Kingdom of Lesotho
Ministry of Education and Training

LESOTHO GENERAL CERTIFICATE OF SECONDARY EDUCATION

Lesotho General Certificate of Secondary Education

Syllabus

Mathematics

0178

For examination in November 2020

National Curriculum Development Centre
in collaboration with
Examinations Council of Lesotho

Lesotho Senior Certificate Mathematics. Examination in **2018**.

1. Introduction

The Lesotho Senior Certificate Mathematics curriculum is designed for Senior Secondary level of education. It places emphasis on broad and balanced study across a wide range of subject areas. The curriculum has been adopted from IGCSE Mathematics (0580). It is structured to provide candidates with both practical skills and theoretical knowledge. It lays a solid foundation for pre-tertiary qualifications as well as prepares candidates for a world-wide employment should they decide to do so: as a proof of mathematical knowledge and understanding. The curriculum is organised into the Core and Extended. The core curriculum is meant for candidates who do not intend to pursue mathematically related careers, while the extended curriculum is suitable for those candidates who have an inclination towards mathematically related careers, as well as more able candidates. Lesotho IGCSE certificates prepare candidates for post-senior secondary qualifications such as AS and A-Level Mathematics or equivalent qualifications.

The curriculum builds on the Junior Certificate Mathematics Curriculum. Any repetition in content is meaningful; it is meant to refine candidates' mathematical competences. Candidates who study the LGCSE Mathematics should have studied the Junior Certificates Mathematics or equivalent.

Learning hours

The LGCSE Mathematics curriculum was designed on the assumption that candidates have about five hours per week during their duration of the course.

Availability

Lesotho Senior Certificate Mathematics Examination will be examined in October /November examination sessions. It is available to all candidates, including private candidates.

2. SYLLABUS AIMS AND OBJECTIVES

The syllabus demands candidates to show understanding of basic mathematical concepts and their applications, together with an ability to show this by clear expression and careful reasoning.

In the examination, importance will be attached to skills in algebraic manipulation and to numerical accuracy in calculations.

2.1 Syllabus Aims

The syllabus aims to enable candidates to:

- develop their mathematical knowledge and confidence by developing a feel for numbers, patterns and relationships;
- Develop an ability to apply mathematical skills in other subjects, particularly in science and technology.

- increase intellectual curiosity, develop mathematical language as a means of communication and investigation and explore mathematical ways of reasoning;
- acquire and apply skills and knowledge relating to number, measure and space in mathematical situations that they will meet in life;
- acquire a foundation appropriate to a further study of Mathematics and skills and knowledge pertinent to other disciplines;
- appreciate the pattern, structure and power of Mathematics and derive satisfaction, enjoyment and confidence from the understanding of concepts and the mastery of skills.

2.2 Assessment Objectives

The assessment objectives in Mathematics are mainly:

- A -Mathematical skills and techniques
- B -Applying mathematical techniques to solve problems

The objectives are reflected in the descriptions bellow.

A – Mathematical skills and techniques

The examination assesses the ability of candidates to:

1. recognise the appropriate mathematical procedures for a given situation
2. perform calculations by suitable methods, with and without a calculating aid
3. use the common systems of units
4. estimate, approximate and use appropriate degrees of accuracy in context and convert between equivalent numerical form
5. interpret, use and present information in written, graphical, diagrammatic and tabular form
6. use geometrical instruments and electronic calculator to solve mathematical problems
7. recognise and apply spatial relationships in two and three dimensions
8. recognise patterns and structures in a variety of situations and form and justify generalisations
9. understand and use mathematical language and symbols and present mathematical arguments in a logical and clear manner
10. apply and interpret Mathematics in a variety of situations, including daily life

B – Applying mathematical techniques to solve problems

In questions which are set in context and/or which require a sequence of steps to solve, candidates should be able to;

1. make logical deductions from a given mathematical situation.
2. recognise patterns and structures in a variety of situations, and form generalisations.
3. Respond to a problem relating to a relatively unstructured situation by translating it into an appropriately structured form.
4. Analyse a problem, select a suitable strategy and apply an appropriate technique to obtain its solution
5. Apply combinations of mathematical skills and techniques in problem solving
6. Set-out mathematical work, including the solution of problems in a logical and clear form using appropriate symbols and technology.
7. formulate problems into mathematical terms, select, apply and communicate appropriate techniques of solution and interpret the solutions in terms of the problems.

