

Help sheet for those teaching L1-2 Functional Mathematics

Purpose

This sheet provides key information about teaching Level 1 and Level 2 Functional Mathematics and is designed to accompany any L1-2 www.skillsworkshop.org numeracy resource – particularly those of an investigative or problem-solving nature. It is aimed at teachers, tutors and support staff who are shifting from adult numeracy teaching to functional mathematics.

Differences between the Adult Numeracy Curriculum and Functional Mathematics

Although the required skills at each level (Entry 1 - Level 2) are similar (*see footnote) the approach is very different in Functional Mathematics (FM). FM hinges on the learner developing a problem-solving approach to mathematics and being able to transfer and apply the skills that they learn to other practical situations in different contexts.

Developing a problem solving approach

To encourage this holistic approach when teaching a maths topic (or using / adapting a [skillsworkshop.org](http://www.skillsworkshop.org) numeracy resource) you must consider the all-important **process skills** that apply at all levels. The process skills underpin the specific **performance skills** and **coverage and range statements** for each level.

It is the process skills that 'should provide the framework for the delivery, development and assessment of functional mathematics.'

(QCA, 2007, p20).

Page 3 explains the process skills. The circular flow chart is included as a planning aid – please note this is a personal interpretation of the process skills and is not an 'official' diagram.

Page 4 lists the specific performance, progression and context skills for Levels 1 and 2.

Pages 5 and 6 provide 1 page overviews of the Level 1 and 2 coverage and range statements and are for reference when planning schemes of work and lessons.

Do not regard pages 5 and 6 as lists of learning objectives. The coverage and range statements are indicative only – not prescriptive – and are by no means an exhaustive list of the mathematical skills / techniques that are likely to be used by learners performing at that level.

The performance and coverage/range statements can be used to give teachers confidence that the problems solved by learners were of sufficient demand to describe their performance as achieving a particular level.

(FSSP, 2009, p21)

Mastery of a certain level is judged by the learner's use of process skills NOT their knowledge of the coverage and range skills. These two quotes stress this point:

In functional mathematics, it is very important for learners to experience the need to decide for themselves whether a problem can be addressed using mathematics, what mathematics might help, and how the problem should be set out mathematically (represented).

Teachers should note that almost all the techniques listed in the coverage/range statements in the standards apply to the analysing aspect of the process skills. It follows that these statements give little help in supporting judgements about the representing and interpreting aspects [of process skills].

(FSSP, 2009, p18 & p104)

**The level of demand of mathematical activities increases when it is contextualised in 'real life' scenarios. For this reason, the mathematical skills and techniques that are expected to be utilised and applied in functional skills activities are slightly lower than the usual band equivalences in the national curriculum levels. (QCA, 2008, p53)*

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Sources

Qualifications and Curriculum Authority (2007), *Functional skill standards*.

http://www.qca.org.uk/libraryAssets/media/QCA-07-3472-functional-skills_standards.pdf

QCA (2008), *Functional skills guidance: amplification of the standards*.

http://www.qca.org.uk/libraryAssets/media/qca-08-3700_Functional_skills_guidance_amplification_of_the_standards.pdf

FSSP (2009), *Teaching and learning functional mathematics* (130 pages) is an update of the original 2007 version prepared by the Functional Skills Support Programme (FSSP) for use in pilot centres. It clearly explains how to make sense of the FM standards and includes masses of ideas for delivering FM, writing your own contextualised resources, etc.

<http://www.excellencegateway.org.uk/pdf/T%20&%20L%20Maths%20Apr%202009.pdf>

Other really useful documents

Learning and Skills Network (2009), *Preparing to Deliver Functional Mathematics* (20 pages)

http://www.excellencegateway.org.uk/pdf/fsfa_maths_web.pdf

AQA (2007) *Tasks for AQA Functional Mathematics 2008* is a 110 page PDF document with 30 Level 2 maths tasks written by Leeds University to support teachers in pilot centres. Each task consists of a data sheet (this could be a short text, a diagram, a table, a graph, etc.) followed by a set of questions. Many cover vocational areas. Topics include: farm animals, solar system, bacterial growth, bricklaying, hair salon, digital prints, picture frames and kitchen design.

<http://store.aqa.org.uk/qual/gcse/qp-ms/AQA-9305-9307-W-TASKS.PDF>

Further useful information

can be found on the FSSP area of the Excellence Gateway

<http://www.excellencegateway.org.uk/page.aspx?o=functionalskills>

Functional Maths Standards – process skills (apply to all levels)

Source: Functional Skill Standards © 2007 Qualifications and Curriculum Authority pp19-20.

