AQA Guidance

Level 3 Mathematical Studies Assumed knowledge

MATHEMATICS

The assumed prior knowledge for AQA's Level 3 Mathematical Studies is all of the content in this booklet.

In addition to this content it is expected that students will:

- be familiar with the knowledge and use of the formula $y = mx + c$
- be able to find the gradient of a line connecting two different points
  be familiar with spreadsheet formulae, including:
  "=A1+A2+A3" to sum values in cells
  "=2*B3" to multiply a value in a given cell
  "=SUM(A1:A10)"

Version 1.0, June 2014

Basic foundation subject content

3.1 Number

3.1.1 Structure and calculation

N1

order positive and negative integers, decimals and fractions

use the symbols =, ≠, <, >, ≤, ≥

Notes: including use of a number line.

N2

apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers – all both positive and negative

understand and use place value (eg when working with very large or very small numbers, and when calculating with decimals)

Notes: including questions set in context. Knowledge of terms used in household finance, for example profit, loss, cost price, selling price, debit, credit and balance, income tax, VAT, interest rate.

N3

recognise and use relationships between operations, including inverse operations (eg cancellation to simplify calculations and expressions)

use conventional notation for priority of operations, including brackets, powers, roots and reciprocals

N4

use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation theorem

Notes: prime factor decomposition including product of prime factors written in index form.

N5

apply systematic listing strategies

Notes: including using lists, tables and diagrams.

N6

use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5

Notes: including square numbers up to 15×15 Students should know that $1000 = 10^3$ and 1 million = 10^6

N8

calculate exactly with fractions

N9

calculate with and interpret standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer

Notes: with and without a calculator. Interpret calculator displays.

3.1.2 Fractions, decimals and percentages

N10

work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and $\frac{7}{2}$ or 0.375 and $\frac{3}{8}$)

Notes: including ordering.

N11

identify and work with fractions in ratio problems

N12

interpret fractions and percentages as operators

Notes: including interpreting percentage problems using a multiplier.

3.1.3 Measures and accuracy

N13

use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate

Notes: know and use metric conversion factors for length, area, volume and capacity.

Imperial / metric conversions will be given in the question.

N14

estimate answers

check calculations using approximation and estimation, including answers obtained using technology

Notes: including evaluation of results obtained.

N15

round numbers and measures to an appropriate degree of accuracy (eg to a specified number of decimal places or significant figures)

Notes: including appropriate rounding for questions set in context.

Students should know not to round values during intermediate steps of a calculation.

3.2 Algebra

3.2.1 Notation, vocabulary and manipulation

A1

use and interpret algebraic notation, including:

- ab in place of $a \times b$
- $3y$ in place of $y + y + y$ and $3 \times y$
- a^2 in place of $a \times a$, a^3 in place of $a \times a \times a$, a^2b in place of $a \times a \times b$
- $\frac{a}{b}$ in place of $a \div b$
- coefficients written as fractions rather than as decimals
- brackets

Notes: it is expected that answers are given in simplest form without an explicit instruction to do so.

A2

substitute numerical values into formulae and expressions, including scientific formulae

Notes: unfamiliar formulae will be given in the question.

A3

understand and use the concepts and vocabulary of expressions, equations, formulae, inequalities, terms and factors

Notes: this will be implicitly and explicitly assessed.

A4

simplify and manipulate algebraic expressions by:

- collecting like terms
- multiplying a single term over a bracket
- taking out common factors
- simplifying expressions involving sums, products and powers, including the laws of indices

A5

understand and use standard mathematical formulae

rearrange formulae to change the subject

Notes: including use of formulae from other subjects in words and using symbols.

A7

where appropriate, interpret simple expressions as functions with inputs and outputs

Notes: understanding and use of f(x), fg (x) and f $^{-1}(x)$ notation is expected at higher tier.

3.2.2 Graphs

A8

work with coordinates in all four quadrants

A9

plot graphs of equations that correspond to straight-line graphs in the coordinate plane

A10

identify and interpret gradients and intercepts of linear functions graphically and algebraically

A12

recognise, sketch and interpret graphs of linear functions and quadratic functions

A14

plot and interpret graphs, and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration

Notes: including problems requiring a graphical solution.

