RECOGNISING ACHIEVEMENT

FUNCTIONAL SKILLS - MATHEMATICS PILOT

ASSESSMENT GUIDANCE AND EXEMPLAR MATERIALS FOR THE JANUARY, MARCH AND JUNE 2008 SERIES

Introduction

Following the successful trials in 2007, OCR has been commissioned by QCA to pilot 'stand-alone' Functional Skills Mathematics assessments over a three year period commencing in September 2007. In the first year, three assessment opportunities will be offered in January, March and June 2008. This will extend to six opportunities in the academic year 2008/2009, probably in September, November, January, March, May and June, while in the final year of the pilot it may be possible to offer 'on-demand' testing. In the first year the pilot will be restricted to specific Centres. OCR is also involved in piloting a similar assessment methodology as part of a GCSE Mathematics qualification. The outcomes from these pilots will be used by QCA to develop and finalise Functional Skills Mathematics assessment within GCSE Mathematics and as a stand alone qualification.

Assessment Methodology

Each assessment opportunity (paper) will be task-based and take the form of a one hour and fifteen minutes supervised activity. This will include the fifteen minutes reading time, based on feedback from the Centres that took part in the January 2007 trial. In the pilot this reading time will be subsumed into the overall time for the assessment and so candidates will be able to write into the answer book immediately. The answer book will include the task and space to answer each section. The first page of each task will be labelled as a planning page and candidates will be advised 'Use this sheet to plan your answer to Task X. It will not be marked but may contribute to the examiner's understanding of your working'. In the trial a single scenario was used across the whole paper. The pilot will use a slightly different approach. At both Levels each paper will consist of three different tasks each equally weighed. At level 1, each of the eight evidence criterion will be equally weighted and all will covered in each task. This will give a task total of 16 marks, across the paper an evidence criterion total of 6 marks and a paper total of 48 marks. At Level 2 there will be nine equally weighted evidence criteria, but not all will necessarily be covered in each task. However, across the paper each evidence criterion will be covered three times giving an evidence criterion total of 6 marks, a task total of 18 marks and a paper total of 54 marks

Using the Exemplification and Guidance produced by QCA (Appendix 1), OCR has developed a mark scheme format for each task at each level; these are shown in Appendix 2. This ensures that across each paper each assessment criterion will be equally weighed at 6 marks. This methodology will ensure consistency in marking and help to standardise the assessment outcomes.

The QCA Exemplification and Guidance places great emphasis on developing and assessing the 'problem solving' aspects of the qualification in line with methodology set out in the National Curriculum Programmes of Study. Consequently, the tasks at both Levels will be much more 'open-ended' than those in existing qualifications. This raises significant assessment issues which the mark scheme format is intended to address. There are also implications for mathematics teaching and learning programmes at both Key Stage 3 and Key Stage 4.

Using specific exemplar tasks which OCR has developed at Level 1 and Level 2, the present document provides Centres with opportunities to review how the QCA Exemplification and Guidance will be used to develop and assess appropriate tasks.

Teaching and Learning Strategies

The tasks at each level are structured to be completed in 25 minutes. The first five minutes should be used by the candidate to plan their answer and space will be provided in the Answer Book for this activity. This planning will not be marked but will be available to the examiner. At Level 1 there will then be two 'lead-in' questions attracting two marks each and then an 'open ended' activity which has 12 marks allocated. At Level 2 the question structure will be completely 'open ended' and may compromise a single activity or one based on two or more parts. This raises a number of issues with regard to teaching and learning activities.

Planning time – this will be critical to the successful completion of each task. Candidates will need to decide not just the mathematical techniques they will need to use but how to apply these to the context of the question. In the Level 1 example, candidates need to decide that in part a) they will need to make a table of room and conventional light bulbs and then in part b) add a third column 'energy saving light bulbs'. To answer part c), candidates need to calculate the difference in the power consumed in each room by conventional and energy saving light bulbs and then add these to get the overall saving. This sum is then compared with 600W to answer the question set.

Setting out answers – the assessment methodology places emphasis on the candidate clearly explaining how they obtained their answer as well as correctly carrying out the mathematical manipulation. Chief Examiners for present GCSE papers regularly comment about this as an issue and the present assessment methodology provides a way of addressing it. In the Level 1 example, the clearest way of providing the information for parts a) and b) is by using a table and this will also provide a sound structure for the calculations needed in part c).

Checking – by providing 'real world' scenarios and contexts and requiring candidates to investigate a given outcome the task based approach will give candidates a basis against which they can check the outcomes of their calculations. In the Level 1 example the calculated difference will be about 600W and this provides a basis against which candidates can check their calculations.

Centres need to consider how these skills can be developed in the candidate's learning programme.