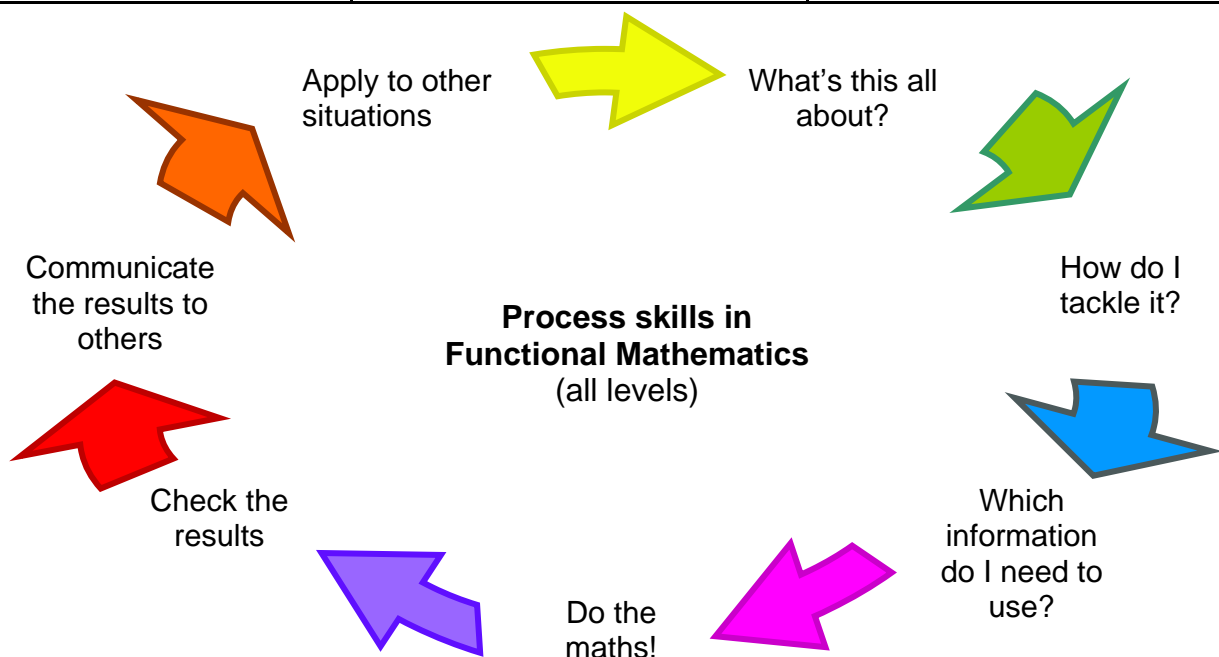
The Process Skills underpin functional maths at all levels and enable learners to:

- understand a situation
- choose an approach to tackle the problem
- formulate a model using mathematics
- use mathematics to provide answers
- interpret and check the results
- evaluate the model and approach
- explain the analysis and results
- apply and adapt this experience in other situations as they arise.

The key components of the process skills are in the table below. It is important that each skill should not be considered as a separate entity but as part of a larger process. (This information adapted from FSSP, 2008, Section 1.4 'How to Read the Standards').

The diagram attempts to depict this larger process: each arrow in the cycle involves various skills from two or more columns. Please note this diagram is a personal interpretation of the problem solving and transferable approach of process skills, not an 'official' representation.

Representing	Analysing	Interpreting
Making sense of situations and representing them	Processing and using mathematics	Interpreting and communicating the results of the analysis
A learner can: <ul style="list-style-type: none"> • recognise that a situation has aspects that can be represented using mathematics • make an initial model of a situation using suitable forms of representation • decide on the methods, operations and tools, including ICT, to use in a situation • select the mathematical information to use. 	A learner can: <ul style="list-style-type: none"> • use appropriate mathematical procedures • examine patterns and relationships • change values and assumptions or adjust relationships to see the effects on answers in the model • find results and solutions. 	A learner can: <ul style="list-style-type: none"> • interpret results and solutions • draw conclusions in light of the situation • consider the appropriateness and accuracy of the results and conclusions • choose appropriate language and forms of presentation to communicate results and conclusions.



M. Harnew, 2009.

Functional Maths Standards – L1 and 2 performance skills and context

Source: Functional Skill Standards © 2007 Qualifications and Curriculum Authority pp21, 25-26.

The 'Performance' statements give teachers an idea of what to expect from learners in terms of complexity, familiarity and the learners' independence.