3. THE CRITERIA OF ASSESSMENT

Candidates who have studied the core content of the curriculum sit papers 1 &3. Those who have studied the extended curriculum sit papers 2 & 4. Grades available for the Core curriculum are C, D, E, F and G while for the Extended curriculum are A*A, B, C, D, E, F, and G.

CORE	**EXTENDED**
Paper 1 **1 Hour** Short answer questions Candidates answer all questions 60 marks Weighting 35%	**Paper 2** **1 ½ hours** Short answer questions Candidates answer all questions 70 marks Weighting 35%
Paper 3 **2 hours** Structured questions Candidates answer all questions 100 marks Weighting 65%	**Paper 4** **2 ½ hours** Structured questions Candidates answer all questions 130 marks Weighting 65%

The weighting of the assessment objectives in the question papers

Each paper may contain questions on any part of the relevant syllabus in the proportion reflected in the tables below.

Question papers	Total Marks	Weighting of Assessment Objective	
		A	B
Paper 1	60	44 - 50	10 - 16
Paper 2	70	28 - 35	35 – 42
Paper 3	100	76 – 86	14 - 24
paper 4	130	52 - 65	65 - 78

Curriculum options	% distribution of assessment objectives	
	A	B
Core (1 & 3	75 - 85	15 - 25
Extended (2 & 4)	40 - 50	50 -60

The weighting of the assessment of different areas of the syllabus is set out below.

Syllabus area	% Weighting for syllabus areas	
	Core (Paper 1 &3)	Extended (Paper 2 & 4)
Number	30-35	15-20
Algebra	20-25	35-40
Space and shape	30-35	30-35
Stats &probability	10-15	10-15

CALCULATION AIDS

Papers 1, 2 – the use of all calculating aids is prohibited.

Papers 3, 4 – all candidates should have a **silent non- programmable** electronic calculator with trigonometric functions. Unless stated otherwise within an individual question, three figure accuracy will be required. This means that four figure accuracy should be shown throughout the working, including cases where answers are used in subsequent parts of the question. Premature approximation will be penalised, where appropriate. In Papers 3 and 4, candidates with suitable calculators are encouraged to show the explicit expressions before punching the calculator's key. They are also encouraged to use the value of π from their calculators. The value of π will be given as 3.142 to 3 decimal places for use by candidates.

Units

SI units will be used in questions involving mass and measures: the use of the centimetre will continue.

Both the 12-hour clock and the 24-hour clock may be used for quoting times of the day. In the 24-hourclock, for example, 3.15 a.m. will be denoted by 03 15; 3.15 p.m. by 15 15 p.m, noon by 12 00 and midnight by 24 00. Candidates will be expected to be familiar with the solidus notation for the expression of compound units, e.g. 5 cm/s for 5 centimetres per second, 13.6 g/cm^3 for 13.6 grams per cubic centimetres.

Mathematical Instruments

Apart from the usual mathematical instruments, candidates may use flexicurves in this examination.

4. SYLLABUS CONTENT

Topic or Theme		
Candidates should be able to:		
CORE	**EXTENDED**	**Notes to a teacher**
1. Number		
• use directed numbers in practical situations. • use natural numbers, integers (positive, negative and zero), prime numbers, composite numbers, common factors and common multiples, 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 *n*th term of the form $an^2 + bn + c$, where $a = 1$) relating to such sequences; • calculate squares, square roots, cubes and cube roots of numbers.	• generalise simple algebraic statements (including expressions for the *n*th term of the form $an^p + bn^{p-1} + cn^{p-2}$ where *a, b* and *c* are integers and $2 \leq p \leq 3$.	Teachers can use examples such as the temperature change, cliffs, pit latrines and tide levels. Emphasise uses of the prime factorized form of a number. E. g Finding the LCM and HCM
2. 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.		
3. Ordering		
• order quantities by magnitude and demonstrate familiarity with the symbols =, ≠, >, <, ≤,≥		