Appendix 1

QCA Exemplification and Guidance for Centres

Functional Mathematics Guidance for Assessors

This guidance needs to be used in conjunction with the functional mathematics standards (June 2007)

Process Skills

Any assessment activity should ensure that, as a minimum requirement, learners can demonstrate (at the appropriate level) the holistic requirements of the process skills: represent, analyse and interpret. For examples of how to these process skills might inform task design see Appendices 1 and 2. The key attributes of these process skills are presented below:

Functional Mathematics Standards		Amplification for assessment purposes
Representing Making sense of situations and representing them	A learner can: • 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	*Can learners understand and identify with the context, formulate / pose the problem clearly and distinguish between relevant and irrelevant information or data? Can they identify a problem that requires mathematics for its solution and choose appropriate information, techniques and strategies to apply in context?*
Analysing Processing and using the mathematics	A learner can: • 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	*Can learners apply their chosen strategies and techniques to tackle the problem checking for technical accuracy? Can they explore connections and links and try out different values and / or methods to see the effect on results?*
Interpreting Interpreting and communicating the results of the analysis	A learner can: • interpret results and solutions • draw conclusions in the 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	*Can learners make sense of the solutions in terms of the original context and use 'commonsense' to check that the solutions are reasonable? Can they respond to the original task in a presentational form and style that is suitable for the context making sure that conclusions are clearly stated?*

Level Differentiation

At all levels learners need to be given the opportunity to

- state the purpose of their activity
- say how they intend to approach the activity including stating the mathematical methods they will use
- select and obtain the appropriate mathematical information
- use the information to make suitable calculations
- check the results of calculations and the methods used
- present results and conclusions in writing with supporting graphs, charts or diagrams as appropriate
- relate the results to the stated purpose

There are fours factors that contribute to the demand of any assessment:
Complexity, familiarity, technical demand and independence. The design of an assessment task needs to give learners the opportunity to represent, analyse and interpret within an appropriate level of demand. Typical descriptions of the **levels of demand** are:

Entry:

The learner can apply mathematics in **contexts** which are likely to be **very familiar,** and **accessible** either because of their familiarity, or because they are not complex. Any **mathematics** used by the learner **is specific to the situation** and **simple, clear and routine**. The learner will receive **some guidance and direction,** possibly on how to approach the situation or on which mathematics to apply. **Solutions should be explained** concerning their reasonableness given the initial problem and context.

Level 1:

The learner can apply mathematics in **contexts** which are **accessible** but **not necessarily very familiar**, or which may be **familiar but with some complexity**. There will be some **non-routine aspects** to the situation. The learner will receive **some guidance,** possibly on how to approach the situation, but will need to **decide** which mathematical techniques to apply, which models to select, or how to adapt these. **Checking procedures will be accurately and appropriately used**. **The solution will be accurate** for the problem and will be effectively communicated.

Level 2:

The learner can apply mathematics in **novel and/or unfamiliar contexts** and there may be some **non-routine mathematical aspects.** The learner will **make independent choices** as to what mathematical techniques and models to use and **evaluate** these, though **may receive some guidance**, e.g. with regard to possible options or models. The response to the problem **may involve several connected steps**. The learner will **try out different values or methods and evaluate the effect** on their results. Appropriate **checking strategies will be accurately and effectively** used at each stage. The learner can **justify the choices made** and the **accuracy and appropriateness of the solution** given the context of the initial problem and the intended audience.

Performance at Particular Levels

The tables below show how the performance statements relate to the process skills and factors that contribute to the level of demand.

Entry 3

	Represent	Analyse	Interpret
Complexity	Understand practical problems in accessible contexts and situations		
Familiarity	Understand practical problems in accessible contexts and situations		Interpret and communicate solutions to practical problems in familiar contexts and situations
Technical Demand	Select mathematics to obtain answers to simple given practical problems that are clear and routine	Apply mathematics to obtain answers to simple given practical problems that are clear and routine Use simple checking procedures	Interpret and communicate solutions to practical problems in familiar contexts and situations
Independence	Select mathematics to obtain answers to simple given practical problems that are clear and routine	Begin to develop own strategies for solving simple problems Select and apply mathematics to obtain answers to simple given practical problems that are clear and routine	Interpret and communicate solutions to practical problems in familiar contexts and situations

Level 1

	Represent	Analyse	Interpret
Complexity	Understand practical problems some of which are non-routine Identify and obtain necessary information to tackle the problem		
Familiarity	Understand practical problems in familiar and unfamiliar contexts and situations		
Technical Demand	Select mathematics in an organised way to find solutions to practical problems for different purposes Identify and obtain necessary information to tackle the problem	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

Independence	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	Interpret and communicate solutions to practical problems, drawing simple conclusions and giving explanations

