CfEM Mastery lessons: Guidance for use with Functional Skills students

Lesson 1: Multiplicative reasoning

Rationale and key principles

When solving proportional problems, students often have just one strategy, most commonly an additive approach. This lesson uses the context of hotel stays and a double number line to explore different ways of solving these problems using both additive and multiplicative approaches. Students are asked to think about the approaches in terms of efficiency for solving proportion problems.

Using representations to provide access to the mathematical structure of a problem is a key principle of teaching for mastery (Key Principle 1). In this lesson, the double number line is used to illustrate and compare the thinking that relies on addition with that which relies on multiplication.

Proportion problems can crop up in many places in the curriculum, e.g. exchange rates, distance–time, rates of pay, conversion between units and similar triangles. This lesson could be used effectively in any of these different places in the curriculum, emphasising that, while the context may change, the approach stays the same. This helps to support students in developing a connected understanding of mathematical topics, which is an important aspect of teaching for mastery.

(KP 2: **Value and build on students' prior learning**)

Guidance for FS teachers

This lesson is suitable for FS students, but, depending on your students' responses to the task in the introduction, you might like to limit the number of approaches you discuss in *Discuss 1*. For *Explore 1*, it is recommended that you print the Cost of stay handout on A4 and then stick it onto a sheet of A3, so that the students have plenty of space for their working. In *Explore 2*, focus on the first two questions and only address the third if you have time. You might like to leave *Explore 3* for another lesson, and adapt Slide 18 accordingly. Throughout the lesson, encourage the students to check their answers by using a different approach and checking that they arrive at the same answer.

Objectives (L1)
17. Work with direct proportions.

Objectives (L2)
22. Understand and calculate using direct proportion.

Exam question
Functional Skills exam questions for this lesson are provided on the CfE L01 Exam questions handout.

Lesson 2: Ratios and fractions

Rationale and key principles

Students often get confused with the different ways in which part–part and part–whole relationships can be represented. In this lesson, ratios and fractions are presented together, with a single diagram that represents both the ratio and the fraction. The diagrams provide insight into mathematical structure (Key Principle 1) and their use encourages students to see links between mathematical concepts, rather than viewing them as separate content. This is important in supporting a coherent and connected curriculum (Key Principle 3) and is essential in the FE sector, where there is limited curriculum time.

(KP 3: Prioritise curriculum coherence and connections)

Guidance for FS teachers

This lesson is suitable for FS students but if you think they will find the number of questions (and little cards) in the grid (in the *Explore* parts of the lesson) overwhelming, remove: rows G, H and I; fraction cards F2, F3, F5 and F6; diagram cards D2, D5, D7 and D8. Spend a little time at the start of the lesson revising the vocabulary associated with sharing, but resist 'teaching' ratios because the point of the lesson is that the students will learn through their own struggle and the use of the diagram cards.

Objectives (L1)

8. Read, write, order and compare common fractions.
17. Work with simple ratios.

Objectives (L2)

7. Order and compare amounts or quantities using proper and improper fractions.
11. Understand and calculate using ratios.

Exam question

Functional Skills exam questions for this lesson are provided on the CfE L02 Exam questions handout.

Lesson 3: Basic algebra

Guidance for FS teachers

This lesson is not appropriate for functional skills students.

Lesson 4: Algebraic thinking in problem solving

Guidance for FS teachers

This lesson is not appropriate for functional skills students.

Lesson 5: Percentage change and best buys

Rationale and key principles

Students often view percentage change as an additive process, calculating the percentage change amount and adding or subtracting to give the required percentage increase/decrease. This lesson focuses on the opportunity that percentage change problems provide to explore the underlying multiplicative relationship (Key Principle 1) between the original and new values. Considering additive approaches that students are already familiar with (Key Principle 2), alongside strategies that involve multiplicative reasoning supports students in developing both their fluency and understanding (Key Principle 4) as they learn to recognise when and how to apply additive and multiplicative approaches.

(KP 4: Develop both understanding and fluency in mathematics)

Guidance for FS teachers

This lesson is suitable for FS students and they should be able to engage fully with the initial activities. In *Explore 3*, you might want to spend a bit of time on how to calculate price per metre; also point out that options A and C are the same so they do not have to calculate the same thing twice. Throughout the lesson, encourage students to check their work by using different approaches and checking that they get the same answer.

