Revision Checklist for O-Level Mathematics 4024

Guide for Students

UNIVERSITY of CAMBRIDGE
International Examinations

REVISION CHECKLIST for O level Mathematics 4024

A guide for students

How to use this guide
This guide has the following sections:

Section 1 - How will you be tested?
This tells you about the structure of the examination

Section 2 - What will be tested?
This tells you the skills you need to develop during the course

Section 3 - What you need to know
This tells you the syllabus content on which you will be tested

You can use this checklist throughout the course, as a guide to how much you have learned and how much syllabus remains to learn.

You can also use it as a checklist during revision, so that you know exactly what to revise and can check off when you are confident with it.

Remember that you can ask your teacher for more details if you need them.

Section 1 - How will you be tested?

Your teacher may give you tests to help you learn during the course, but these do not count towards your O level in mathematics.

This O level qualification in mathematics is gained by taking two examination papers at the end of your course. Each of these counts 50% towards the qualification.

Paper 1
Has about 25 short questions in it, so it tests many topics.

- You answer on the question paper
- You are not allowed to use a calculator in paper 1
- This paper has 80 marks and lasts for 2 hours

Paper 2
Has 11 longer questions. You have to do 10 of them.

- In section A, you have to do all of the 6 questions
- In section B, there is a choice – you have to do 4 of the 5 questions, so you can choose which question to leave out
- You answer this paper on lined answer paper, with graph questions done on graph paper
- You need a calculator (or logarithm tables) for paper 2
- This paper has 100 marks and lasts for 2 ½ hours

Section 2 - What will be tested?

Any of the material in the syllabus can be tested on either paper. Between them, they aim to cover as much of the syllabus as possible. The 'What you need to know' section of this guide gives the content in detail

Skills that you will need to demonstrate while answering the questions include

- recognising what mathematics it is appropriate to use in a situation
- using suitable methods to calculate, with and without a calculator
- estimating, rounding and giving answers to appropriate accuracy
- using the common systems of units
- interpreting and drawing graphs
- using ruler, compasses and protractor
- recognising and applying spatial relationships
- understanding and using mathematical language and symbols
- presenting your working and solutions to problems logically and clearly
- recognising patterns and justifying generalisations
- applying and interpreting mathematics in a variety of situations, including daily life
- using mathematics to solve problems

Your teacher will be able to provide you with more detail and information about these skills. You will be developing the skills throughout the course for O level.

Section 3 - What you need to know

The syllabus content is divided into 39 main sections. The table that follows gives the detailed breakdown of these sections. The order in the table is the order in the syllabus. It doesn't tell you what order you will study them in or how much time each topic takes to learn.

You can use the checkboxes during the course as you study each topic, or during revision near the end of your course. If you tick in pencil when you learn a topic and in pen when you revise it, you can use the same copy for both purposes!

You can use the comments column

- to add further information about the details for each bullet point
- to note relevant page numbers from your text book
- to add learning aids
- to highlight areas of difficulty/things which you need to ask your teacher about

Mathematics is much more about applying your skills than it is about learning formulae. So try to do enough practice in answering questions on each topic so that you are confident in using your skills.

	Topic	Detail	Check	Comments
1	**Number**	• use natural numbers, integers (positive, negative and zero) • use prime numbers, common factors and common multiples • use rational and irrational numbers, real numbers • continue given number sequences • recognise patterns within and across different sequences and generalise to simple algebraic statements (including expressions for the nth term) relating to such sequences	☐ ☐ ☐ ☐ ☐	
2	**Set language and notation**	• use set language and set notation, and Venn diagrams, to describe sets and represent relationships between sets as follows: Definition of sets, e.g. $A = \{x : x \text{ is a natural number}\}$ $B = \{(x, y): y = mx + c\}$ $C = \{x : a \leq x \leq b\}$ $D = \{a, b, c... \}$ Notation: Union of A and B — $A \cup B$ Intersection of A and B — $A \cap B$ Number of elements in set A — n(A) ". . . is an element of . . ." — $\in$ ". . . is not an element of . . ." — $\notin$ Complement of set A — A' The empty set — $\emptyset$ Universal set — ξ A is a subset of B — $A \subseteq B$ A is a proper subset of B — $A \subset B$ A is not a subset of B — $A \not\subseteq B$ A is not a proper subset of B — $A \not\subset B$	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	

