Subject content functional skills: mathematics

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Contents

Introduction

This document sets out the purpose, learning aims and outcomes, and subject content for Functional Skills mathematics at Entry Level, Level 1 and Level 2.

A key aim for Functional Skills mathematics specifications is that they enable the student to gain confidence and fluency in, and a positive attitude towards, mathematics. Students will convey their confidence in using mathematics when they can demonstrate a sound grasp of mathematical knowledge and skills (see purpose section) and apply it to solve mathematical problems.

Awarding Organisation specifications should encourage teachers to emphasise the interconnectedness of the three different areas of mathematics set out in this content, namely: number and the number system; common measures, shape and space; and information and data. At each level (Entry Levels 1-3, Level 1 and Level 2) the level of difficulty of mathematical problem solving increases as does the number and extent of connections made within the content.

Mathematical problem solving is an important aspect of Functional Skills, but it is also vital that the underpinning knowledge and skills[1] required, both with and without a calculator, can be demonstrated in their own right, for example, use of times tables. Awarding Organisation specifications should encourage teachers to ensure that core knowledge and skills are secure in their students. Throughout this document, mathematical problem solving is conveyed via the following terms: simple (Entry Level), straightforward (Level 1) and complex (Level 2). Each term relevant to that level is explained in the subject content.

In interpreting the content, Awarding Organisations should note that the content at each level of qualification subsumes and builds upon the content at lower levels.

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[1] *The ability to do maths when not as part of a problem.*

Purpose

Functional Skills qualifications should provide reliable evidence of a student's achievements against demanding content that is relevant to the workplace. They need to provide assessment of students' underpinning knowledge as well as their ability to apply this in different contexts. They also need to provide a foundation for progression into employment or further technical education and develop skills for everyday life. In some contexts, Functional Skills qualifications will also play a part in the Government's accountability systems.

Functional Skills mathematics specifications should enable the student to gain confidence and fluency in and a positive attitude towards, and to develop behaviours such as persistence and logical thinking as they apply mathematical tools and approaches.

Purpose of Functional Skills Mathematics for Entry Levels: to demonstrate a sound grasp of the underpinning skills and basics of mathematical skills appropriate to the level, and the ability to apply mathematical thinking to solve simple problems in familiar situations. Achievement of these qualifications can provide the skills for further study at Levels 1 and 2.

Purpose of Functional Skills Mathematics for Level 1 and Level 2: a qualification for work, study and life. Achievement of the qualification demonstrates a sound grasp of mathematical skills at the appropriate level and the ability to apply mathematical thinking effectively to solve problems successfully in the workplace and in other real life situations.

Functional Skills Mathematics - Entry Levels 1 to 3

Learning aims and outcomes at Entry Level

Functional Skills mathematics qualifications at these levels should:

- Enable students to become confident in their use of fundamental mathematical knowledge and skills, as described through the content; and

- Indicate that students can demonstrate their understanding by applying their knowledge and skills to solve simple mathematical problems or carry out simple tasks.

Subject Content: Entry Level 1

Entry Level 1 - using numbers and the number system – *whole numbers*
1. Read, write, order and compare numbers up to 20
2. Use whole numbers to count up to 20 items including zero
3. Add numbers which total up to 20, and subtract numbers from numbers up to 20
4. Recognise and interpret the symbols +, – and = appropriately
Entry Level 1 - using common measures, shape and space
5. Recognise coins and notes and write them in numbers with the correct symbols (£ & p), where these involve numbers up to 20
6. Read 12 hour digital and analogue clocks in hours
7. Know the number of days in a week, months, and seasons in a year. Be able to name and sequence
8. Describe and make comparisons in words between measures of items including size, length, width, height, weight and capacity
9. Identify and recognise common 2-D and 3-D shapes including circle, cube, rectangle (incl. square) and triangle
10. Use everyday positional vocabulary to describe position and direction including left, right, in front, behind, under and above
Entry Level 1 - handling information and data
11. Read numerical information from lists
12. Sort and classify objects using a single criterion
13. Read and draw simple charts and diagrams including a tally chart, block diagram/graph

Solving mathematical problems and decision making: Entry Level 1 students are expected to be able to use the knowledge and skills listed above to recognise a simple mathematical problem and obtain a solution. A simple mathematical problem is one which requires working through one step or process.

