Chapter 3 Ratio and proportion

Specification

FS coverage and range	Solve simple problems involving ratio, where one number is a multiple of the other
FS exemplification	Share an amount in a ratio (1:n) Use ratios to find quantities, e.g. simple map scale, parts in a mixture Simple proportion, e.g. scaling up/down

GCSE

GCSE specification	**N p**	Use ratio notation, including reduction to its simplest form and its various links to fraction notation
	N t	Divide a quantity in a given ratio
Edexcel GCSE course	**Specification A:** **Foundation** 24.1–24.4 **Higher** 16.1–16.3 **Specification B:** **Foundation Unit 1:** 5.9; **Unit 2:** 6.1–6.4 **Higher Unit 1:** 5.9; **Unit 2:** 6.1–6.3	

Resources

General resources	Pretend money Red and blue pens Maps with a range of scales (e.g. 1 cm:4 km, 1:100 000) Recipe books or recipes from other sources (optional)
Resource sheets	3.1
Links	http://www.bbc.co.uk/food/recipes http://www.ordnancesurvey.co.uk http://www.bbc.co.uk/skillswise/numbers/wholenumbers (Choose Ratio and proportion, then Game)
ActiveTeach resources	Video ResultsPlus Knowledge Check ResultsPlus Problem Solving Question Audio Animations

Lesson 1

Objectives

- Use and simplify ratios to solve practical problems
- Scale quantities that are directly proportional

Starter

- Using pretend money, give one student 10p and another 20p. Ask students to describe the relationship between the amounts. Then give the first student another 10p and the second another 20p. Ask: *Has the relationship changed?* Establish that we write 20p to 40p as 20p:40p which is the same ratio as 10p:20p. Discuss how this can be simplified to 1:2. The second student has twice as much money as the first student.

Main teaching and learning

- Relate the Starter activity to *Take a look*: Making scones and *Take a look*: Investing in a business (p34), both of which give students a chance to use a similar process but with larger numbers.
- Now begin to look at using proportion. Ask*: If I have £3 and Johnny has £21, what could we say about the amount of money that Johnny has in relation to the amount I have?*
- Establish that Johnny has seven times more money than you. Ask: *Eight sweets cost 60p. If you have £2.40, how many sweets could you buy?* Establish that £2.40 ÷ 60p = 4, therefore you can buy 4 × 8 = 32 sweets.
- Ask students to complete *Have a go* Q1–6.

Issues and misconceptions

- Students may have difficulty cancelling (simplifying) ratios in the form 1:n. Encourage them to cancel in stages, dividing by easy factors until they reach the simplest form.

Support

- Support the students with metric conversions and pence to pounds.
- Division and multiplication is required throughout this section. Students may require support via a multiplication grid. Check that they remember how to divide by 100.

Extension

- *Chris and Kerry are making salads. Chris has 250 g of tomatoes and 700 g of cucumber. Kerry has 300 g of tomatoes and 750 g of cucumber. Both of them say that the ratio of tomatoes to cucumber in their salad is 2:5. Who is correct?*

Plenary

- Ask students to develop their own smoothie drink using four ingredients and a maximum of 200 ml. How much of each ingredient would be needed for 1litre of the drink?

Formative assessment

- Check students' understanding at each stage using self-assessment (via smiley/sad faces or a traffic-light scale).
- Mark the numerical answers to Q1–6 and discuss any discrepancies in students' answers.

Homework

- Ask students to find a recipe for a cake for at least four people and using at least four ingredients. They should work out how much of each ingredient is required to make the cake for eight people.

Lesson 2

Objectives

- Use proportional relationships
- Use ratios to find quantities
- Justify answers

Starter

- Begin with a matching pairs memory game using the 12 cards from Resource sheet 3.1. These consist of six pairs of equivalent ratios. Lay the cards face down and turn over two cards at a time. The aim of the game is to collect matching pairs by remembering where the matching cards are. This could be done as a teacher-led activity, or by students in pairs or larger groups.