Level 2

	Represent	Analyse	Interpret
Complexity	Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations		
Familiarity	Understand routine and non-routine problems in a wide range of familiar and unfamiliar contexts and situations		Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations
Technical Demand	Identify the situation or problem and the mathematical methods needed to tackle it Select a range of mathematics to find solutions	Apply a range of mathematics to find solutions Use appropriate checking procedures and evaluate their effectiveness at each stage	Use appropriate checking procedures and evaluate their effectiveness at each stage Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations Draw conclusions and provide mathematical justifications
Independence	Identify the situation or problem and the mathematical methods needed to tackle it Select a range of mathematics to find solutions	Apply a range of mathematics to find solutions Use appropriate checking procedures and evaluate their effectiveness at each stage	Use appropriate checking procedures and evaluate their effectiveness at each stage Interpret and communicate solutions to practical problems in familiar and unfamiliar routine contexts and situations Draw conclusions and provide mathematical justifications

Coverage/Range

The content and skills are intended to be indicative they are drawn from the National Curriculum, the Adult Numeracy standards and the Application of Number key skill. The content is amplified in appendices 3 to 5.

	National Curriculum	Adult Numeracy	Application of Number
Entry 3	Levels 1-3	Entry 3	
Level 1	Levels 1-4	Level 1	Level 1
Level 2	Levels 1-6	Level 2	Level 2

Appendix 1A: Amplification of the Functional Mathematics Process Skills

This amplification is intended to help those who design assessment items to understand the Functional Mathematics Process Skills. Examples are given in the context of the 'Airport Schedule' task.
The examples are not exclusive and learners might well address the key attributes in other ways.
The examples in the right hand column do not constitute a mark scheme.
The task is not presented in the way that it would be to learners.

This task is high on Complexity and Unfamiliarity but low on Technical Demand.

Task

Learners are given the times that various jobs take between when a plane lands and when it takes off.
For example it takes 25 minutes for the passengers to get off the plane; it takes 8 people 30 minutes to clean the plane and 40 minutes for 4 baggage handlers to unload the luggage …
Learners are asked to produce a report for the operations manager of the airline showing the shortest time to turn a plane round.

Representing Making sense of situations and representing them	
• Recognise that a situation has aspects that can be represented using mathematics	Recognise that the turn round time depends on the total time taken to complete a series of separate tasks some of which can take place at the same time.
• Make an initial model of a situation using suitable forms of representation	Organise the data using, for example, a table, a time line, a flow chart, etc.
• Decide on the methods, operations and tools, including ICT, to use in a situation	Order and group tasks, decide to add up times.
• Select the mathematical information to use	

	Decide which tasks need to be completed first and the relevant times (ignore redundant information regarding tasks that can happen at the same time).
Analysing Processing and using the mathematics • Use appropriate mathematical procedures • Examine patterns and relationships • Change values and assumptions to see the effects on answers in the model • Find results and solutions	 Add times together Relationships between tasks, pattern of order, concurrent tasks Consider the effects of – for example using more cleaners, using two exits for leaving the plane, more unloading time on long haul flights Work out the shortest time for the turn round
Interpreting Interpreting and communicating the results of the analysis • Interpret results and solutions • Draw conclusions in the light of the situation • Consider the appropriateness and accuracy of the results and conclusions • Choose appropriate language and forms of the presentation to communicate results and conclusions	 Identify the minimum time to turn round the plane and therefore a realistic period to allow before take off time Suggest alternatives for shortening turn round time, and consider the consequences of – for example - increasing cleaning time. Is the turn round time realistic? Check on the reasonableness of the calculations Present the findings in an appropriate way for the report to the operations manager using tables, diagrams and giving alternatives.

Appendix 1B: Amplification of the Functional Mathematics Process Skills

This amplification is intended to help those who design assessment items to understand the Functional Mathematics Process Skills. Examples are given in the context of the 'Pop concert' task.
The examples are not exclusive and candidates might well address the key attributes in other ways.
The examples in the right hand column do not constitute a mark scheme.

Task

You are a member of a group that is organising a charity pop concert at the local football ground.
Your role is to investigate how many people can be accommodated on the pitch and make recommendations to the group.

Representing Making sense of situations and representing them • 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	Understand that, to achieve a degree of accuracy in numbers, the problem has to be tackled using mathematics rather than by guesswork Decide to use a square for the ground space each individual needs Decide to find out how many squares would fit on the pitch. This could be done diagrammatically or by dividing the area of the football pitch by the area of the square. Uses the dimensions of the football pitch and an appropriate individual square
Analysing Processing and using the mathematics	

• Use appropriate mathematical procedures	Successful estimate of the number of people that can fit in the available space
• Examine patterns and relationships	Explores the relationship between the number of people and the dimensions/area of the pitch and the amount of space allowed per person.
• Change values and assumptions to see the effects on answers in the model	Varies the dimensions of the ground space allocated to each individual and considers the effects of more/less space on the number of people able to attend. Decides to take into account space for aisles.
• Find results and solutions	Completes the calculations, giving answers to an appropriate level of accuracy
Interpreting Interpreting and communicating the results of the analysis	
• Interpret results and solutions	State how many people can be accommodated, rounding the number in an appropriate way
• Draw conclusions in the light of the situation	Recommend the number that can be accommodated, stating assumptions clearly.
• Consider the appropriateness and accuracy of the results and conclusions	Comment on the accuracy and validity of their solution.
• Choose appropriate language and forms of the presentation to communicate results and conclusions	Presents the solution in an appropriate style/format for the organising group.