Objectives (L1)

14. Calculate percentages of quantities, including simple percentage increases and decreases by 5% and multiples thereof.

Objectives (L2)

5. Work out percentages of amounts and express one amount as a percentage of another.
6. Calculate percentage change (any size increase and decrease).

Exam questions

Functional Skills exam questions for this lesson are provided on the CfE L05 Exam questions handout.

Lesson 6: Frequency charts and averages

Rationale and key principles

When working with frequency charts, students often struggle to see the relationship between data presented as a list and the same data represented on a chart. The use of sticky notes in this lesson, to both record and display data values provided by students, helps students to identify their own data values within a frequency chart and develop their understanding of the relationships between different representations of data. Using multiple representations provides insight into the mathematical structure of data sets and exposes the way in which the three averages provide a summary (Key Principle 1). Developing both fluency and understanding is an important part of the mastery approach (Key Principle 4) and in this lesson, time is spent interpreting and comparing various data sets represented using frequency charts and summary statistics. By exploring these different representations, students are supported in developing a deeper understanding of the way in which the mode,

median and mean represent the average of a set of data and the distinction between measures of average and range as a measure of spread.

Guidance for FS teachers

This lesson is not appropriate for Level 1 functional skills students but could be used with Level 2 students. Once you have discussed the differences between mean, median and mode, you might like to write the definitions on the board for students to refer to in the main activity. We recommend that you spend some time on the discussion for Slides 18 and 19, because if the students follow this discussion they will have a good understanding of how to get started in the main task (*Explore 3*). You might like to remove Fitness classes 6 and 8, and Cards C2 and C3; or you could just give them the first page of the grid. Remove the discussion slides as appropriate. Throughout the lesson, encourage the students to examine the sets of data carefully, and to estimate the mean where applicable.

Objectives (L2)

23. Calculate the median and mode of a set of quantities.
25. Use the mean, median, mode and range to compare two sets of data.

Exam question

Functional Skills exam questions for this lesson are provided on the CfE L06 Exam questions handout.

Lesson 7: Understanding straight line graphs

Guidance for FS teachers

This lesson is not appropriate for functional skills students.

Lesson 8: Algebraic equations

Guidance for FS teachers

This lesson is not appropriate for functional skills students.

Lesson 9: Using frequencies and probabilities

Rationale and key principles

Students at this level are likely to be familiar with the probability scale and know how to calculate theoretical probabilities. They usually understand that the relative frequency of an event can differ from its theoretical probability, but can sometimes focus on procedures rather than developing their understanding of the 'why'. In this lesson, frequencies are explored and represented on a frequency tree diagram, and from this example, a probability model is developed. The shift from the actual frequency to the theoretical probability develops students' understanding of mathematical structure (Key Principle 1). Students work with decimals and fractions within these models, encouraging them to make connections (Key Principle 3) with other areas of mathematics.

Carefully designed solutions are presented to students within the lesson to expose common misconceptions and provide opportunities to establish what students already know (Key Principle 2), as well as promoting a **collaborative community** (Key Principle 5), where students are encouraged to contribute and share their own ways of working.

Guidance for FS teachers

This lesson is not appropriate for Level 1 functional skills students but could be used with Level 2 students. You might like to teach it over two lessons, making sure that the students have plenty of time to engage in all the class discussion. The lesson makes a link between two-way tables and frequency tree diagrams; point out to the students that while two-way tables are encouraged in functional skills, frequency tree diagrams are just as valid as a way of organising and representing the information.

Objectives (L2)

26. Work out the probability of combined events including the use of diagrams and tables, including two-way tables.
27. Express probabilities as fractions, decimals and percentages.

Exam question

Functional Skills exam questions for this lesson are provided on the CfE L09 Exam questions handout.

Lesson 10: Geometric reasoning

Guidance for FS teachers

This lesson is not appropriate for functional skills students.