3	**Function notation**	• use function notation, e.g. f(x) = $3x - 5$, f: $x \mapsto 3x - 5$ to describe simple functions, and the notation $f^{-1}(x) = \frac{x+5}{3}$, $f^{-1} : x \mapsto \frac{x+5}{3}$ to describe their inverses	☐ ☐	
4	**Squares, square roots, cubes and cube roots**	• calculate squares, square roots, cubes and cube roots of numbers	☐	
5	**Directed numbers**	• use directed numbers in practical situations (e.g. temperature change, tide levels)	☐	
6	**Vulgar and decimal fractions and percentages**	• use the language and notation of simple vulgar and decimal fractions and percentages in appropriate contexts • recognise equivalence and convert between these forms	☐ ☐	
7	**Ordering**	• order quantities by magnitude and demonstrate familiarity with the symbols =, ≠, >, <, ≤, ≥.	☐	
8	**Standard form**	• use the standard form $A \times 10^n$ where n is a positive or negative integer, and $1 \leq A < 10$	☐	
9	**The four operations**	• use the four operations for calculations with o whole numbers, o decimal fractions o vulgar (and mixed) fractions • correct ordering of operations and use of brackets	☐ ☐ ☐ ☐	
10	**Estimation**	• make estimates of numbers, quantities and lengths • give approximations to specified numbers of significant figures and decimal places	☐ ☐	

		• round off answers to reasonable accuracy in the context of a given problem	☐	
11	**Limits of accuracy**	• give appropriate upper and lower bounds for data given to a specified accuracy (e.g. measured lengths) • obtain appropriate upper and lower bounds to solutions of simple problems (e.g. the calculation of the perimeter or the area of a rectangle) given data to a specified accuracy	☐ ☐	
12	**Ratio, proportion, rate**	• demonstrate an understanding of the elementary ideas and notation of ratio, direct and inverse proportion and common measures of rate • divide a quantity in a given ratio • use scales in practical situations • calculate average speed • express direct and inverse variation in algebraic terms and use this form of expression to find unknown quantities	☐ ☐ ☐ ☐ ☐	
13	**Percentages**	• calculate a given percentage of a quantity • express one quantity as a percentage of another • calculate percentage increase or decrease • carry out calculations involving reverse percentages, e.g. finding the cost price given the selling price and the percentage profit	☐ ☐ ☐ ☐	
14	**Use of an electronic calculator or logarithm tables**	• use an electronic calculator or logarithm tables efficiently • apply appropriate checks of accuracy	☐ ☐	

15	**Measures**	• use current units of mass, length, area, volume and capacity in practical situations • express quantities in terms of larger or smaller units	□ □	
16	**Time**	• calculate times in terms of the 12-hour and 24-hour clock • read clocks, dials and timetables	□ □	
17	**Money**	• solve problems involving money • convert from one currency to another	□ □	
18	**Personal and household finance**	• use given data to solve problems on personal and household finance involving o earnings, o simple interest, o discount, profit and loss; • extract data from tables and charts	 □ □ □ □	
19	**Graphs in practical situations**	• demonstrate familiarity with cartesian coordinates in two dimensions • interpret and use graphs in practical situations including travel graphs and conversion graphs • draw graphs from given data • apply the idea of rate of change to easy kinematics involving distance-time and speed-time graphs, acceleration and retardation • calculate distance travelled as area under a linear speed-time graph	□ □ □ □ □	

