

Syllabus Mathematics Syllabus D 4024

Recommended Prior Knowledge

- A basic competence with number operations
- Familiarity with the ideas of using letters to represent unknown numbers
- Knowledge of the basic ideas of shape and measurement.
- Basic knowledge of Cartesian coordinates

Syllabuses such as CIE's checkpoint give a good foundation for O level. There is overlap with the easier topics in the O level syllabus for mathematics.

The mathematics curriculum has a spiral nature, where topics are often not 'stand alone' but make use of earlier knowledge. So it is recommended that prior to introducing each topic of work, the opportunity is taken to revise earlier work which will be used in that topic.

Depending on the level of competence shown by students at the start of the course, the first two units may take more or less time than the suggested time allocation shown.

General Resources

Websites

<http://www.m-a.org.uk> The Mathematical Association. Amongst other things on this website there are excellent links to other mathematical websites at <http://www.m-a.org.uk/links> and to resources <http://www.m-a.org.uk/links/resources>

<http://www.curriculumonline.gov.uk/Subjects/Ma/Subject.htm> has links to free and paid resources for individual lessons, groups of lessons etc.

<http://www.tre.ngfl.gov.uk/> Try searching under secondary, mathematics to find lesson plans etc on various topics that teachers have contributed to share with others.

<http://www.ngfl.gov.uk> Search under Site Map and then Learning resources.

<http://www.1000problems.com> The extension problems on this site are at a suitable level for O level students.

<http://www.mathsphere.co.uk> Most of the worksheets on this site are for younger students, but there are some activities which are suitable for O level.

<http://www.nrich.maths.org> contains puzzles, games and articles suitable for all ages. Visiting the home page at this web address to choose the best age group for your needs and then searching on Maths Finder is a good way to see the wealth of material available.

<http://www.ex.ac.uk/cimt/> is the website of Exeter University's Centre for Innovation in Mathematics Teaching. There are on-line versions of UK GCSE textbooks on this site at <http://www.ex.ac.uk/cimt/mepres/allgcse/allgcse.htm>. Many of these chapters contain useful material for the O level course. This CIMT website also has downloadable worksheets at <http://www.ex.ac.uk/trol/>. Some of them are at too low a level for O level but there are some useful worksheets, for example on mensuration.

<http://www.fsmq.org/resources/index.asp> is the Nuffield Foundation's website for Free-Standing Mathematics Qualifications at different levels. Some of the material is suitable for use for O level students, and contains teaching notes as well as activities <http://www.fsmq.org/resources/ww0000000134.asp> is a collection of a large number of data sites, with descriptions.

<http://www.bbc.co.uk/schools/gcsebitesize/maths> is a revision site for those studying GCSE maths, but does not cover higher level topics.

<http://www.bbc.co.uk/education/asguru/maths> is a revision site for the start of A level, and some of the material in the pure mathematics section is useful for harder topics in algebra for O level.

<http://www.statistics.gov.uk> is the national Statistics site in the UK. Other countries will also have their own statistics sites which can be used for data.

<http://www.worldbank.org/data> Here data can be found by country or by topic.

<http://www.odci.gov/cia/publications/factbook/index.html> A good source of facts about different countries for use in questions.

<http://www.censusatschool.ntu.ac.uk> A project collected data from students which the students could then use. Other countries have now joined the project. and this site holds the international data base, worksheets and suggested activities etc. For example, <http://worksheet.censusatschool.ntu.ac.uk/random2> gives the site for collecting random samples of real data from the project.

<http://science.ntu.ac.uk/rsscse> is the website of the Royal Statistical Society Centre for Statistical Education and contains much useful information.

<http://science.ntu.ac.uk/rsscse/pose/index.html> contains material which was published some while ago and is now out of print but contains many ideas and help on the teaching of statistics which is still relevant. <http://science.ntu.ac.uk/rsscse/ts> is the website for the journal *Teaching Statistics* and a compilation of articles 'The Best of Teaching Statistics' may be viewed here.