At Entry Level 1 it is expected that students will be able to address individual problems each of which draw upon knowledge and/or skills from one mathematical content area (i.e. number and the number system; common measures, shape and space; information and data).

Entry Level 1 - solving mathematical problems and decision making
Entry Level 1 students are expected to be able to: • Use given mathematical information and recognise and use simple mathematical terms appropriate to Entry Level 1; • Use the methods given above to produce, check and present results that make sense; and

- Provide a simple explanation for those results.

The context for simple problems at this level should be familiar to all students and easily described.

Subject Content: Entry Level 2

Entry Level 2 - using numbers and the number system – *whole numbers, fractions and decimals*
1. Count reliably up to 100 items
2. Read, write, order and compare numbers up to 200
3. Recognise and sequence odd and even numbers up to 100
4. Recognise and interpret the symbols +, – , x, ÷ and = appropriately
5. Add and subtract two-digit numbers
6. Multiply whole numbers in the range 0x0 to 12x12 (times tables)
7. Know the number of hours in a day and weeks in a year. Be able to name and sequence
8. Divide two-digit whole numbers by single-digit whole numbers and express remainders
9. Approximate by rounding to the nearest 10, and use this rounded answer to check results
10. Recognise simple fractions (halves, quarters and tenths) of whole numbers and shapes
11. Read, write and use decimals to one decimal place
Entry Level 2 - using common measures, shape and space
12. Calculate money with pence up to one pound and in whole pounds of multiple items and write with the correct symbols (£ or p)
13. Read and record time in common date formats, and read time displayed on analogue clocks in hours, half hours and quarter hours, and understand hours from a 24-hour digital clock
14. Use metric measures of length including millimetres, centimetres, metres and kilometres
15. Use measures of weight including grams and kilograms
16. Use measures of capacity including millilitres and litres
17. Read and compare positive temperatures
18. Read and use simple scales to the nearest labelled division
19. Recognise and name 2-D and 3-D shapes including pentagons, hexagons, cylinders, cuboids, pyramids and spheres
20. Describe the properties of common 2-D and 3-D shapes including numbers of sides, corners, edges, faces, angles and base
21. Use appropriate positional vocabulary to describe position and direction including between, inside, outside, middle, below, on top, forwards and backwards
Entry Level 2 - handling information and data
22. Extract information from lists, tables, diagrams and bar charts
23. Make numerical comparisons from bar charts
24. Sort and classify objects using two criteria
25. Take information from one format and represent the information in another format including use of bar charts

Solving mathematical problems and decision making: Entry Level 2 students are expected to be able to use the knowledge and skills listed above to recognise a simple problem and obtain a solution. A simple problem is one which requires working through one step or process.

At Entry Level 2 it is expected that students will be able to address individual problems each of which draw upon knowledge and/or skills from one mathematical content area (i.e. number and the number system; common measures, shape and space; information and data).

Entry Level 2 - solving mathematical problems and decision making

Entry Level 2 students are expected to be able to:
- Use given mathematical information including numbers, symbols, simple diagrams and charts;
- Recognise, understand and use simple mathematical terms appropriate to Entry Level 2;
- Use the methods given above to produce, check and present results that make sense; and
- Present appropriate explanations using numbers, measures, simple diagrams, simple charts and symbols appropriate to Entry Level 2.

The context for simple problems at this level should be familiar to all students and easily described.

Subject Content: Entry Level 3

Entry Level 3 - using numbers and the number system – whole numbers, fractions and decimals

1. Count, read, write, order and compare numbers up to 1000
2. Add and subtract using three-digit whole numbers
3. Divide three-digit whole numbers by single and double digit whole numbers and express remainders
4. Multiply two-digit whole numbers by single and double digit whole numbers
5. Approximate by rounding numbers less than 1000 to the nearest 10 or 100 and use this rounded answer to check results
6. Recognise and continue linear sequences of numbers up to 100
7. Read, write and understand thirds, quarters, fifths and tenths including equivalent forms
8. Read, write and use decimals up to two decimal places
9. Recognise and continue sequences that involve decimals