Main teaching and learning

- Ask: *Is a third greater or less than a quarter?* Relate the discussion to *Take a look*: Shoe sales (p36). Discuss whether or not the manager needs to order more sandals.
- Begin to look at comparing proportions. Tell students that a supermarket is selling packs of 10 pens for £3.20. Another supermarket is selling packs of seven pens for £2.63. Ask: *Which supermarket is selling the better value pens? How do we find the value of one pen?*
- Then begin to look at ratios as 'parts'. Tell students that you need eight red pens. A supermarket only sells red pens and blue pens together in the ratio 1:5 per pack. Ask: *If I purchase enough packs to get eight red pens, how many pens will I have in total?* Establish that 5 × 8 gives the number of blue pens; in order to find the total number of pens it is necessary to add the number of parts in the ratio (1:5) and multiply the total by 8 (6 × 8 = 48 pens in total).
- Ask students to complete *Have a go* Q7–9.

Issues and misconceptions

- Ensure students understand how to use division in a functional context and can relate a ratio to parts. For example, in the first pens example above, some students may try to calculate 7 ÷ 2.63 rather than 2.63 ÷ 7.

Support

- Support students in beginning the tasks. Less confident students will require assistance in relating ratios to parts. Use real pens to illustrate the examples used above.

Extension

- Reverse the question about pens in the Main teaching and learning by giving a total and a ratio and asking students to find the number of pens. *I have 78 pens. The ratio of red pens to blue pens is 5:8. How many of each coloured pen do I have?*

Plenary

- As a class, discuss the answers to Q7–9. When appropriate, ensure that students realise why their answers are wrong.

Formative assessment

- Encourage students to peer-assess each other's answers during the Plenary and to lead the discussion on any incorrect answers.

Homework

- Ask students to find the ratio of cement to water required to make concrete and then to calculate how much cement is required if you have 10 litres of water.

Lesson 3

Objectives

- Use information in questions to write ratios
- Identify and use ratios to find solutions
- Find and use proportional relationships in order to scale quantities up or down
- Calculate missing values in proportional relationships
- Interpret answers to calculations
- State any assumptions made in order to support answers

Starter

- Choose two places that appear on a map and give the students the scale of the map (e.g. 1 cm:10 km). Measure the distance between the two places and calculate the actual distance. Discuss the fact that every centimetre represents 10 km so we need to use proportion to find the actual distance.

Main teaching and learning

- Begin to look at situations in which not all the values are given. Discuss *Take a look*: Visiting castles (pp38–9), in which the ratio of Edinburgh Castle visitors to Conway Castle visitors (3:1) must be used to calculate the number of visitors to Conway Castle.
- Convert 100 000 cm to metres and kilometres. Discuss *Take a look*: Choosing a map scale.
- Look at various maps. Choose some that scale centimetres to kilometres (e.g. 1 cm:4 km) and some that scale centimetres to centimetres (e.g. 1:100 000). Establish that 1:100 000 means that 1 cm on the map represents 100 000 cm in reality.
- Discuss the use of other scales. Look at *Have a go* Q12. The kitchen floor measures 4 m by 6 m. Ask: *What scale could be used?* Tell students that Alan uses a piece of paper measuring 20 cm by 30 cm. Consider whether or not the scale would work.
- Ask students to complete *Have a go* Q10–14.

Issues and misconceptions

- Emphasise that, if different units are used, it is essential to convert one so that they are both the same before beginning to calculate.
- Some students may not recognise that one value is a multiple of the other when using scales.

Support

- Help students highlight key features in the question before they begin work on a solution.
- Display common metric conversions to support students when working with map scales.

Extension

- Look at maps with scales that are not 1:n. Ask: *A map has a scale of 2 cm:5 km. What does a distance of 10 cm on the map represent in real life?*

Plenary

- Use the *Now you can* section as a revision and self-assessment tool. Ask: *Can you now do everything from the chapter?*

Formative assessment

- Ask students to peer-assess each other's answers to Q10–14. Choose one question and discuss it in detail as a class.

Homework

- Students design a layout for a kitchen on cm squared paper, using a scale of 1 cm:0.2 m. Students bring their design to class and discuss as a class how realistic their designs are.