4. Basic Operations		
use basic operations for calculations; • with whole numbers, decimal fractions vulgar (and mixed) fractions and directed numbers involving the correct ordering of operations and use of brackets.		**NB**: **+** and **–** are at the same level of precedence, much as **×** and **÷**
5. Estimations and limits of accuracy		**Notes to a teacher**
• make estimates of numbers, quantities and lengths, give approximations to specified numbers of significant figures and decimal places, and round off answers to a reasonable accuracy in the context of a given problem. • give appropriate upper and lower bounds for data given to a specified accuracy.	• obtain appropriate upper and lower bounds to solutions of simple problems given data to a specified accuracy.	e.g Measured lengths e.g. the calculation of the perimeter or the area of a rectangle
6. Indices and Standard Form		
• use and interpret positive, negative, zero and +ve fractional indices with **1** as a numerator. • use the standard form $A \times 10^n$ where n is an integer, and $1 \leq A < 10$.	• use and interpret negative fractional indices e. g where $p, q \in Z$ • solve equations involving indices.	
7. Algebraic representation and manipulation		
• use letters to express generalized numbers • express basic arithmetic processes algebraically • substitute numbers for words and letters in formulae • manipulate simple algebraic expressions • use brackets and extract common factors • expand products of algebraic expressions • factorise expressions of the form *a)* $ax + ay$ *b)* $ax + bx + kay + kby$ *c)* $a^2x^2 - b^2y^2$ *d)* $a^2 + 2ab + b^2$	• factorise expressions of the form $ax^2 + bx + c$ *where* $\boldsymbol{a}$ is an integer	Review of directed numbers may help in teaching the topic.

e) $ax^2 + bx + c$ where a = 1 • simplify algebraic expressions (fractions) with a numeric denominator e. g $\frac{x}{3}+\frac{x-4}{2}$	• simplify fractional expressions with algebraic denominators. e. g $\frac{1}{x-2}+\frac{2}{x-3}$ or $\frac{x^2-2x}{2x^2-7x+6}$	
8. Geometrical Constructions & Loci		**Notes to a teacher**
• measure lines and angles; • construct simple geometrical figures from given data, angle bisectors and perpendicular bisectors using a protractor or a set square as necessary. • read and make scale drawings. • use the following loci and the method of intersecting loci to construct sets of points in two dimensions which are; a) at a given distance from a given point, b) at a given distance from a given straight line, c) equidistant from two given points; d) equidistant from two given intersecting straight lines.	• describe sets of points in three dimensions	(c) &(d) using straight edge and compasses only
9. Bearings		
• interpret and use three-figure bearings measured clockwise from the north line (i.e. 000°–360°). • Represent 2-stage journey diagrammatically	• represent a 3-stage journey diagrammatically	

10. Geometrical terms and relationships		
• use, interpret and relate the geometrical terms: point, line, plane, parallel, perpendicular, right angle, acute, obtuse and reflex angles, interior and exterior angles, regular and irregular polygons, pentagons, hexagons, octagons, decagons; similarity and congruence • use and interpret vocabulary of triangles, circles, special quadrilaterals. • use and interpret vocabulary of simple solid figures: cube, cuboid, prism, cylinder, pyramid, cone, and sphere.		Use of models and nets may enhance understanding
11. Symmetry		
• recognise line and rotational symmetry (including the order of rotational symmetry) in two dimensions, • recognise properties of triangles, quadrilaterals and circles directly related to their symmetries. • recognise symmetry properties of prisms (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;	
12. Angle		**Notes to a teacher**
• 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 f) angles properties of quadrilaterals; g) angle properties of regular polygons; h) angle in a semi-circle is a right angle; i) angle between tangent and radius of a circle is a right angle.	• calculate unknown angles and give simple explanations using the following geometrical properties: (j) angle properties of irregular polygons k) angle at the centre of a circle is twice the angle at the circumference; l) angles in the same segment are equal; m) angles in opposite segments are supplementary;	

	n) tangents from an external point are equal in length; *o)* alternate segment theorem *p)* intersecting chord theorem	
13. Ratio, Proportion, Rate		**Notes to a teacher**
• demonstrate an understanding of the elementary ideas of; a) ratio (including notation) b) direct proportion c) common measures of rate • divide a quantity in a given ratio; • use ratios and proportions in practical situations. E .g scale used in maps • calculate average speed;	• demonstrate an understanding of the elementary ideas of inverse proportion • express direct and inverse variation in algebraic terms and use this form of expression to find unknown quantities.	
14. 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 /loss
15. Use of an electronic calculator		
• use an electronic calculator efficiently. • apply appropriate checks of accuracy.		Learners should be encouraged to estimate and verify outcomes
16. Measures		
• use current units of mass, length, area, volume and capacity in practical situations. • express quantities in terms of larger or smaller units. • calculate times in terms of the 12-hour and 24-hour clock. • read clocks, dial and timetables.		e.g speedometer, petrol gauge, paraffin gauge and weighing scales
17. Mensuration		**Notes to a teacher**
• solve problems involving; a) the perimeter and area of a rectangle and triangle, b) the area of a parallelogram and a trapezium, c) the circumference and area of a circle, d) arc length and sector area as fractions of the circumference and area of a circle,		Use of models and nets may be useful to enhance visualization and understanding. Exposure to varied situations involving combinations of different solids is encouraged. Candidates should be