Entry Level 3 - using common measures, shape and space

10. Calculate with money using decimal notation and express money correctly in writing in pounds and pence
11. Round amounts of money to the nearest £1 or 10p
12. Read, measure and record time using am and pm
13. Read time from analogue and 24 hour digital clocks in hours and minutes
14. Use and compare measures of length, capacity, weight and temperature using metric or imperial units to the nearest labelled or unlabelled division
15. Compare metric measures of length including millimetres, centimetres, metres and kilometres
16. Compare measures of weight including grams and kilograms
17. Compare measures of capacity including millilitres and litres
18. Use a suitable instrument to measure mass and length
19. Sort 2-D and 3-D shapes using properties including lines of symmetry, length, right angles, angles including in rectangles and triangles
20. Use appropriate positional vocabulary to describe position and direction including eight compass points and including full/half/quarter turns

Entry Level 3 - handling information and data

21. Extract information from lists, tables, diagrams and charts and create frequency tables
22. Interpret information, to make comparisons and record changes, from different formats including bar charts and simple line graphs
23. Organise and represent information in appropriate ways including tables, diagrams, simple line graphs and bar charts

Solving mathematical problems and decision making: Entry Level 3 students are expected to be able to use the knowledge and skills listed above to recognise a simple problem and obtain a solution. A simple problem is one which requires working through one step or process.

At Entry Level 3 it is expected that students will be able to address individual problems each of which draw upon knowledge and/or skills from one mathematical content area (i.e. number and the number system; common measures, shape and space; information and data).

Entry Level 3 - solving mathematical problems and decision making
Entry Level 3 students are expected to be able to: • Use given mathematical information including numbers, symbols, simple diagrams and charts; • Recognise, understand and use simple mathematical terms appropriate to Entry Level 3; • Use the methods given above to produce, check and present results that make sense to an appropriate level of accuracy; and • Present results with appropriate and reasoned explanation using numbers, measures, simple diagrams, charts and symbols appropriate to Entry Level 3. The context for simple problems at this level should be familiar to all students.

Functional Skills Mathematics - Levels 1 and 2

Learning aims and outcomes at Levels 1 and 2

Functional Skills mathematics qualifications at these levels should:

- Indicate that students can demonstrate their ability in mathematical skills and their ability to apply these, through appropriate reasoning and decision making, to solve realistic problems of increasing complexity;

- Introduce students to new areas of life and work so that they are exposed to concepts and problems which, while not of immediate concern, may be of value in later life; and

- Enable students to develop an appreciation of the role played by mathematics in the world of work and in life generally.

Subject Content: Level 1

Use of number and the number system: students at Level 1 are expected to be able to count in steps of various sizes, including negative numbers; read, write and understand positive whole numbers to one million. They can order and compare whole numbers of any size, and fractions, ratios and decimals and recognise the effect of multiplying and dividing by powers of 10, 100 and 1000. They can identify, compare and extend a range of numerical and spatial patterns, use, understand and calculate with fractions, decimals and percentages and calculate simple interest. For specific content on numbers and the number system see below.

Level 1 - using numbers and the number system – *whole numbers, fractions, decimals and percentages*
1. Read, write, order and compare large numbers (up to one million)
2. Recognise and use positive and negative numbers
3. Multiply and divide whole numbers and decimals by 10, 100, 1000
4. Use multiplication facts and make connections with division facts
5. Use simple formulae expressed in words for one or two-step operations
6. Calculate the squares of one-digit and two-digit numbers
7. Follow the order of precedence of operators
8. Read, write, order and compare common fractions and mixed numbers
9. Find fractions of whole number quantities or measurements
10. Read, write, order and compare decimals up to three decimal places
11. Add, subtract, multiply and divide decimals up to two decimal places
12. Approximate by rounding to a whole number or to one or two decimal places
13. Read, write, order and compare percentages in whole numbers
14. Calculate percentages of quantities, including simple percentage increases and decreases by 5% and multiples thereof
15. Estimate answers to calculations using fractions and decimals
16. Recognise and calculate equivalences between common fractions, percentages and decimals
17. Work with simple ratio and direct proportions

Use of common measures, shape and space: students at Level 1 are expected to be able to work out simple relationships between common units of measurement to define quantities, also involving mathematical terms for position and direction. They can apply and use calculations with common measures including money, time, length, weight and capacity. They can visualise, draw and describe 2-D and 3-D shapes and use properties of 2-D shapes in calculations. For specific content on common measures, shape and space – see below.