20	**Graphs of functions**	• construct tables of values and draw graphs for functions of the form $y = ax^n$ where $n = -2, -1, 0, 1, 2, 3$, and simple sums of not more than three of these and for functions of the form $y = ka^x$ where a is a positive integer • interpret graphs of linear, quadratic, reciprocal and exponential functions • find the gradient of a straight line graph • solve equations approximately by graphical methods • estimate gradients of curves by drawing tangents	☐ ☐ ☐ ☐ ☐	
21	**Straight line graphs**	• calculate the gradient of a straight line from the coordinates of two points on it • interpret and obtain the equation of a straight line graph in the form $y = mx + c$ • calculate the length and the coordinates of the midpoint of a line segment from the coordinates of its end points	☐ ☐ ☐	
22	**Algebraic representation and formulae**	• use letters to express generalised numbers and express basic arithmetic processes algebraically • substitute numbers for words and letters in formulae • transform simple and more complicated formulae • construct equations from given situations	☐ ☐ ☐ ☐	
23	**Algebraic manipulation**	• manipulate directed numbers • use brackets and extract common factors • expand products of algebraic expressions • factorise expressions of the form	☐ ☐ ☐ ☐	

		o $ax + ay$; o $ax + bx + kay + kby$; o $a^2x^2 - b^2y^2$; o $a^2 + 2ab + b^2$; o $ax^2 + bx + c$; • manipulate simple algebraic fractions.	□ □ □ □ □	
24	**Indices**	• use and interpret positive, negative, zero and fractional indices	□	
25	**Solutions of equations and inequalities**	• solve simple linear equations in one unknown • solve fractional equations with numerical and linear • algebraic denominators • solve simultaneous linear equations in two unknowns • solve quadratic equations by factorisation and either by use of the formula or by completing the square • solve simple linear inequalities	□ □ □ □ □ □	
26	**Graphical representation of inequalities**	• represent linear inequalities in one or two variables graphically. (Linear Programming problems are not included.)	□	
27	**Geometrical terms and relationships**	• use and interpret the geometrical terms: o point, line, plane, parallel, perpendicular o right angle, acute, obtuse and reflex angles o interior and exterior angles, o regular and irregular polygons, pentagons, hexagons, octagons, decagons • use and interpret vocabulary of o triangles o circles o special quadrilaterals	□ □ □ □ □ □ □	

		• solve problems and give simple explanations involving similarity and congruence • use and interpret vocabulary of simple solid figures: cube, cuboid, prism, cylinder, pyramid, cone, sphere • use the relationships between areas of similar triangles, with corresponding results for similar figures, and extension to volumes of similar solids	□ □ □ □	
28	**Geometrical constructions**	• measure lines and angles • construct simple geometrical figures from given data, angle bisectors and perpendicular bisectors using protractors or set squares as necessary (Where it is necessary to construct a triangle given the three sides, ruler and compasses only must be used.) • read and make scale drawings.	□ □ □	
29	**Bearings**	• interpret and use three-figure bearings measured clockwise from the north (i.e. 000° - 360°)	□	
30	**Symmetry**	• recognise line and rotational symmetry (including order of rotational symmetry) in two dimensions, and properties of triangles, quadrilaterals and circles directly related to their symmetries • recognise symmetry properties of the prism (including cylinder) and the pyramid (including cone) • use the following symmetry properties of circles: a) equal chords are equidistant from the centre; b) the perpendicular bisector of a chord passes through the centre; c) tangents from an external point are equal in length	□ □ □ □ □ □	

31	**Angle**	• calculate unknown angles and give simple explanations using the following geometrical properties: (a) angles on a straight line (b) angles at a point (c) vertically opposite angles (d) angles formed by parallel lines (e) angle properties of triangles and quadrilaterals (f) angle properties of polygons including angle sum (g) angle in a semi-circle (h) angle between tangent and radius of a circle (i) angle at the centre of a circle is twice the angle at the circumference (j) angles in the same segment are equal (k) angles in opposite segments are supplementary	 ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐	
32	**Locus**	• use the following loci and the method of intersecting loci: (a) sets of points in two or three dimensions (i) which are at a given distance from a given point (ii) which are at a given distance from a given straight line (iii) which are equidistant from two given points (b) sets of points in two dimensions which are equidistant from two given intersecting straight lines	 ☐ ☐ ☐ ☐	
33	**Mensuration**	• solve problems involving		

