TEACHER'S NOTES
Maths Level 1

Chapter 3
Working with ratio, proportion and formulae

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Chapter 3: Working with ratio, proportion and formulae

Use these free pilot resources to help build your learners' skill base
We are delighted to continue to make available our free pilot learner resources and teacher notes, to help teach the skills learners need to pass Edexcel FS Mathematics, Level 1.

But use the accredited exam material and other resources to prepare them for the real assessment
We developed these materials for the pilot assessment and standards and have now matched them to the final specification in the table below. They'll be a useful interim measure to get you started but the assessment guidance should no longer be used and you should make sure you use the accredited assessments to prepare your learners for the actual assessment.

New resources available for further support
We're also making available new learner and teacher resources that are completely matched to the final specification and assessment – and also providing access to banks of the actual live papers as these become available. We recommend that you switch to using these as they become available.

Coverage of accredited specification and standards
The table below shows the match of the accredited specification to the unit of pilot resources. This table supersedes the pilot table within the teacher notes.

Coverage and Range	Exemplification	Learner Unit
Solve simple problems involving ratio, where one number is a multiple of the other	• 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	**E1** Understanding ratios **E2** Using ratios to find quantities **E3** Direct proportion **E4** Using simple scales in scale diagrams
		E5 Remember what you have learned
Use simple formulae expressed in words for one- or two-step operations	• Substitute numbers into a formula in words	**F1** Formulae in words
		F2 Remember what you have learned

Where to find the final specification, assessment and resource material
Visit our website **www.edexcel.com/fs** then:
• **for the specification and assessments:** under **Subjects**, click on **Mathematics (Levels 1–2)**
• **for information about resources:** under **Support**, click on **Published resources**.

3 Working with ratio, proportion and formulae

(pages 53–64 in the learner materials)

Performance	Coverage and Range	Unit Objectives
Learners can:	**Learners can:**	
■ understand practical problems in familiar and unfamiliar contexts and situations, some of which are non-routine ■ identify and obtain necessary information to tackle the problem ■ select mathematics in an organised way to find solutions to practical problems for different purposes ■ apply mathematics in an organised way to find solutions to practical problems for different purposes ■ use appropriate checking procedures at each stage ■ interpret and communicate solutions to practical problems, drawing simple conclusions and giving explanations	■ solve simple problems involving ratio, where one number is a multiple of the other ■ use simple formulae expressed in words for one-or-two-step operations	**E1** Understanding ratio **E2** Using ratios to find quantities **E3** Direct proportion **E4** Using simple scales in scale diagrams
		E5 Remember what you have learned
		F1 Formulae in words
		F5 Remember what you have learned

Approaches to teaching

This section covers the skills necessary for learners to be able to work efficiently with ratios, direct proportion and simple formulae expressed in words. The unit focuses on the delivery of ratios, proportion and using formulae and the questions set allow the learner to practice the full range of skills being taught. The table identifies the coverage and range from the functional skills standards: mathematics level 1 which are covered in this section.

E1 *Understanding ratios*

The main idea is to develop learners' understanding that ratios can be used to compare quantities. Ratios can then be simplified in a similar way to fractions. Advise learners to read questions carefully to work out which values to express as a ratio and the correct order in which to place them. Encourage them to check first, to see if the amounts given are in the same units, for example, both in pounds or centimetres. Advise learners that if quantities are not in the same units, they should convert them to the same units first. Then they should look for a number that will divide into both parts of the ratio (or all parts in a three-part ratio). Remind them that they can divide by 2 if the numbers are even or by 5 if the numbers end in either 0 or 5. Discuss how they will

know when they have simplified the ratio as far as possible.

Activities

Provide collections of beads, counters or buttons of different colours for learners to practise simplifying ratios. Show how 12 red and 9 blue counters can be grouped in threes to give the simplified ratio 4 : 3. Extend to three-part ratios as appropriate.

Prepare sets of ratio equivalency dominoes. Let learners play, in pairs or threes, matching 6:3 with 2 : 1, for example, or 6 : 8 with 3 : 4.

Prepare 30 money cards, with simple amounts such as £10, £15, £12, 50p. Lay them face down, then ask learners to picks two cards at random and say what ratio is made by the two amounts, and simplify it; for example, cards showing £12 and £10 give the ratio 6 : 5.