Appendix 1C: Entry 3 Coverage and Range- Amplification

Understand and use whole numbers to 1000

- count, read, write, order and compare numbers to 1000
- understand that the position of a digit signifies its value including the use of zero as a place holder e.g. make the biggest even number, lowest odd number from the digits 5,7 and 8.
- count on or back in 10s, 100s starting from any two or three digit number up to 1000

Complete written calculations with two digit numbers

- standard column methods are **not** required
- use a calculator efficiently

Add and subtract using three digit numbers

- understand there are different strategies for adding and subtracting e.g. 26+19 = 26+20-1= 45
- know how to partition numbers e.g. 32+127+6 = 100+30+20+2+7+6

Solve whole number problems involving multiplication and division

- multiply or divide two-digit whole numbers by single digit whole numbers
- understand division as repeated subtraction and the inverse of multiplication e.g. use multiplication to check 125 divided by 5
- understand that division is not commutative i.e. 8 divided by 4 is not the same as 4 divided by 8
- interpret situations where division doesn't give an exact answer remainder e.g. 5 people per taxi, 17 people, how many taxis?

Use mental recall of multiplication facts for 2, 3, 4, 5 and 10

- recognise two digit and three digit multiples of 2, 5 and 10 and three digit multiples of 50 and 100 e.g. count coins.
- understand how the distributive law can be used in multiplication e.g. 3x56 = 3(50+6)=3x50+3x6
- understand there are different strategies for multiplying e.g. to multiply by four, double and double again; to multiply by five, multiply by ten and halve

Round to the nearest 10 or 100

- understand place value for units, tens and hundreds e.g. A shop reports its sales to the nearest 10 items. One week the shop sells 167 magazines what number would this be reported as?
- round numbers less than 1000 to the nearest 10 and 100
- estimate answers to calculations using rounding
- round sums of money e.g. £1.99 to £2

Understand and use simple fractions

- read and write common fractions e.g. halves, quarters, thirds, tenths
- understand what the top and bottom numbers represent
- understand that a unit fraction is one part of a whole divided into equal parts e.g. 1/3, 1/10
- understand that non-unit fractions are several equal parts of a whole e.g. ¾ represents three parts of something that has been divided into four equal parts (1/4+1/4+1/4).
- understand that equivalent fractions look different but have the same value
- recognise and use equivalence e.g. 2/4= 5/10 = ½, 6/6 = 1.

Understand decimals to two decimal places in practical contexts

- understand common measures to one decimal place - 1.5 metres; money to two decimal places - £2.37
- understand the decimal point separates pounds and pence, m and cm
- understand how zero as a place holder, £1.05 and as leading zero, £0.35 and 0.5m

Recognise number patterns

- describe a number pattern, e.g. goes up by 3 each time; doubles
- identify multiples of 2, 5, 10 in a number square
- recognise number patterns e.g. extend sequences such as 50, 55, 60, 65, …
- recognise odd and even numbers up to 1000 e.g. 754, 247

Understand, estimate, measure and compare length, capacity, weight and temperature

- choose and use appropriate units and measuring instruments
- read scales to the nearest labelled and unlabelled division on measuring instruments
- distance - know the units miles and kilometres
- length – know that 10mm = 1cm, 100cm=1m, 1000m = 1 km
- capacity – know that 1000ml = 1 litre
- weight – know that 1000g = 1kg
- temperature – read a thermometer, understand that temperature can be measured Celsius and Fahrenheit

Complete simple mental calculations involving money and measures

Recognise, name and draw simple 2D and 3D shapes

- 2D shapes e.g. triangle, rectangle (including square), circle
  3D shapes e.g. cylinder (cans), cuboid (boxes), cube.
- identify right angles in 2D shapes and in the environment

Use metric and imperial units in everyday situations

- length, weight, capacity

Extract and use information from lists, tables, simple charts and simple graphs and make comparisons of this information

- understand title, labels, axis, scale, key
- use a scale to extract numerical values
- use a bar chart to make comparisons
- understand that an icon in a pictogram may have a value of more than one
- make observations and record numerical information using a tally chart
- understand simple pie charts e.g. 2, 3 or 4 segments.

Check accuracy of calculations and results

- add in a different order,
- use inverses,
- estimate answers by rounding e.g. £1.99 to £2.