'The performance statements should be regarded as indicating one way among many possible ways in which the difficulty of a problem may be expressed at the relevant level. A different problem with greater complexity but involving less independence, for example, could be of equivalent difficulty.'

(FSSP, 2008, Section 1.5: Level Differentiation)

Performance at L1	Performance at L2
<ul style="list-style-type: none"> • understand practical problems in a wide range of familiar and unfamiliar contexts and situations, some of which are non-routine • identify and obtain necessary information to tackle the problem • select and apply mathematics in an organised way to find solutions to practical problems for different purposes • use appropriate checking procedures at each stage • interpret results and communicate solutions to practical problems, drawing simple solutions and giving explanations 	<ul style="list-style-type: none"> • understand routine and non routine practical problems in a wide range of familiar and unfamiliar contexts and situations • identify the situation or problem and the mathematical methods needed to tackle it • select and apply a range of mathematics to find solutions • use appropriate checking procedures and evaluate their effectiveness at each stage • interpret results, consider the accuracy and appropriateness of results and solutions, and communicate solutions to practical problems in familiar and unfamiliar routine and non-routine contexts and situations • draw conclusions in light of situations and provide mathematical justifications

Level 1 context	Level 2 context
<ul style="list-style-type: none"> • The context may be less familiar than at Entry level but is accessible to the learner. • The mathematics demanded are clear but with some non-routine aspects to the situation or problem. • Methods and procedures may require selection and an organised approach. Models need to be selected and adapted. • Guidance is provided but autonomous decisions are required to find solutions. 	<ul style="list-style-type: none"> • In some respects the context is unfamiliar to the learner, and the situation or problem needs to be identified. • The mathematics demanded may not be obvious in all situations and there will be non-routine aspects to the situation or problem. • Methods may involve several steps and require identification of underlying mathematical structures and ways of describing them. • Guidance may be provided but choices are independently made and evaluated

Level 1 Functional Maths (FM) Standards – coverage and range

Important: coverage and range statements are indicative only – not an exhaustive list. FM skill levels are determined by a 'learner's ability to use and apply this information for 'real life' and purposeful activities.' (QCA, 2007, p4). Thus, the L1 coverage and range skills **must be underpinned** by the process and performance skills (see pp 3-4).

Understand and use whole numbers and recognise negative numbers in practical contexts

- Read, write, order and compare numbers, including large numbers.
- Know what each digit represents in a number of up to seven digits, including the use of zero as a place holder.
- Understand the symbols for greater than and less than.
- Understand the words positive and negative.
- Recognise negative numbers in the context of temperature.
- Work to the given level of accuracy, for example nearest ten.
- Recognise and use numerical relationships, for example multiples and squares.
- Use a range of calculation strategies, including use of a calculator.

Add, subtract, multiply, and divide whole numbers using a range of mental methods

Multiply and divide whole numbers by 10 and 100 using mental arithmetic

- Understand place value to two decimal places, for example 3 divided by 100.

Understand and use equivalences between common fractions, decimals and percentages

- Read, write, order and compare common fractions, including mixed numbers, decimals with up to three decimal places and percentages.

Add and subtract decimals up to two decimal places

- In the context of money and measure, for example, £3.27 + £5.67, 3.56 m + 7.86 m.

Solve simple problems involving ratio, where one number is a multiple of the other

- Understand simple ratio as the number of parts, for example three parts to one part. A drink is made from juice and water in the ratio of 1:5. How many litres of drink can I make from 2 litres of juice?
- Understand direct proportion as the same rate of increase or decrease, for example double, half, scale up amounts of food for three times the number of people, put items in piles with twice as many items in one pile as in the other.
- Know how to use a simple scale to estimate distance on a road map.

Use simple formulae expressed in words for one- or two-step operations

- For example, to cook a chicken takes 40 minutes per kilogram plus 20 minutes. How long to cook a 4kg chicken?

Solve problems requiring calculation, with common measures including money, time, length, weight, capacity and temperature

- Money – add, subtract, multiply, divide and record sums of money.
- Time – read, measure and record time in common date formats and in the 12-hour and 24-hour clock; know that midnight is 00:00 or 0000 and noon or midday is 12:00 or 1200; understand and use timetables; know units of time – century, year, month, week, day, hour, minute, second; calculate using time by adding / subtracting times in hours and minutes.
- Read, estimate, measure, compare and calculate length, distance, weight, capacity, and temperature.
- Understand and use a mileage chart.

Convert units of measure in the same system

For example, 70 minutes to 1 hour 10 minutes, 0.36 metres to 360 mm, 0.6 hours to 36 minutes.

