.3, 9.3	
	Higher Unit 2: Chapter 14; **Unit 3:** 11.1, 11.6, 12.1–12.3	

Resources

General resources	Sticky notes
	Rulers, metre rulers, tape measures, trundle wheels (optional)
Resource sheets	8.1
Links	http://www.thefa.com (choose The FA, then Rules and Regulations, open The FA Handbook 2010–2011, and go to p538)
	http://www.teachingideas.co.uk/maths/contents11measure.htm
ActiveTeach resources	Video
	ResultsPlus Knowledge Check
	ResultsPlus Problem Solving
	Question Audio
	Animations

Lesson 1

Objectives

- Choose appropriate lengths
- Make sure all measurements are in the same units
- Use the formulae for the area of a rectangle and the volume of a cuboid
- Decide whether to round solutions up or down

Starter

- Give students 3 minutes to list all the formulae they know for perimeter, area and volume. Ask students to share their answers and write findings on the board.

Main teaching and learning

- Use questioning to establish what students know about perimeter, area and volume. For example, ask: *What are perimeter, circumference, area and volume? What units are used to measure length, area and volume? What are imperial and metric units? What is the difference between capacity and volume?*
- Use the ResultsPlus Knowledge Check to establish students' prior knowledge. Address any misconceptions or identified gaps in knowledge.
- Discuss *Take a look*: Post Office charges (p75). Ask: *Could we convert all measurements to mm? What are the advantages of converting into cm instead of mm?*
- Discuss *Have a go* Q1. Ask: *Knowing that 1 litre equals 1000 cm^3, how can you convert cm^3 into litres? What information do you need to consider when rounding your answer?* Ask students to complete Q1.
- Ask students to complete Q2 and Q3.

Issues and misconceptions

- Ensure that, for Q1, students realise that 12.6 litres of orange juice has to be rounded down to avoid overfilling the container.
- Students may lack clarity when communicating their calculations.

Support

- Encourage students to break questions into component parts. For example in Q1, help students to identify that they need to find the volume, convert into litres, share by the given ratio and round down.

Extension

- Ask students to complete Q1 using different ratios of juices. For example, orange and mango in a ratio of 2:3.

Plenary

- As a class, create a spider diagram showing different professions that require the use of perimeter, area and volume. Extend the spider diagram to include the tasks that these professions might be required to complete.

Formative assessment

- Ask students to write a 2–3 mark exam question on perimeter, area or volume. They should swap books with a partner and solve each other's questions. They then return their books and mark the work, giving feedback where required.

Homework

- Ask students to create a revision sheet to show the following:
  - The formula for the perimeter, area and volume of common shapes
  - Conversions between common metric and imperial units
  - Conversions between metric units of length, area and volume.

Lesson 2

Objectives

- Calculate the area of compound shapes
- Communicate facts and figures when giving outcomes

Starter

- Ask students to draw a labelled sketch of a shape with an area of 100 cm^2. Encourage students to consider compound areas.

Main teaching and learning

- Discuss how compound areas can be found by splitting shapes up in different ways. To demonstrate this, ask students to find another way of splitting up the floor plan in *Take a look*: Office space (pp76–7). Students should draw a labelled sketch and find the area methodically to check that it gives the same answer.
- Discuss the solution to *Take a look*: Office space.
- Use questioning and the Know Zone (p74) to discuss the area of a triangle and volume of a prism. Ask: *What is a prism? Can you think of some everyday examples? How do you calculate the volume of a prism? How do you calculate the area of a triangle? Explain what is meant by the height of a triangle.*
- Discuss *Have a go* Q4. Ask: *Can you assume that the bigger the tin of paint, the better the value for money? What methodical approach can you take to find the cheapest combination of tins?* Ask students to complete Q4.
- Ask students to complete Q5, then discuss their methods. Ask: *What was the easiest way to calculate the compound area? Did you round your answer? If so, how did you state your degree of accuracy?*
- Discuss Q6. Ask: *Does the question contain any redundant information? What are the four main steps to the solution?* Ask students to complete Q6.

Issues and misconceptions

- Ensure that students remember to divide by 2 when finding the area of the triangle in Q4.
- For Q6, you may need to remind students of the formula for the area of a trapezium and how to calculate percentages.

Support

- Provide scaffolding for Q6. Ask: *What is the tank's volume? What volume of natural gas can it contain once converted into LNG? What volume of gas is lost on a typical voyage? What is the cost of this lost gas?*

Extension

- Ask students to design a building and draw the front, back and side elevations of the building to scale before finding the cost of painting the building using the paint from Q4.

Plenary

- Discuss different strategies for finding the area in Q5.

Formative assessment

- Mark numerical answers to Q4–6. Ask students to swap books and peer-assess the advice given in answer to Q5. They should identify one strength and one area for development.

Homework

- Ask students to make a scale drawing of a room in their house. They should then research the cost of different types of paint and, assuming that 1 litre of paint covers 5 m^2, write a statement comparing the cost of various options.

Lesson 3

Objectives

- Read and follow sets of instructions
- Use diagrams to model a situation
- Think about different solutions to a problem
- Advise on the advantages and disadvantages of different options

Starter

- Ask students to make a list of all the facts they know about circles and cylinders.

Main teaching and learning

- Discuss the facts listed in the Starter. Ensure that students know the following:
  - How to label a circle
  - How to calculate the area and circumference of a circle
  - What pi (π) represents and its approximate value
  - How to calculate the volume of a cylinder.

  Circle facts are given in the Know Zone (p74).
- Ask students to complete *Have a go* Q7 (p80).
- Discuss Q8. Ask: *What are the important pieces of information? What information is redundant? Is it easier to work in cm or m?* Ask students to complete Q8.
- Discuss Q9. Ask: *Is there more than one way to calculate the total internal floor space? What information does the table include? What information do we need before selecting the cost per square metre from the table?* Ask students to complete Q9.

Issues and misconceptions

- Students may require help with the text in *Have a go* Q8, in order to make correct judgements.
- Students may require help deciphering the table in Q9.

Support

- Encourage students to draw a sketch for Q8 that includes the 50 mm of extra wallpaper at the top and bottom of the wall.

Extension

- Tell students that the ground floor of the house in Q9 has a height of 2.1 m. Ask them to decide on appropriate positions for windows and doors and communicate their ideas in a series of diagrams. They should then use the information in Q8 to calculate the cost of wallpapering the walls.

Plenary

- Give students a 3D sketch of a house with a pitched roof (Resource sheet 8.1). Pose the following question: Roof tiles are 20 cm wide and 40 cm long. When laid on a roof they overlap by 25% in the vertical direction. Calculate the number of tiles needed to cover the roof.

Formative assessment

- Give students sticky notes and ask them to write down something they have learned in the last three lessons and something they are still unsure about. Ask students to place the sticky notes on a designated part of the board as they leave the classroom.

Homework

- Pose the following question: The FA has rules that state the maximum and minimum dimensions of a football pitch (information can be found at www.thefa.com). Investigate the maximum and minimum total length of the white lines on a football pitch.