Present findings to make sense to others

- know how to use a simple scale to represent data
- present results in a table or chart
- label diagrams and charts

Appendix 1D: Level 1 Coverage and Range- Amplification

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 e.g. nearest ten.
- recognise and use numerical relationships e.g. 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 2 decimal places e.g. 3 divided by 100.

Understand and use equivalencies 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

- e.g. in the context of money and measure e.g. £3.27+ £5.67, 3.56m+7.86m

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

- understand simple ratio as the number of parts e.g. 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 e.g. 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

- e.g. To cook a chicken takes 40 minutes per kilogram plus 20 minutes. How long will it take 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 the units of time – century, year, month, week, day, hour, minute, second: calculate using time by adding and 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

- e.g. 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

- 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 e.g. net of a cuboid.
- know that angles are measured in degrees, a right angle is 90^0 and four right angles fit around a point, an obtuse angle is greater than 90 degrees, an acute angle less than 90 degrees.
- Draw lines of symmetry on a shape.

Extract and interpret information from lists, 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 e.g. to find distances on a map
- know how to obtain information, from tables such as a timetable or pricelist, charts such as 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 e.g. 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 e.g. salaries
- calculate the mean by summing all the values then dividing by the number of items e.g. temperature, prices, time.
- understand that the range measures the spread of a set of data e.g. 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 e.g. gender of a baby.
- understand that some events can happen in more than one way e.g. 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

Appendix 1E: Level 2 Coverage and Range- Amplification

Understand and use positive and negative numbers 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 and 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 e.g. approximate calculation, estimation
- give the level of accuracy of results e.g. nearest pound, nearest hundredth, in the context of money 12.458 on the calculator means £12.46

Understand, use and calculate ratio and proportion, including 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 e.g. 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 three times its width, the stockroom is about two thirds full

Understand and use equivalencies 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 e.g. 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 and subtract fractions; add, subtract, multiply and divide decimals and percentages

- 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 e.g. a bill for £32.67 shared equally among 3 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 (i.e. numbers) **not** things ie 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 e.g. in maps and plans
- solve problems involving 2D shapes and parallel lines e.g. in laying carpet tiles

Find area, perimeter and volume of common shapes

- know what is meant by perimeter, circumference, diameter, radius
- understand and use given formulae for finding perimeters and areas of common and composite shapes, circumference and area of circular surfaces e.g. 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 e.g. cuboid or cylinder
- know that measurements must be in the same units when calculating perimeters, areas or volumes

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

- calculate with sums of money and 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 e.g. sec., min., hour, day, week, month, year
- estimate, measure and compare length, distance, weight, capacity and temperature, including reading Celsius and Fahrenheit scales and conversion tables
- know common imperial units e.g. yard, feet, inch, mile, ton, pound, ounce, pint, gallon and metric measures e.g.. mm., cm., m., km., mg., g., kg., tonne, ml., litre
- use mixed units of measure within the same system e.g. m. and cm. and give 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 2 lbs, I lb is approximately 450 grams, 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 2.5 cm, a foot is about 30cm, 5 miles is about 8km

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

- get relevant information from different sources e.g. 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, 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 and interpret discrete and continuous data, using ICT where appropriate, statistical measures, tables and diagrams

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 e.g. the probability of choosing a red card from a pack of cards is 26/52=1/2, a club 13/52=1/4 and an ace 4/52=1/13.
- identify the range of possible outcomes of combined events and record the information in tree diagrams or tables e.g. One bag of 10 balls contains 6 red balls. A spinner divided into five equal sections has 2 red sections. In which situation is red most likely?

Appendix 2

OCR Level 1 Mark Scheme

Functional Mathematics Level 1

Each criterion will have a maximum of 2 marks making the question total 16

	Represent	Analyse	Interpret
Complexity	**Identify and obtain necessary information to tackle the problem**		
Familiarity	**Understand practical problems in familiar and unfamiliar contexts and situations**		
Technical Demand	**Select mathematics to find solutions to practical problems for different purposes**	**Apply mathematics in an organised way to find solutions to practical problems for different purposes**	**Draw simple conclusions**
Independence	**Make an initial model and decide how to apply methods in an organised way**	**Examine patterns and relationships as values are changed**	**Interpret and communicate solutions to practical problems, giving explanations**

OCR Level 2 Mark Scheme

Functional Mathematics Level 2

Each criterion will have a maximum of 2 marks making the question total 18

	Represent	Analyse	Interpret
Complexity	**Identify with the context. Clearly distinguish between irrelevant and relevant information and data.**		
Familiarity	**Recognise that an unfamiliar situation/practical problem has aspects that can be represented using previously encountered mathematics**		**Interpret and communicate solutions to practical problems in familiar and unfamiliar contexts**
Technical Demand	**Decide on the method/ operation and tools including ICT where appropriate to use in a situation**	**Apply appropriate mathematical procedures and strategies to examine patterns and relationships.**	**Draw conclusions and provide mathematical justifications, and find and check results and conclusions**
Independence	**Making and refining a model/models and explain/justify methods chosen.**	**Changing values and assumptions etc, to investigate their effects on the model/models**	**Draw conclusions and consider the appropriateness and accuracy of the results and conclusions**