Work out areas, perimeters and volumes in practical situations

- Know that the perimeter is the boundary of a shape and is measured in units of length.
- Know that area is a measure of 2D space, measured in square units and that the area of a rectangle = length x width.
- Know that volume is a measure of 3D space, measured in cubic units and the volume of a cuboid = length x width x height.
- Know that measurements must be in the same units before calculating.

Construct models and draw shapes, measuring and drawing angles and identifying line symmetry

- Construct models, draw shapes, for example net of a cuboid.
- Know that angles are measured in degrees, a right angle is 90° (degrees) and four right angles fit around a point; an obtuse angle is greater than 90°, an acute angle less than 90°
- Draw lines of symmetry on a shape.

Extract and interpret information from tables, diagrams, charts and graphs

- Understand that title, labels, and key provide information.
- Know how to read a scale on an axis.
- Know how to use a simple scale such as 1cm to 1m, 20mm to 1m, for example to find distances on a map.
- Know how to obtain information, from tables e.g. timetable or pricelist, charts e.g. a pictogram, simple pie chart or bar chart, single line graphs, diagrams such as a map, workshop drawing or plan.

Collect and record discrete data and organise and represent information in different ways

- Collect (including by making accurate observations) and record discrete data in a tally chart.
- Organise discrete data in a table.
- Represent discrete data in pictograms, bar charts and line graphs.
- Know how to choose a sensible scale and to label charts, graphs and diagrams.
- Represent the results of calculations to show the purpose of the task, for example more staff are needed to handle enquiries between 12:30 and 1:30pm because findings show this is the busiest time.

Find mean and range

- Know that the mean is a single value that represents the data.
- Know that the mean is one sort of average that can give a distorted view if one or two values are much higher or lower than the other values, for example salaries
- Calculate the mean by summing all the values then dividing by the number of items, for example temperature, prices, time.
- Understand that the range measures the spread of a set of data, for example temperatures.
- Understand that the range is the difference between the minimum and maximum values in the set of data.

Use probability to show that some events are more likely to occur than others

- Understand that some events are impossible, some events are certain, some events are likely to occur.
- Understand the concept of possible outcomes, for example gender of a baby.
- Understand that some events can happen in more than one way, for example getting an odd number on the throw of a dice. (Expressing a probability as a fraction, decimal or percentage is not required).

Understand outcomes, check calculations and explain results

- Estimate using rounding.
- Understand that knowledge of a context enables judgement of whether answers are sensible.

Source: Functional skills guidance: amplification of the standards © 2008 Qualifications and Curriculum Authority pp.65-69

Note: each level builds on and subsumes the skills from lower levels so learners' knowledge of skills at Entry 3, Entry 2, etc. should be checked.

Level 2 Functional Maths Standards – coverage and range

Important: coverage and range statements are indicative only – not an exhaustive list. FM skill levels are determined by a 'learner's ability to use and apply this information for 'real life' and purposeful activities.' (QCA, 2007, p4). Thus, the L2 coverage and range skills **must be underpinned** by the process and performance skills (see pp 3-4).

Understand and use positive / negative nos. of any size in practical contexts

- Read, write, order and compare positive and negative numbers of any size.
- Understand the meaning of negative numbers in a practical context, e.g. temperature below zero, loss in trading.

Carry out calculations with numbers of any size in practical contexts

- Use efficient methods to carry out calculations involving two or more steps, including efficient use of a calculator.
- Understand multiple & factor, and relate them to multiplication and division facts.
- Understand primes and know prime numbers up to 20.
- Know and use strategies to check answers, for example approximate calculation, estimation.
- Give the level of accuracy of results, for example nearest pound, nearest hundredth, in the context of money 12.458 on the calculator means £12.46.

Understand, use & calculate ratio & proportion, inc. problems involving scale

- Understand ratio written in the form 3:2, sharing £60 in the ratio 3:2.
- Understand how to work out the number of parts in a given ratio, and the value of 1 part. E.g. the total cost for a job is £200. If the ratio between labour and materials is 5:3, how much was the labour?
- Work out dimensions from scale drawings. For example, the scale of a plan is 1:20. If a room is 12m by 8m, what are the dimensions, in cm, on the plan?
- Estimate amounts using proportions, e.g. the length of the room is about 3 times its width, the stockroom is about 2/3 full.