e) the surface area and volume of a cuboid, cylinder and a triangular prism.	• Solve problems involving prism, sphere, pyramid and cone (formulae will be given for the sphere, pyramid and cone),	encouraged to show the explicit expression to be evaluated before punching calculators' keys.
18. Similarity and Congruency		
	• give explanations and solve problems involving similarity and congruency; • use the relationships between: a) areas of similar figures (including triangles) b) volumes of similar solids	Candidates should be encouraged to express themselves clearly using mathematical terms. Candidates are expected to show that two figures are similar or congruent
19. Personal and household finance		
• extract data from tables and charts to solve problems involving money. • calculate using money and convert from one currency to another. • use given data to solve problems on personal and household finance involving earnings, simple interest, compound interest (up to the third term), discount, profit and loss.	• use given data to solve problems on compound interest up to the *n*th term (knowledge of formula is required).	Use $A = P\left(1 + \frac{r}{100}\right)^n$
20. Solutions of Equations		
• solve simple linear equations in one unknown; • solve fractional equations with numerical denominator (s) • transform simple formulae • solve simultaneous linear equations in two unknowns, using substitution and elimination method. • construct linear equations in one unknown from given situations. • solve quadratic equations by factorisation where a=1	solve fractional equations with algebraic denominators; • transform more complicated formulae; • solve by substitution a pair of simultaneous equations of which one is linear and one is quadratic. • construct equations leading to quadratic equations from given situations. • solve quadratic equations (where ***a*** is an integer) by factorisation and by use of the formula or by completing the square.	**NB**: Other methods of solving simultaneous equations are treated under relevant topics (graphs, matrices)
21. Relations and Function Notation		
• find the input and output of linear and quadratic mappings • use the given inputs and outputs to express linear mappings algebraically • recognise a function as a special	• use the given inputs and outputs to express quadratic mappings algebraically • use function notation to describe	e.g f(x) = 3x – 5 for the

relation • evaluate simple functions using appropriate notations	and evaluate simple functions and their inverses • manipulate simple functions to form composite functions • Evaluate composite functions	function or f: $x \rightarrow 3x - 5$ $f^{-1}(x) = \frac{x+5}{3}$ or $f^{-1}: x \rightarrow \frac{x+5}{3}$ $f(x) = x^2 - 1$ $g(x) = 2x + 1$ then $fg(x) = (2x+1)^2 - 1$
22. Graphs of Functions		
• demonstrate familiarity with Cartesian coordinates in two dimensions and plot given points; • draw linear graphs from given coordinates and find the gradient from the graph; • 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 • construct tables of values and draw graphs for functions of the form: y = mx + c $y = x^2 + bx + c$ • interpret graphs • solve linear simultaneous equations by graphical methods to obtain approximate solutions;	construct tables of values and draw graphs for functions of the form: ax^n where **a** is a rational constant and n = -2,-1, 0, 1, 2, 3 and simple sums of not more than three of these; and ka^x where ***a*** is a positive integer; • interpret graphs of quadratic, reciprocal and exponential functions; • solve graphically a pair of simultaneous equations of which one is linear and one is quadratic • solve other equations graphically • estimate gradients of curves by drawing tangents.	Emphasise labeling of axes. Application of graphs to practical situations are not to be included in this topic. e.g $y = x^2 + \frac{1}{x^2}$ Including linear simultaneous equations.
23. Graphs in practical situations		
• draw graphs using data from practical situations; • interpret and use linear graphs in practical situations. • use and interpret travel and	• apply the idea of rate of change	