Appendix 3

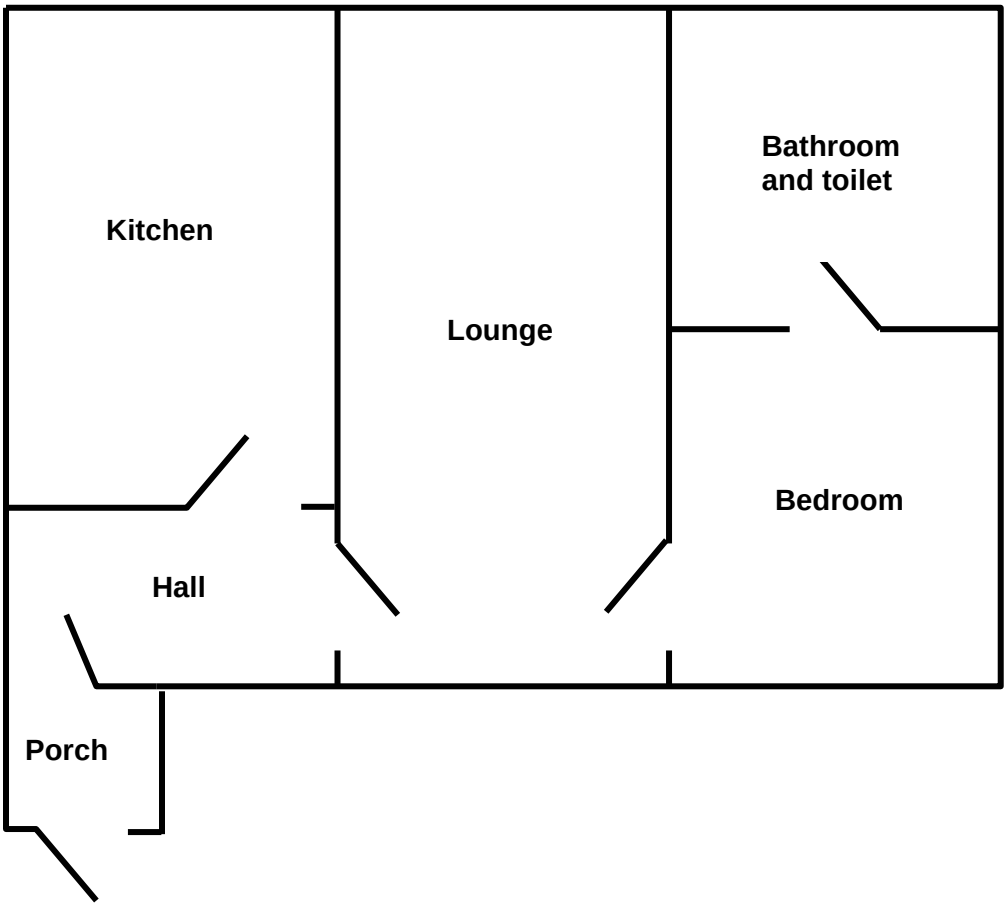
Exemplar Tasks and Mark Schemes

Level 1 Exemplar Task

Planning sheet
Any work on this sheet will not be directly marked, but may be used to contribute to the examiner's understanding of your answer.

Level 1 Task

When Emma goes to college, she is going to live in a student flat.
This is the floor plan of the flat.



Floor plan
NOT TO SCALE

- **Each room and the porch have a centre light.**
- **There are two table lamps in the lounge and two bedside lights in the bedroom.**
- **All the bulbs in the flat are conventional light bulbs.**

Emma plans to replace the conventional light bulbs with energy saving bulbs.

(a) Use the table to make a list of conventional bulbs that Emma needs for her flat.

Conventional bulb (Watts)	General use
40	Child's bedside light that might be left on at night.
60	Bedside reading light, wall light.
100	Table lamp, centre light
150	Large standard lamp.

[2]

This table shows the energy saving bulbs that can be used to replace conventional bulbs.

Conventional bulb (Watts)	Energy saving bulb (Watts)
40	10
60	15 - 18
100	20 - 25
150	32

(b) List the energy saving bulbs that Emma needs to replace her conventional bulbs.

[2]

(c) Emma thinks that she can save over 700W of power by replacing the conventional bulbs with energy saving bulbs. Is she right?

[12]

Credit will be given for well organised work, where you make clear the method and calculations you have used in your answers.