Understand & use equivalences between fractions, decimals and percentages

- Understand that fractions, decimals and percentages are different ways of expressing the same thing.
- Use fractions, decimals & percentages to order and compare amounts or quantities and to solve practical problems. For example, what decimal must I multiply by to find the cost after a reduction of 25%?
- Choose to use a fraction, decimal or percentage to work out VAT.
- Know how to change fractions to equivalent fractions with a common denominator.
- Identify equivalences between fractions, decimals and percentages.
- Evaluate one number as a fraction or percentage of another.
- Understand that quantities must be in the same units to evaluate and compare.

Add & subtract fractions; add, subtract, multiply & divide decimals (and %s) to a given number of decimal places

- Add and subtract using halves, thirds, quarters, fifths and tenths.
- Add, subtract, multiply and divide decimals up to three places and check answers in the

context of measurements and money, for example a bill for £32.67 shared equally among three people.

Understand and use simple equations and simple formulae involving one- or two-step operations

- Understand that words and symbols in expressions and formulae represent variable quantities (numbers) not things, so $2a + 2b$ cannot be explained as 2 apples and 2 bananas.
- Understand that the contents of brackets must be worked out first.
- Understand that when there is no operator between a number and a variable, two variables, or a bracket, multiplication is implied.
- Make substitutions in given formulae in words and symbols.

Recognise and use 2D representations of 3D objects

- Recognise and use common 2D representations of 3D objects, for example in maps and plans.
- Solve problems involving 2D shapes and parallel lines, e.g. laying carpet tiles.

Find area, perimeter and volume of common shapes

- Know what is meant by perimeter, circumference, diameter and radius.
- Understand and use given formulae for finding perimeters and areas of common and composite shapes, circumference and area of circular surfaces, for example rooms or plots of land.
- Understand the symbol for pi and know its approximate value.
- Understand and use given formulae for finding volumes of common shapes, for example cuboid or cylinder.
- Know that measurements must be in the same units when calculating perimeters, areas or volumes.

Use, convert and calculate using metric &, where appropriate, imperial measures

- Calculate with sums of money & convert between currencies, understanding buying and selling rates, and that exchange rates are not fixed.
- Calculate, measure and record dates and times in different formats and know the relationship between units of time, for example second, minute, hour, day, week, month and year.
- Estimate, measure and compare length, distance, weight, capacity & temperature, including reading Celsius and Fahrenheit scales and conversion tables.
- Know common imperial units, e.g. yard, foot, inch, mile, ton, pound, ounce, pint, gallon, and metric measures, for example mm, cm, m, km, mg, g, kg, tonne, ml, l.
- Use mixed units of measure within the same system, for example m and cm, giving answer in m.

- Calculate with units of measure between systems, using conversion tables and scales, and know how to use approximate conversion factors, e.g. a kilogram is a bit more than 2lb, 1 lb is approximately 450g, a litre is less than 2 pints, a gallon is about 4.5 litres, a metre is a bit more than a yard, an inch is about 2.5cm, a foot is about 30cm, 5 miles is about 8km.

Collect & represent discrete & continuous data, using ICT where appropriate

- Get relevant information from different sources, for example written and graphical material, first-hand by measuring or observing.
- Know how to extract discrete and continuous data from tables, spreadsheets, bar charts, pie charts and line graphs with more than one line.
- Draw conclusions from scatter diagrams, understanding that correlation does not imply causality.
- Understand how to use scales in diagrams, charts and graphs.
- Know how to choose a suitable format and scale to fit the data and ensure all charts, graphs and diagrams are labelled.

Use & interpret statistical measures, tables and diagrams, for discrete and continuous data, using ICT where appropriate

- Use statistical methods to investigate situations.
- Find the mean, median and mode and understand that each average is useful for different purposes.
- Use the range to describe the spread within a set of data, e.g. sales results.
- Use the average and range to compare two sets of data

Use a numerical scale from 0 to 1 to express and compare probabilities.

- Understand that probability is an expression of likelihood and can be written as a fraction, decimal or percentage.
- Understand that probability is expressed as the number of ways an event can happen compared with the number of possible outcomes, for example the probability of choosing a red card from a pack of cards is $26/52 = 1/2$, a club is $13/52 = 1/4$ and an ace is $4/52 = 1/13$.
- Identify the range of possible outcomes of combined events and record the information in tree diagrams or tables. For example, one bag of 10 balls contains six red balls. A spinner divided into five equal sections has two red sections. In which situation is red most likely?

Source: Functional skills guidance: amplification of the standards © 2008 Qualifications and Curriculum Authority pp.70-73

Note: each level builds on and subsumes the skills from lower levels so learners' knowledge of skills at Level 1, Entry 3, etc. should be checked.