conversion graphs.	to easy kinematics involving distance-time and speed-time graphs, acceleration and retardation; • calculate distance travelled as area under a linear speed-time graph	
24. Set language and notation		
• use set language and notation, to describe sets e.g. $A = \{ x : x$ is a natural number$\}$ $B = \{(x, y): y = mx + c\}$ $C = \{x : a \leq x \leq b\}$ $D = \{a, b, c... \}$ • use set language, notation, and Venn diagrams , to describe sets and represent relationships between two sets as follows: $A \cup B$: Union of *A* and *B* $A \cap B$: Intersection of *A* and *B* $n(A)$: Number of elements in set *A* $\in$ " . . . is an element of . . . " $\notin$ ". . . is not an element of. " *A' :* Complement of set *A* $\emptyset$: The empty set { }:empty set $\mathcal{E}$: Universal set $A \subseteq B$:*A* is a subset of *B* $A \subset B$: *A* is a proper subset of *B* $A \not\subseteq B$: *A* is not a subset of *B* $A \not\subset B$: *A* is not a proper subset of *B*	• use set language, notation, and Venn diagrams , to describe sets and represent relationships between three sets .	Core questions will not include more than one complement. Learners should be encouraged to always verify their results
25. Inequalities and linear programming		**Notes to a teacher**
	• solve simple linear inequalities in one variable. • represent and solve linear inequalities in one or two variables graphically. • solve simple linear programming problems with up to **four linear** constraints of which **two** are the axes or parallel to the axes	Candidates are expected to always shade the unwanted region and leave the wanted region clear, unless otherwise stated.
26. Pythagoras and Trigonometry		
• use 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;	• solve trigonometric problems in	Practice on problems

• solve trigonometric problems in two dimensions including those involving bearings;	two dimensions including those involving angles of elevation and depression; • extend sine and cosine ratios to angles between 90° and 180°; solve problems in two dimensions using the sine and cosine rules for any triangle and the trigonometric formula for the area of a triangle e.g (1/2)(ab)sinC • solve simple trigonometric problems in three dimensions.	involving elevation and depression are encouraged. Exposure to varied situations problems is encouraged. Calculations of the angle between two planes or of the angle between a straight line and plane will not be required.
27. 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 and pictograms. • calculate the range, mean, median and mode for individual data and distinguish between the purposes for which they are used; • construct and use frequency tables for ungrouped data to calculate the mean and the median, and to identify the mode.	• construct and use **frequency table** for grouped data to estimate the mean and the median, and to identify the modal class. • for continuous and grouped data; a) use frequency density to construct and read histograms with equal and unequal intervals; b) construct and use frequency polygons and cumulative frequency diagrams; estimate the median, percentiles, quartiles and inter-quartile range	Data can be drawn from a variety of sources such as accounts and business studies.
28. Probability		
• calculate the probability of a single event as either a fraction or a decimal (not a ratio); •demonstrate understanding of independent events; • calculate the probability of simple combined events using possibility	• demonstrate understanding of the probability involving; (a) mutually exclusive events. (b) dependent (conditional) events • calculate the probability of simple combined events using tree	

calculate the magnitude of a vector $\begin{pmatrix} x \\ y \end{pmatrix}$ as $\sqrt{x^2 + y^2}$	• use the sum and difference of two vectors to express given vectors in terms of two co-planar vectors, use position vectors. • solve vector equations in two unknowns.	Vectors will be represented as $\overrightarrow{AB}$ or **a** and their magnitudes denoted by modulus signs, e.g. l $\overrightarrow{AB}$ l or l**a**l. In all their answers to questions candidates are expected to indicate **a** in some definite way, e.g. by an arrow or by underlining, thus $\overrightarrow{a}$ or a;
30. Matrices		
• display information in the form of a matrix of any order. • solve problems involving the calculation of the sum and difference of two matrices, and interpret the results. • calculate the product of a scalar quantity and a matrix; • use the algebra of 2 × 2 matrices involving addition, subtraction and multiplication by scalar quantity.	• calculate the product of two matrices. • solve problems involving the calculation of the product of two matrices, and interpret the results. • use the algebra of 2 × 2 matrices including the zero and identity • calculate the determinant and inverse of a 2 x 2 matrix. (**A**$^{-1}$ denotes the inverse of **A**.) • Solve simultaneous linear equations by matrix method.	
31. Transformations		
• Describe and perform the following transformations on simple plane figures using; Reflection, rotation, translation, enlargement including negative and fractional scale factor.	• Describe and perform Shear and stretch on simple plane figures • Combine transformations • Identify and give precise descriptions of transformations connecting given figures; • Describe transformations using coordinates, vectors and matrices.	If M(a) = b and R(b) = c the notation RM(a) = c will be used;

4.1 Grade descriptions

Grade descriptions give a general indication of the expected standards of achievement likely to have been displayed by candidates awarded a particular grade. They are the expected success criteria for each level of performance. The grades awarded to candidates will depend on the extent to which candidates have met the overall assessment objectives. Short-comings in some aspects of a candidate's performance in the examination may be balanced by a better performance in other objectives.