<http://www.learnacie.org.uk/> is a subscription service with plenty of resources for both students and teachers

http://teachers.cie.org.uk/teacher_support/o_level/o_level4024.htm The site where this scheme of work is published, and containing other resources too for O level mathematics.

Textbooks

The following books are suitable for use with this syllabus. Content of the books does not necessarily match the CIE syllabus closely and examples may be British in focus.

Excel in O Level Mathematics (Edition 1996). Publisher: EPB, Singapore

IGCSE Mathematics by Pimentel, R & Wall, T (Edition 1997)

ISBN: 0719574587

Publisher: John Murray, Hodder Murray, 338 Euston Road, London, NW1 3BH, United Kingdom www.johnmurray.co.uk

IGCSE Revision Guide for Mathematics by Wilde, E, Patmore, M, Handbury, M, Jeskins, J, Seager, B (Editor), Matthews, Jean and Baxter, H (Edition 2004)

ISBN: 0340815787

Publisher: Hodder & Stoughton, 338 Euston Road, London, NW1 3BH, United Kingdom www.hodderheadline.co.uk

IGCSE Mathematics by Morrison, Karen (Edition 2002)

ISBN: 0521011132

Publisher: Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge, CB2 2RU, United Kingdom
uk.cambridge.org/education/international/cie/

Mathematics Revision Guide: IGCSE by Law, Martin (Edition 2004)

ISBN: 0521539021

Publisher: Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge, CB2 2RU, United Kingdom
uk.cambridge.org/education/international/cie/

GCSE Mathematics for OCR Higher Text Book by Patmore, M, Handbury, M, Jeskins, J, Seager, B (Editor), Matthews, Jean and Baxter, H (Edition 2001)

ISBN: 0340758708

Publisher: Hodder & Stoughton, 338 Euston Road, London, NW1 3BH, United Kingdom www.hodderheadline.co.uk

GCSE Mathematics for OCR Higher Teacher's Guide by Patmore, M, Handbury, M, Jeskins, J, Seager, B (Editor), Matthews, Jean and Baker, H (Edition 2001)

ISBN: 0340758678

Publisher: Hodder & Stoughton, 338 Euston Road, London, NW1 3BH, United Kingdom www.hodderheadline.co.uk

A fuller list of text books, including more UK textbooks such as the last examples above, is available on the CIE website at

<http://www.cie.org.uk/CIE/WebSite/qualificationsandawardshub/qualificationhubs/generalqualsubject/resourcelist.jsp?oid=2889&typeoid=2247>

UNITS

The broad syllabus areas of Number, Algebra, Shape and Data have been used in each unit. The time allocation shown is approximate. In the early units in particular, the time spent will depend on the previous experience of the students.

unit	sub-unit	Title	syllabus references	Outline of content
1 10%	N1 4%	Integers	1, 4, 5, 9, 24,	Primes, common factors and common multiples, directed numbers, squares and cubes and other positive integer indices, square roots and cube roots, leading on to the ideas of rational and irrational numbers.
	A1 2%	Letters and numbers	22, 23, 25	Substitution of numbers into word and algebraic formulae. Basic algebraic simplifying. Solving simple equations.
	S1 3%	Measures	15, 16, 28	Using and reading protractors, scales, timetables. Calculate time in terms of the 12 hr and 24 hr clocks. Using current units of mass, length, area, volume, capacity and converting between them.
	D1 1%	Averages	35	Mean, median and mode for individual data, and the purposes for which they are used
2 10%	N2 4%	Fractions, decimals, percentages. Money problems and personal finance	6, 9, 13, 17, 18	Conversion between fractions, percentages and decimals. The four operations with fractions and decimals. Finding a percentage of a quantity. Percentage increase and decrease. Money problems, including currency conversion, and personal finance using these and more basic skills..
	A2 2%	Brackets with linear expressions	9, 23	Order of operations, multiplying out with brackets, extracting common factors, solving linear equations with brackets
	S2 3%	Lines and angles, triangles and quadrilaterals	27, 30, 31, 33	Using and interpreting geometrical terms concerned with these. Calculating unknown angles. Symmetry properties of isosceles and equilateral triangles and special quadrilaterals. Calculating area of triangles, rectangles, parallelograms, trapezia.
	D2 1%	Charts	35	Constructing and interpreting bar and pie charts and pictograms. Calculate the mean of a discrete frequency distribution
3	N3 1%	Ordering and estimation	7, 10, 14	Ordering quantities by magnitude, familiarity with symbols such as $>$. Estimating, checking, rounding.