3.2.3 Solving equations and inequalities

A17

solve linear equations in one unknown algebraically

find approximate solutions using a graph

Notes: including use of brackets.

3.2.4 Sequences

A23

generate terms of a sequence from either a term-to-term or a position-to-term rule

Notes: including from patterns and diagrams.

A24

recognise and use sequences of triangular, square and cube numbers and simple arithmetic progressions

Notes: other recursive sequences will be defined in the question.

A25

deduce expressions to calculate the n^{th} term of linear sequences

3.3 Ratio, proportion and rates of change

R1

change freely between related standard units (eg time, length, area, volume/capacity, mass) and compound units (eg speed, rates of pay, prices), in numerical contexts

R2

use scale factors, scale diagrams and maps

Notes: including geometrical problems.

R3

express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1

R4

use ratio notation, including reduction to simplest form

R5

divide a given quantity into two parts in a given part : part or part : whole ratio

express the division of a quantity into two parts as a ratio

apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations)

Notes: including better value or best buy problems.

R6

express a multiplicative relationship between two quantities as a ratio or a fraction

R7

understand and use proportion as equality of ratios

R8

relate ratios to fractions and to linear functions

R9

define percentage as ‘number of parts per hundred’

interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively

express one quantity as a percentage of another

compare two quantities using percentages

work with percentages greater than 100%

solve problems involving percentage change, including percentage increase/decrease and original value problems, and simple interest including in financial mathematics

R10

solve problems involving direct and inverse proportion, including graphical and algebraic representations

R11

use compound units such as speed, rates of pay, unit pricing

Notes: including making comparisons.

R12

compare lengths, areas and volumes using ratio notation;

scale factors

3.4 Geometry and measures

3.4.1 Properties and constructions

G1

use conventional terms and notations: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries

use the standard conventions for labelling and referring to the sides and angles of triangles

draw diagrams from written description

G3

apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles

understand and use alternate and corresponding angles on parallel lines

derive and use the sum of angles in a triangle (eg to deduce and use the angle sum in any polygon, and to derive properties of regular polygons)

Notes: colloquial terms such as Z angles are not acceptable and should not be used.

G4

derive and apply the properties and definitions of: special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus

and triangles and other plane figures using appropriate language

Notes: including knowing names and properties of isosceles, equilateral, scalene, right-angled, acute-angled, obtuse-angled triangles. Including knowing names and using the polygons: pentagon, hexagon, octagon and decagon.

G7

identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement

G9

identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference

G11

solve geometrical problems on coordinate axes

G12

identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres

G13

interpret plans and elevations of 3D shapes

3.4.2 Mensuration and calculation

G14

use standard units of measure and related concepts (length, area, volume/capacity, mass, time, money, etc.)

G15

measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings

Notes: including the eight compass point bearings and three-figure bearings.

G16

know and apply formulae to calculate: area of triangles, parallelograms, trapezia;

volume of cuboids and other right prisms (including cylinders)

G17

know the formulae: circumference of a circle = $2\pi r = \pi d$, area of a circle = πr^2

calculate: perimeters of 2D shapes, including circles

areas of circles and composite shapes

Notes: including frustums.

Solutions in terms of π may be asked for.

3.4.3 Vectors

G24

describe translations as 2D vectors

3.5 Probability

P1

record, describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees

Notes: probabilities should be written as fractions, decimals or percentages.

P2

apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments

P3

relate relative expected frequencies to theoretical probability, using appropriate language and the 0 to 1 probability scale

P4

apply the property that the probabilities of an exhaustive set of outcomes sum to one

apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one

P6

enumerate sets and combinations of sets systematically, using tables, grids, Venn diagrams

P7

construct theoretical possibility spaces for single and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities

3.6 Statistics

S2

interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, and know their appropriate use

Notes: including choosing suitable statistical diagrams.

S4

interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:

- appropriate graphical representation involving discrete, continuous and grouped data
- appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers)

Notes: students should know and understand the terms primary data, secondary data, discrete data and continuous data.

S5

apply statistics to describe a population

S6

use and interpret scatter graphs of bivariate data

recognise correlation

Notes: students should know and understand the terms: positive correlation, negative correlation, no correlation, weak correlation and strong correlation.

SP/05/14