		(i) the perimeter and area of a rectangle and triangle (ii) the circumference and area of a circle (iii) the area of a parallelogram and a trapezium (iv) the surface area and volume of a cuboid, cylinder, prism, sphere, pyramid and cone (formulae will be given for the sphere, pyramid and cone) (v) arc length and sector area as fractions of the circumference and area of a circle	□ □ □ □ □ □ □	
34	**Trigonometry**	• apply Pythagoras Theorem and the sine, cosine and tangent ratios for acute angles to the calculation of a side or of an angle of a right-angled triangle (angles will be quoted in, and answers required in, degrees and decimals of a degree to one decimal place) • solve trigonometrical problems in two dimensions including those involving angles of elevation and depression and bearings • extend sine and cosine functions to angles between 90° and 180° • solve problems using the sine and cosine rules for any triangle and the formula ½ ab sin C for the area of a triangle • solve simple trigonometrical problems in three dimensions. (Calculations of the angle between two planes or of the angle between a straight line and plane will not be required.)	□ □ □ □ □ □	
35	**Statistics**	• collect, classify and tabulate statistical data; read, interpret and draw simple inferences from tables and statistical diagrams • construct and use bar charts, pie charts, pictograms, simple frequency distributions and frequency polygons	□ □	

		• use frequency density to construct and read histograms with equal and unequal intervals • calculate the mean, median and mode for individual data and distinguish between the purposes for which they are used • construct and use cumulative frequency diagrams; estimate the median, percentiles, quartiles and interquartile range • calculate the mean for grouped data; identify the modal class from a grouped frequency distribution	□ □ □ □	
36	**Probability**	• calculate the probability of a single event as either a fraction or a decimal (not a ratio) • calculate the probability of simple combined events using possibility diagrams and tree diagrams where appropriate. (In possibility diagrams outcomes will be represented by points on a grid and in tree diagrams outcomes will be written at the end of branches and probabilities by the side of the branches.)	□ □	
37	**Matrices**	• display information in the form of a matrix of any order • solve problems involving the calculation of the sum and product (where appropriate) of two matrices, and interpret the results; • calculate the product of a scalar quantity and a matrix; • use the algebra of 2 x 2 matrices including the zero and identity 2 x 2 matrices; • calculate the determinant and inverse of a non-singular matrix. ($\mathbf{A}^{-1}$ denotes the inverse of **A**.)	□ □ □ □ □	
38	**Transformations**	• use the following transformations of the plane: o reflection (M),	□	

		o rotation (R), o translation (T), o enlargement (E), o shear (H), o stretching (S) o and their combinations (If M(a) = b and R(b) = c the notation RM(a) = c will be used; invariants under these transformations may be assumed.) • identify and give precise descriptions of transformations connecting given figures • describe transformations using coordinates and matrices. (Singular matrices are excluded.)	□ □ □ □ □ □ □ □	
39	**Vectors in two dimensions**	• describe a translation by using a vector represented by $\begin{pmatrix} x \\ y \end{pmatrix}$, $\overrightarrow{AB}$ or **a** • add vectors and multiply a vector by a scalar • calculate the magnitude of a vector $\begin{pmatrix} x \\ y \end{pmatrix}$ as $\sqrt{x^2 + y^2}$ (Vectors will be printed as $\overrightarrow{AB}$ or **a** and their magnitudes denoted by modulus signs, e.g. $\left\|\overrightarrow{AB}\right\|$ or l**a**l. In all their answers to questions you are expected to indicate **a** in some definite way, e.g. by an arrow or by underlining, thus $\overrightarrow{AB}$ or $\underset{\sim}{a}$) • represent vectors by directed line segments; use the sum and difference of two vectors to express given vectors in terms of two coplanar vectors; use position vectors	□ □ □ □	