Level 1 Exemplar Task - Mark Scheme

Functional Skills Mathematics Level 1 Mark Scheme for Light bulb Task

Structure
Number of lamps
Type of lamps
Energy used
Replacements
Energy used by replacements
Energy saved

Calculations	
8 x 100 + 2 x 60 = 920 8 x 25 + 2 x 15 = 230 920 - 230 = 690	100 → 25 = 75 60 → 15 = 45 8 x 75 + 2 x 45 = 690

Mark	Evidence	Aspect	Standard	
2	8, 100W & 2, 60W	C	R	**Identify and obtain necessary information to tackle the problem**
1	Any 10 bulbs.			
2	Replaces "their" conventional bulbs listed in part (a) with the lowest, equivalent energy saving bulbs from the table.	F	R	**Understand practical problems in familiar and unfamiliar contexts and situations**
1	Shows the same number of bulbs as part (a) but not all wattage equivalences are correct.			
2	From (a) method involving number of bulbs x wattage	T	R	**Select mathematics in an organised way to find solutions to practical problems for different purposes**
1	A method of **totalling** the wattage from (a) or (b)			
2	Offers valid justifications for their choice of replacement values.	T	A	**Examine patterns and relationships as values are changed.**
1	Uses consistent replacement values without justification.			
2	"Correct" conclusion, compared with 700W, based on their value.	T	I	**Draw simple conclusions.**
1	"Correct" conclusion, compared with 700W, based on inappropriate replacements.			
2	Method involving **difference** between their total for conventional and their total for energy saving.	I	R	**Make an initial model and decide how to apply methods in an organised way**

1	Method that shows **difference** between conventional and energy saving for one or more bulbs but not total.			
2	Their method applied correctly Eg (8 x 100 + 2 x 60 – 8 x 20 – 2 x 15 = 730)	I	A	**Apply mathematics in an organised way to find solutions to practical problems for different purposes**
1	Correctly applies partial method OR applies full method with errors.			
2	Working clearly explained.	I	I	**Interpret and communicate solutions to practical problems, giving explanations**
1	Some annotations to working (such as headings)			
16	Total			

Level 1 Exemplar Task – Guidance

This will be available once the results of a small scale trial are available, in early October.