Misconceptions

Learners often write the numbers in a ratio in the wrong order. For example, they may give the required ratio in question 5 on page 56 of the Skills Book as 3 : 1, not 1 : 3. Another frequent error is to try to simplify the ratio without ensuring the units used are consistent. In question 4h on page 56, for example,

they may simplify as $3:75$ instead of $300:75$. Some learners do not simplify ratios fully. For example, in question 6 on page 56, the ratio of £2500 to £25 000 may be partially simplified to $25:250$ and not fully, to $1:10$.

E2 *Using ratios to find quantities*

The main idea is to enable learners to use ratios to find required amounts, for example, of money or quantities of fruit juice, hair dye or cement. Advise learners always to work out how much one part is worth first. Explain that, after doing this, they will then be able to work out the value of any number of parts.

Misconceptions

Learners often make mistakes in finding out how much one part is worth. This is mainly because questions vary in the way they present information: some questions start by giving the total amount whereas others state how much one side of the ratio is worth. For example, in Example 1 on page 57 of the Skills Book, the total profit is £36 and it is worth a total of four parts; therefore it is necessary to divide 36 by 4 to find out how much one part is worth. In question 4 on page 57 however, the question states that the amount of juice is 2 litres, not the amount of drink. As the juice is only worth 1 part and there are 6 parts in total, here it is necessary to multiply 2 litres by 6 to find the total amount of drink. Another common error is to interpret 'twice as much' as requiring the total amount to be divided by 2, instead of 3, to find what one part is worth.

E3 *Direct proportions*

The main idea is to enable learners to use proportional relationships to increase or decrease quantities by the same rate. If the relationship is simply double or half, as in the case of altering a recipe for four people to cater for eight or two, advise learners simply to double or halve the amounts of each ingredient. At level One, Functional Skills content focuses on problems where one number is a multiple of another.

Activities

Prepare cards showing the amounts of different ingredients needed for a certain number of people, and ask how much of each ingredient is needed for a different number of people (or how many people for a different quantity), for example, *4oz flour for 6 people, 12oz flour for ? people*. Pupils work in groups or pairs to work out the missing figures and discuss their reasoning.

Misconceptions

Learners often make mistakes, trying to work out new quantities by adding or subtracting instead of multiplying or dividing. For example, in question 2 b on page 58, learners may try to add 15 ml to the 150 ml of milk required for three people, rationalising that they need quantities for an extra 15 people.

Another common error is to divide and multiply by the wrong number. For example, *If I have 12 blue buttons and the ratio of blue to red is 3 : 2, how many red buttons do I have?* Advise learners to look at the amount they have – 12 blue – and divide by the number that has the same colour (3) and then multiply by the other number, to give $12 \div 3 \times 2 = 8$.

E4 *Using simple scales in scale diagrams*

The main idea is to enable learners to use scales to convert from lengths on maps and scale drawings to actual distances.

Advise learners that, when they are working out actual distances, either lengths on maps or diagrams are given in the question or they are required to estimate the lenghts from a given scale. They then need to multiply the length on the map or diagram by the value given in the scale; for example, if the scale is $1:50$, they need to multiply the length on the diagram by 50. Stress that, if the length on the diagram is in centimetres, then the resulting actual length will also be in centimetres. Learners must then carry out a conversion to give the final answer in units that are more sensible. For example, in question 4 on page 60, it would not be sensible to leave the final answer as 400 000 cm; learners may either wish to divide by 100, giving an answer of 4000 m, or divide by 100 000, giving an answer of 4 km.

Misconceptions

Some learners make mistakes when using scales, incorrectly converting units after using the scale.

If learners are working on the concepts of ratio and proportion but have not worked with centimetres, metres or kilometres, encourage them to practise skills in section G of the skills materials. Advise learners to decide whether actual distances should be given in metres or kilometres. Demonstate how to convert centimetres into metres or kilometres.

F Working with formulae

F1 *Formulae in words*

The main idea is that rules or relationships can be described in words. Remind learners that they must be

consistent with units. Emphasise that they should go through the formulae step by step to see which values need to be multiplied/divided or added/subtracted. Discuss the sorts of formula that can be expressed in words.

Activities

Card activity: Prepare, on cards, several scenarios involving formulae in two variables. For example, a quarterly electricity bill has a £15 standing charge plus a charge of 6p per unit used. Give each student a card with a number of units on one side and a cost on the other. Start with one student, who reads out the number of units on their card. Then the student holding the card with the correct cost reads out the answer, then reads out the number of units on their card, and so on.

Misconceptions

The main area of difficulty with these questions for learners is in confusing the units. For example, in question 5 on page 63, learners may not realise the importance of converting 6p into pounds as the fixed charge is given in pounds. Encourage learners to check for consistency of units and also to check that their answer is sensible.