10%	A3 4%	Graphs of straight lines. Simple algebraic fractions	20, 21, 23, 25	Drawing graphs of straight lines, calculating gradient, finding the equations of straight line graphs in the form $y = mx + c$. Manipulating algebraic fractions with numerical denominators and solving equations containing these. Constructing simple equations from given situations
	S3 4%	Geometrical constructions and scale drawings. Pythagoras' theorem.	28, 29, 12, 34, 21	Constructing simple geometrical figures from given data. Constructing angle bisectors and perpendicular bisectors. Making and interpreting scale drawings, including the use of bearings, using simple scales. Using Pythagoras' theorem to calculate unknown sides in right-angled triangles.
	D3 1%	Working with grouped data with equal intervals	35	Constructing and interpreting frequency polygons. Calculating the mean of a grouped frequency distribution with equal intervals and identifying the modal class
4 10%	N4 3%	Ratio and proportion, rate	12, 19	Elementary ideas of ratio and proportion. Dividing a quantity on a given ratio. Calculating average speed. Constructing and interpreting conversion and travel graphs. Application to scale drawing using harder scales.
	A4 3%	Inequalities and simultaneous equations, expanding $(ax + b)(cx + d)$	25, 23	Solving simple linear inequalities and solving simultaneous linear equations. Quadratic expansions
	S4 3%	Polygons and circles	27, 30, 31, 33	Names and symmetry properties of polygons. Calculating unknown angles and angle sums of polygons. Vocabulary and symmetry properties of circles. Calculating the circumference and area of a circle
	D4 1%	Probability	36	Elementary ideas of probability, leading to calculating the probability of a single event as a fraction or decimal.
5 10%	N5 1%	Calculations involving reverse percentages. Using a calculator efficiently. Indices.	13, 14, 24	eg finding the cost price given the selling price and the percentage profit. Efficient use of a calculator, including checks for accuracy. Using and interpreting negative and zero indices.
	A5 3%	Transforming simple formulae. Simple factorising of quadratics. Graphs of quadratic functions.	20, 12, 22, 23	Transforming simple formulae. Using algebra to express and solve problems for direct and inverse variation. Factorising quadratic expressions of type $x^2 + bx + c$. Drawing and interpreting the graphs of quadratic functions.
	S5 4%	Prisms. Transformations. Loci	27,30, 32, 33, 38, 39	Use and interpret the vocabulary and calculate the surface area and volume of, cuboids, cylinders and other prisms. Recognise symmetry properties of the prism (including cylinder). Basic ideas of transformations, including reflection, rotation, enlargement, translation, with reference to drawings and descriptions. Using column vectors to describe translations but no other reference to matrices. Interpreting loci in 2D and 3D. Construct loci accurately in 2D, including intersecting loci.
	R1 2%	----	----	This time may be used for revision and consolidation, halfway through the O level course.