Level 2 Exemplar Task

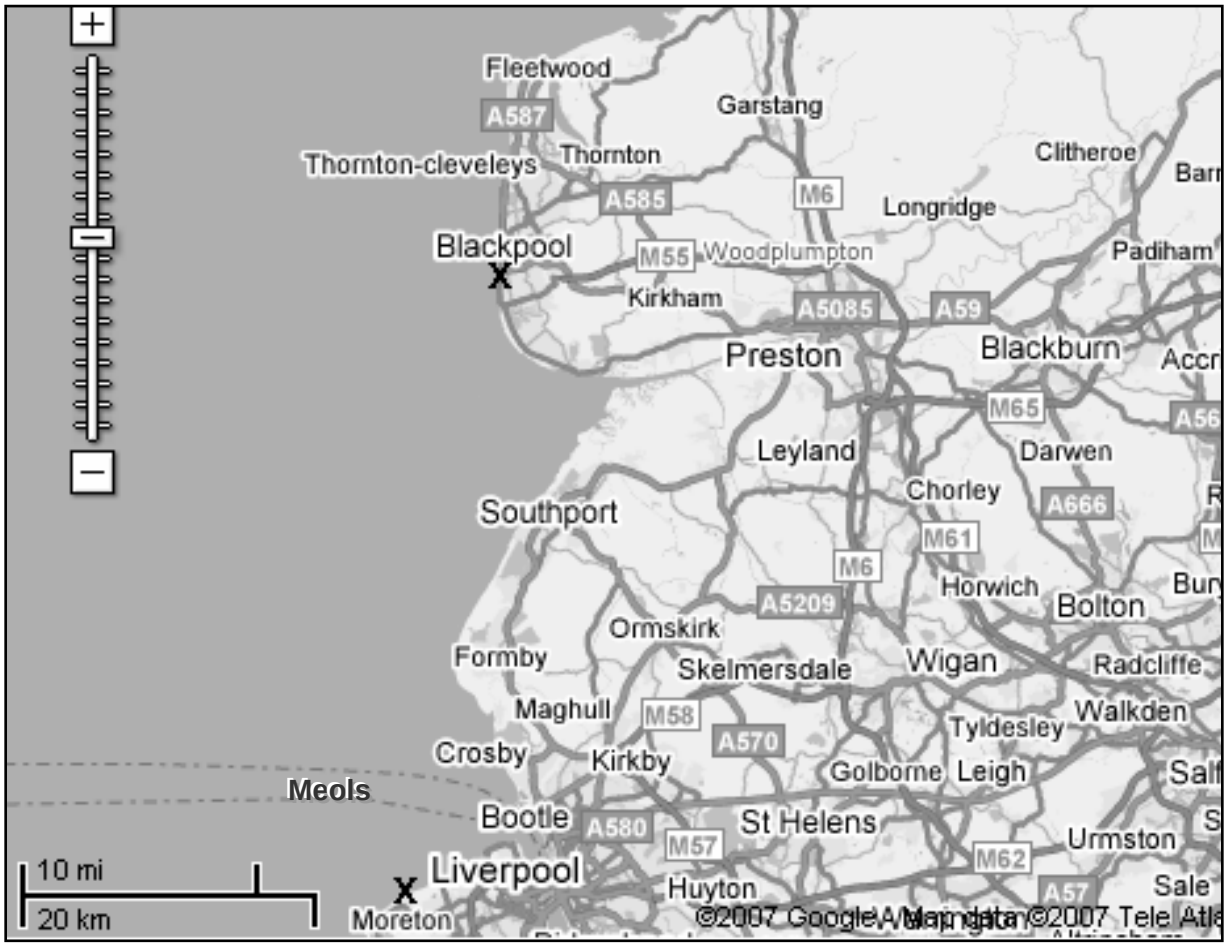
Planning sheet

Any work on this sheet will not be directly marked, but may be used to contribute to the examiner's understanding of your answer.

Blackpool Tower

Amy lives on the coast in Meols. Meols is south of Blackpool and just west of Liverpool.

She says she can just see Blackpool Tower from the beach.



Blackpool Tower

It was originally called the “Blackpool Eiffel Tower”.

The Tower cost £42 000 to build and was opened on 14th May 1894.

It is about 519 feet tall.

Some handy conversions

A kilogram is a bit more than 2 pounds

A pound is approximately 450 grams

A metre is a bit more than a yard (which is 3 foot).

An inch is about 2.5 cm

A foot is about 30 cm

5 miles is about 8 km

A litre is less than 2 pints.

A gallon is 8 pints.

A gallon is about 4.5 litres.

How tall, how far away?

This tells you how far away a tall building can be seen.

(1) First find the square root of the building’s height in metres.

(2) Multiply this answer by 3.5

(3) Now add 5.

The final answer is how far away the building can be seen in kilometres.

For example, a 36 m tall building can be seen from a distance of

(6 x 3.5) + 5 = 26 km

(note: the square root of 36 is 6)

Use the map and the other information to investigate Amy’s claim that she can see Blackpool Tower from the beach at Meols.

[18]

Credit will be given for well organised work, where you make clear the method and calculations you have used in your answers.

Level 2 Exemplar Task - Mark Scheme

Functional Skills Mathematics Level 2 Mark Scheme for Blackpool Task

Process	Award	on evidence of …	Specification Criteria
[A] Finding true distance from Meols to Blackpool	**1**	Attempts measurement of distance on map - .a value recorded	Decide on the method/ operation and tools including ICT where appropriate to use in a situation RT
	2	measurement of 8 to 9 (cm) or 80 to 90 (mm) seen	
Changes scale into "usable" form	**1**	Attempts to use scale	Decide on the method/ operation and tools including ICT where appropriate to use in a situation RT
	2	Recognises that 4cm = 20km so 1 cm = 5 km	
Uses scale to convert to km	**1**	For "number" x 5 seen and/or their measurement converted to km	Apply appropriate mathematical procedures and strategies to examine patterns and relationships. AT
	2	Correct answer 40 to 45 (km) seen	
Evidence of checking distance	**1**	No obvious mistakes in measurement etc – ie measures in cm and converts from cm	Draw conclusions and provide mathematical justifications, and find and check results and conclusions IT
	2	Appreciation/evidence that distance calculated is reasonable	
[B] Converting height of Tower into metres	**1**	Attempts conversion e.g. 519 x 30 ÷100 seen	Identify with the context. Clearly distinguish between irrelevant and relevant information and data. RC
	2	155.7m or 156m seen	

Use of word formula	**1** **2**	Attempts to find square root i.e. $\sqrt{\text{"their height"}}$ seen but not correct $\sqrt{\text{"their height"}}$ correct	Apply appropriate mathematical procedures and strategies to examine patterns and relationships. AT
	1 **2**	Attempts to deal with constants in formula i.e. $\sqrt{\text{"their height"}}$ x 3.5 + 5 51 km (1 for just 51)	Apply appropriate mathematical procedures and strategies to examine patterns and relationships. AT
Evidence of checking	**1** **2**	No obvious mistakes etc – x 3.5 then + 3 Appreciation/evidence that distance calculated is reasonable	Draw conclusions and provide mathematical justifications, and find and check results and conclusions IT
[C] Comparison of their answer with Amy's	**1** **2**	Evidence of checking their answer to [B] – the formula with their answer to [A] – the map distance. Correct statement made consistent with their answers to [A] and [B]	Interpret and communicate solutions to practical problems in familiar and unfamiliar contexts IF
Marks awarded to part (a)	**18**	**R = 6, A = 6, I = 6**	

Level 2 Exemplar Task – Guidance

This will be available once the results of a small scale trial are available in early October.