Level 1 - using common measures, shape and space
18. Calculate simple interest in multiples of 5% on amounts of money
19. Calculate discounts in multiples of 5% on amounts of money

20.	Convert between units of length, weight, capacity, money and time, in the same system
21.	Recognise and make use of simple scales on maps and drawings
22.	Calculate the area and perimeter of simple shapes including those that are made up of a combination of rectangles
23.	Calculate the volumes of cubes and cuboids
24.	Draw 2-D shapes and demonstrate an understanding of line symmetry and knowledge of the relative size of angles
25.	Interpret plans, elevations and nets of simple 3-D shapes
26.	Use angles when describing position and direction, and measure angles in degrees

Handle information and data: students at Level 1 are expected to be able to select, construct and interpret a range of statistical diagrams in various contexts; select and use methods and forms to present and describe outcomes. They can extract and interpret information from tables, diagrams, charts and graphs; apply simple statistics and recognise features of charts to summarise and compare sets of data; recognise and use the probability scale and interpret probabilities. For specific content on information and data – see below.

Level 1 - handling information and data	
27.	Represent discrete data in tables, diagrams and charts including pie charts, bar charts and line graphs
28.	Group discrete data and represent grouped data graphically
29.	Find the mean and range of a set of quantities
30.	Understand probability on a scale from 0 (impossible) to 1 (certain) and use probabilities to compare the likelihood of events
31.	Use equally likely outcomes to find the probabilities of simple events and express them as fractions

Solving mathematical problems and decision making: students at Level 1 are expected to be able to use the knowledge and skills listed above to recognise and obtain a solution or solutions to a straightforward problem. A straightforward problem is one that requires students to either work through one step or process or to work through more than one connected step or process.

Individual problems are based on the knowledge and/or skills in the mathematical content areas (number and the number system; common measures, shape and space; information and data). At Level 1 it is expected that the student will be able to address individual problems, some of which draw upon a combination of any two of the mathematical content areas and require students to make connections between those content areas.

Level 1 - solving mathematical problems and decision making
Students at Level 1 are expected to be able to:

- Read, understand and use mathematical information and mathematical terms used at this level;
- Address individual problems as described above;
- Use knowledge and understanding to a required level of accuracy;
- Analyse and interpret answers in the context of the original problem;
- Check the sense, and reasonableness, of answers; and
- Present results with appropriate explanation and interpretation demonstrating simple reasoning to support the process and show consistency with the evidence presented.

The context of individual problems at this level will require some comprehension in order for the student to be able independently to identify and carry out an appropriate mathematical approach.

Subject Content: Level 2

Use of numbers and the number system: students at Level 2 are expected to be able to use numbers of any size; read, write and make use of positive and negative integers of any size; use, order and compare integers, fractions, decimals, percentages and ratios as well as recognise the value of a digit in any whole or decimal number. They can use numerical and spatial patterns for a purpose and calculate with, and convert between, numbers written as fractions, decimals, percentages and ratios. For specific content on numbers and the number system – see below.

Level 2 - using numbers and the number system – *whole numbers, fractions, decimals and percentages*
1. Read, write, order and compare positive and negative numbers of any size
2. Carry out calculations with numbers up to one million including strategies to check answers including estimation and approximation
3. Evaluate expressions and make substitutions in given formulae in words and symbols
4. Identify and know the equivalence between fractions, decimals and percentages
5. Work out percentages of amounts and express one amount as a percentage of another
6. Calculate percentage change (any size increase and decrease), and original value after percentage change
7. Order, add, subtract and compare amounts or quantities using proper and improper fractions and mixed numbers
8. Express one number as a fraction of another
9. Order, approximate and compare decimals
10. Add, subtract, multiply and divide decimals up to three decimal places
11. Understand and calculate using ratios, direct proportion and inverse proportion
12. Follow the order of precedence of operators, including indices

Use of measures, shape and space: students at Level 2 are expected to be able to handle relationships between measurements of various kinds, use angles and coordinates when involving position and direction and make use of geometric properties in calculations with 2-D and 3-D shapes and understand the relationships between them. For specific content on measures, shape and space – see below.