Lesson 11: Factors and multiples

Rationale and key principles

For many students, factors and multiples are abstract concepts that are difficult to relate to. As a result, they often confuse factors and multiples, and highest common factors (HCF) and lowest common multiples (LCM). They rely on remembering a method or technique for finding these, rather than understanding the principles underpinning the techniques. This lesson uses the context of chocolate bars and packing trays to support the development of thinking about factors as the dimensions of a rectangular array and multiplication as the area of the array. Developing an understanding of *mathematical structure* (Key Principle 1) through mathematical representations such as arrays is a key part of the teaching for mastery approach. The use of arrays aims to highlight the *links between mathematical concepts* (Key Principle 3).

(KP 1: **Develop an understanding of mathematical structure**).

Guidance for FS teachers

This lesson is suitable for FS students but it is strongly recommended that you use the cardboard models of chocolate bars and trays to develop their understanding of how the bars can be packed into the trays. The mathematics involved is basic and students do not need to know highest common factor and lowest common multiple to solve the problems involved as the emphasis is on developing an understanding of mathematical structure. In the *Explore* part of the lesson, if you think your students will struggle, focus on Tasks A and B, leaving Task C as an optional extra. You will need to adapt the slides accordingly.

Objectives (L1)

4. Use multiplication facts and make connections with division facts.

Objectives (L2)

2. Carry out calculations with numbers up to one million including strategies to check answers including estimation and approximation.

Lesson 12: Area and volume

Rationale and key principles

Students at this level usually know how to find the area and volume of 2- and 3-dimensional shapes and can recall and apply the relevant formulae correctly. Valuing and building on students' prior learning is an important part of the mastery approach (Key Principle 2). In this lesson, time is spent discussing why their area and volume calculations work; this establishes what students already know and supports them in developing a deeper understanding.

This lesson's focus on the effects on area and volume of scaling the dimensions of rectangles and cuboids provides an opportunity for students to see the links between mathematical concepts such as area and volume, proportionality, enlargement and similarity. Helping students to make connections across the curriculum is an important aspect of teaching for mastery (Key Principle 3).

(KP 2: **Value and build on students' prior learning**).

Guidance for FS teachers

This lesson is suitable for FS students, but it may be helpful to provide them with some cuboid boxes or blocks and to spend a bit of time establishing which side is referred to as the base. You might also want to provide them with the formula for finding the volume of a cuboid once you have established why it 'works'. In *Explore 1*, if you think they will find the grid overwhelming, ask them only to fill in a limited number of cells. Depending on the level of your class and what you want to emphasise, you might also like to fill in the row and column headers for them before the start of the lesson.

Objectives (L1)

22. Calculate the area of simple shapes.
23. Calculate the volumes of cuboids.

Objectives (L2)

16. Calculate areas of 2-D shapes.
17. Use formulae to find volumes and surface areas of 3-D shapes.

Exam question

Functional Skills exam questions for this lesson are provided on the CfE L12 Exam questions handout.

Functional Skills Guide Credits

Lesson 1

Pearson Education Ltd: Pearson Edexcel - Functional Skills PRACL1/CO3 (Calculator) Mathematics Level 1 Question 11

Lesson 2

Pearson Edexcel - Functional Skills PRACL1/CO2 (Calculator) Mathematics Level 1 Question 8

Lesson 5

Pearson Education Ltd: Pearson Edexcel - Functional Skills PRACL1/NO3 (Non-Calculator) Mathematics Level 1 Question 3, Pearson Edexcel - Functional Skills Past Paper 3 Mathematics Level 2 Section B(Non-Calculator) 2019 PMAT2/N03 Question 4

Lesson 6

Pearson Education Ltd: Pearson Edexcel Functional Skills Past Paper 3 Mathematics Level 1 Section A(Non-Calculator) 2019 PMAT1/N03 Question 2, Pearson Edexcel - Functional Skills PRACL1/C01 (Calculator) Mathematics Level 1 Question 10

Lesson 9

Pearson Education Ltd: Pearson Edexcel - Functional Skills PRACL2/CO3 (Calculator) Mathematics Level 2 Question 8

Lesson 12

Pearson Education Ltd: Pearson Edexcel - Functional Skills Past Paper 3 Mathematics Level 1 Section B(Calculator) 2019 PMAT1/C03 Question 11, Pearson Edexcel - Functional Skills PRACL1/NO2 (Non-Calculator) Mathematics Level 1 Question 3