6 10%	N6 1%	Standard form	8	Using the standard form $A \times 10^n$ where n is a positive or negative integer and $1 \leq A < 10$
	A6 3%	Solving quadratic equations by factorising Graphical representation of inequalities.	23, 25, 26	Further factorising of quadratics $ax^2 + bx + c$ with $a \neq 1$. Solution of quadratic equations by factorisation. Graphs of one or two inequalities, but not linear programming
	S6 4%	Trigonometry. Similarity and congruence	27,34	Finding unknown lengths and angles in right-angled triangles, including angles of elevation and depression and bearings. Solving problems and giving simple explanations involving similarity and congruence.
	D6 2%	Cumulative frequency	35	Construct and use cumulative frequency graphs. Estimate the median, percentiles, quartiles and inter-quartile range
7 10%	N7 1%	Sequences	1	Continuing sequences, recognising different patterns in and comparing sequences, generalising to find the n th term
	A7 3%	Solve quadratic equations which do not factorise. Fractional indices.	25, 24	Solving quadratic equations by the quadratic formula or completing the square. Using and interpreting fractional indices.
	S7 4%	Circle theorems, arcs and sectors.	31, 33	Using circle theorems to calculate unknown angles. Calculating arc length and sector area
	D7 2%	Probability of combined events	36	Calculating the probability of simple combined events using tree diagrams and possibility space diagrams where appropriate.
8 10%	N8 1%	Limits of accuracy	11	Giving appropriate upper and lower bounds of data and calculations using these, eg finding the upper and lower bound for area given lengths to a specified accuracy
	A8 4%	Graphs of cubic, reciprocal and exponential functions. Graphs in practical situations. Transforming more complicated formulae.	19, 20, 22	Constructing and interpreting graphs. Solving equations approximately by using graphical methods. Estimating the gradient of curves by drawing tangents, with application also to speed-time and distance-time graphs. Calculate distance travelled as area under a linear speed-time graph. Transforming formulae involving powers and roots or where the new subject appears more than once
	S8 4%	Pyramid, cone and sphere. Solving problems in 3D	30, 33, 34	Recognise symmetry properties of the pyramid (including cone). Calculating surface area and volume of cone, pyramid, sphere. Solving simple trigonometrical problems in 3D
	D8 1%	Working with grouped data with unequal intervals	35	Use frequency density to construct and interpret histograms. Calculating the mean of such distributions
9 10%	N9 1%	Set language	2	Using set language and notation and Venn diagrams to represent and describe sets
	A9 2%	Matrices	37	Display information in the form of a matrix of any order. Calculate sums and products of matrices where appropriate and interpret the results. Use the algebra of 2×2 matrices. Calculate the determinant and inverse of a non-singular matrix

	S9 4%	Sine and cosine rule. Vectors	34, 39	Extending sine and cosine functions to obtuse angles. Using the sine and cosine rules for any triangle and the formula $\frac{1}{2}ab \sin C$ for the area of a triangle. Vectors in 2D, including modulus of a vector, position vectors and sums and differences of vectors. Express given vectors in terms of two coplanar vectors
	R2 2%	----	----	This time may be used for revision
10	R3 1%	----	----	This time may be used for revision
10%	A10 3%	Functions. Algebraic fractions with variables in the denominator	3, 23	Using function notation. Finding the inverses of functions. Manipulating algebraic fractions with variables in the denominator and solving equations involving them.
	S10 3%	Transformations using matrices	38	Use combinations of transformations, including shears and stretches as well as reflection, rotation, enlargement, translation. Describe transformations using coordinates and matrices
	R4 3%	----	----	This time may be used for revision

TEACHING ORDER

The early units contain the basics of each of the main syllabus areas, and should be done first. There is also progression in general through the units, with later topics such as S8 and S9 building on work done in S6, for example. Making use of the spiral nature of the mathematics curriculum in this way enables re-visiting of the easier topics at intervals, which reminds students of them and aids confidence amongst students. For teachers who prefer to do so, it is of course possible to work on one subject area for longer at a time. For instance, N1, N2, A1 and A2 could be used first, before S1 and D1.

The scheme of work for the individual units gives in detail which units must be covered prior to the one concerned.