The learners need to develop their Process Skills, which are:

Representing	Analysing	Interpreting
Making sense of situations and representing them	Processing and using the mathematics	Interpreting and communicating the results of the analysis

At Level 1 the learners may receive some guidance on how to first approach a problem but then must decide on the methods used and identify the information they need for themselves. A suitable activity to practice these number skills would be to investigate statistics on local recycling. Ratio and proportion can be used to compare amounts recycled on a regional basis and to compare the number of different items which are recycled. Simple formulae in words can be used to investigate energy saved and costs involved. A practice Level 1 task is given below

For a Level 1 activity, learners should use a similar approach on their own statistics. Use rounding and estimating strategies to ensure some ratios involve relationships where one part is a multiple of another. [More able learners may be able to deal with more accurate data].

Recycling ratios

The table shows some of the recycling figures for a particular area. Your task is to compare the recycling figures as indicated in the questions below and use them to work out the energy saved.

You must show evidence of checking your work using different methods, including whether your results make sense. You may use ICT to complete this task, but you must include evidence of all your calculations including spreadsheet formulae.

Item	June 2007	June 2005
Tin cans	12 000	6000
Newspapers	6000	2000
Glass bottles	27 000	18 000
Plastic bottles	24 000	

1 What is the ratio of the number of cans recycled in June 2007 to the number of cans recycled in June 2005 in its simplest form?

2. What is the ratio of the number of cans recycled in June 2005 to the number of newspapers recycled in June 2005 in its simplest form?

3. Simplify the following ratio for June 2005: number of cans: number of newspapers: number of glass bottles

4. Simplify the following ratio for June 2007: number of cans: number of newspapers: number of glass bottles

5. The ratio of the number of plastic bottles recycled in June 2007 to the number recycled in June 2005 is 6 : 1. How many plastic bottles were recycled in June 2005?

6. What **proportion** of the total number of cans, newspapers, glass bottles and plastic bottles recycled in June 2005 were tin cans?

7. 1 recycled tin can saves enough energy to power a television for 3 hours.
    (a) Use this information to write a formula in words to connect the amount of hours to the number of tin cans.
    (b) Use the formula to work out the number of hours that a television can be powered in June 2007 and in June 2005 by the cans recycled in this area.

8. A formula to find the number of hours a computer can be powered by a glass bottle is hours = $\frac{5 \times \text{number of glass bottles}}{12}$

    Use the formula to find the number of hours that a computer can be powered in June 2007 and in June 2005 by the glass bottles recycled in this area.

Useful websites
http://www.defra.gov.uk/
http://www.recycling-guide.org.uk/facts.html
http://www.wastewatch.org.uk/Homepage
http://www.assurre.org/

Answers

E Working with ratio and proportion

1 Understanding ratios – *page 55*

1. a 9 : 11
   b 11 : 9
2. 5 : 7
3. 1 : 4 : 6
4. a 2 : 1
   b 1 : 2
   c 1 : 6
   d 2 : 3
   e 5 : 3
   f 1 : 5
   g 1 : 2
   h 4 : 1
   i 1 : 2 : 4
   j 2 : 5 : 6
5. 1 : 3
6. 1 : 10
7. 2 : 1
8. 6 : 9 : 7

2 Using ratios to find quantities – *page 57*

1. £4 and £20
2. 26 litres and 42 litres
3. 120 kg
4. 12 litres
5. 4 hours

3 Direct proportion – *page 58*

1. 96 fruit scones
2. a 6 eggs
   b 900 millitlitres
3. 150 millilitres
4. a 30 litres
   b 150 km

4 Using simple scales in scale diagrams – *page 59*

1. a 400 cm 4 m
   b 1000 cm 10 m
   c 500 cm 5 m
   d 30 000 cm 300 m
2. 4 m
3. 1.5 m
4. 8 × 50 000 cm = 400 000 cm = 4000 m (4 km)

5 Remember what you have learned – *page 60*

1. C
2. A
3. C
4. B
5. B
6. C

F Working with formulae

1 Formulae in words – *page 62*

1. 4 × £18 + £15 = £72 + £15 = £87
2. £45.50
3. 40 × 6 + 20 = 240 + 20 = 260 minutes
4. £0.25 × 100 + £20 × 6 = £25 + £120 = £145
5. £6 ÷ 100 × 500 + £12 = £30 + £12 = £42
6. a 40 ÷ 8 = 5   5 tins matt
   b 40 ÷ 6 = 6.66   So 7 tins silk needed.

2 Remember what you have learned – *page 64*

1. D
2. C
3. C
4. B
5. C