Level 2 - measures, shape and space
13. Calculate amounts of money, compound interest, percentage increases, decreases and discounts including tax and simple budgeting
14. Convert between metric and imperial units of length, weight and capacity using a) a conversion factor and b) a conversion graph
15. Calculate using compound measures including speed, density and rates of pay

16. Calculate perimeters and areas of 2-D shapes including triangles and circles and composite shapes including non-rectangular shapes (formulae given except for triangles and circles)
17. Use formulae to find volumes and surface areas of 3-D shapes including cylinders (formulae to be given for 3-D shapes other than cylinders)
18. Calculate actual dimensions from scale drawings and create a scale diagram given actual measurements
19. Use coordinates in 2-D, positive and negative, to specify the positions of points
20. Understand and use common 2-D representations of 3-D objects
21. Draw 3-D shapes to include plans and elevations
22. Calculate values of angles and/or coordinates with 2-D and 3-D shapes

Handle information and data: students at Level 2 are expected to be able to construct, interpret and evaluate a range of statistical diagrams. They can calculate and interpret probabilities. They can calculate, analyse, compare and interpret appropriate data sets, tables, diagrams and statistical measures such as common averages (mean, median, mode) and spread (range), and use statistics to compare sets of data. They can identify patterns and trends from data as well as recognise simple correlation. For specific content on information and data see below.

Level 2 - handling information and data
23. Calculate the median and mode of a set of quantities
24. Estimate the mean of a grouped frequency distribution from discrete data
25. Use the mean, median, mode and range to compare two sets of data
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
28. Draw and interpret scatter diagrams and recognise positive and negative correlation

Solving mathematical problems and decision making: students at Level 2 are expected to be able to use the knowledge and skills listed above to recognise and obtain a solution or solutions to a complex problem. A complex problem is one which requires a multistep process, typically requiring planning and working through at least two connected steps or processes.

Individual problems are based on a combination of the knowledge and/or skills from the mathematical content areas (number and the number system; measures, shape and space; information and data). At Level 2 it is expected that the student will be able to address individual problems some of which draw upon a combination of all three mathematical areas and require students to make connections between those content areas.

Level 2 - solving mathematical problems and decision making

Students at Level 2 are expected to be able to:

- Read, understand, and use mathematical information and mathematical terms;
- Address individual problems as described above;
- Use knowledge and understanding to a required level of accuracy;
- Identify suitable operations and calculations to generate results;
- Analyse and interpret answers in the context of the original problem;
- Check the sense and reasonableness of answers; and
- Present and explain results clearly and accurately demonstrating reasoning to support the process and show consistency with the evidence presented.

The context of individual problems at this level will require interpretation and analysis in order for the student to be able independently to identify and carry out an appropriate mathematical process or processes.

Explanation behind the use of the term *mathematical problem solving* (for information)

Mathematical problem solving is a core element of Functional Skills mathematics, though underpinning knowledge will also be tested in its own right. Problem solving should not seek to obscure or add additional mathematical complexity beyond the level of the qualification. Defining what problem solving means in the context of examinations is challenging.

In discussing this same issue, a working group in 2015 for higher level qualifications[2] suggested that considering *attributes* of problem solving was a way forward. They came to a consensus regarding a range of attributes typical of problem solving questions. They emphasised that not all (in fact often just one) of these attributes – listed below – may be necessary to be present within a single task in order to consider it as involving problem solving[3]. This is especially pertinent when considering the difference in intended level of challenge between students studying for higher level qualifications as compared to Functional Skills.

Attributes, of which one or more may be present in a single task to consider it as problem solving, are listed below:

A. Tasks that have little or no scaffolding: there is little guidance given to the student beyond a start point and a finish point. Questions do not explicitly state the mathematical process(es) required for the solution.

B. Tasks that provide for multiple representations, such as the use of a sketch or a diagram as well as calculations.

C. The information is not given in mathematical form or in mathematical language; or there is a need for the results to be interpreted or methods evaluated, for example, in a real-world context.

D. Tasks have a variety of techniques that could be used.

E. The solution requires understanding of the processes involved rather than just application of the techniques.

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[2] *See 'A' level mathematics working group report, (2015) Ofqual/15/5789 pages 4-5*

[3] *Problem-solving tasks - tasks that focus primarily on the assessment of problem solving - a set of requirements focusing on one problem. These tasks may be broken down into a number of steps or parts (that is, items). See also report by ACME 'Problem-Solving within mathematics', June 2016.*

F. The task requires two or more mathematical processes or may require different parts of mathematics to be brought together to reach a solution[4].

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[4] *Not all of these attributes would be required within a single task to establish it as problem solving. Neither does the presence of one or more attributes within a task automatically imply problem solving is taking place.*

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