Grade F

At this grade, candidates are expected to identify and obtain necessary information. They would be expected to recognize if their results are sensible. An understanding of simple situations should enable candidates to describe them, using symbols, words and diagrams. They draw simple, basic conclusions with explanations where appropriate. In addition candidates should be able to;

- Perform the four rules on positive integers and decimals fractions (one operation only) using a calculator where necessary, using their understanding of the place value. They should be able to convert between fractions, decimals and percentages for the purpose of comparing quantities between 0 and 1 in a variety of forms, and reduce a fraction to its simplest form. Candidates should appreciate the idea of direct proportion and the solution of simple problems involving ratios should be expected. Basic knowledge of percentages is needed to apply to simple problems involving percentage parts of quantities. They need to understand and apply metric units of length, mass and capacity together with conversion between units in these areas of measure. The ability to recognize and continue a straight forward pattern in sequence and understand the terms multiples, factors and squares is needed as a foundation to higher grade levels of applications in the areas of number and algebra.

- At this level, algebra is very basic involving the construction of simple algebraic expressions, substituting numbers for letters and evaluating simple formulae. Candidates should appreciate how a simple linear equation can represent a practical situation and be able to solve such equations.

- Knowledge of names and recognition of simple plane figures and common solids is basic to an understanding of shape and space. This will be applied to the perimeter and the area of a rectangle and other rectilinear shapes. The skill of using geometrical instruments, ruler, protractor and compasses is required for applying to measuring length and angles as well as drawing a triangle given three sides.

- Candidates should be familiar with reading data from a variety of sources and be able to extract data from them, in particular timetables. The tabulation of the data is expected in order to form frequency tables and draw a bar chart. They will need the skill of plotting given points on a graph and reading a travel graph. From a set of numbers they should be able to calculate the mean.

Grade C

At this level candidates are expected to show some insight into the mathematical structures and problems, which enable them to justify generalizations, arguments and solutions. Mathematical presentations and stages of derivations should be more extensive in order to generate fuller solutions. They should

appreciate the difference between mathematical explanation and experimental evidence. Candidates should display the following additional competences:

- Ability to apply the four rules of number to positive and negative integers, fractions and decimal fractions, in order to solve problems. Display the ability to extend percentages to problems involving calculating one quantity as a percentage of another and its application to percentage change. Calculations would now involve several operations and allow candidates to demonstrate fluent and efficient use of calculators. As well as giving reasonable approximations. The relationship between decimal and standard form of a number should be appreciated and applied to positive and negative power of 10. They should be familiar with the differences between simple and compound interest and apply this to calculating both.

- Candidates should be able to extend their knowledge of sequence to recognize, and in simple cases formulate rules for generating a pattern or sequence. While extending the level of difficulty of solving linear equations by involving appropriate algebraic manipulations, candidates are also expected to solve simple simultaneous equations in two unknowns. Work with formulae extends into harder substitution and evaluating the remaining term, as well as transforming simple formulae. The knowledge of basic algebra is extended to the use of brackets and common factor factorization. On graph work candidates should be able to plot points from given values and use them to draw and interpret graphs in practical situations, including travel and conversion graph as well as algebraic graphs of linear and quadratic functions.

- Candidates should be able to extend perimeter and area beyond rectilinear shapes to circles. They are expected to appreciate and use units of area and volumes in relation to finding the volume and surface area of the prism and cylinder. The basic construction work, with approximate geometrical instruments, should now be extended and applied to accurate scale diagrams to solve a two – dimensional problem. Pythagoras theorem and trigonometry of right-angled triangles should be understood and applied to solving, by calculation, problems in a variety of contexts. The calculation of angles in a variety of geometrical figures, including polygons and to some extent circles should be expected from straightforward diagrams,

- Candidates should show the ability to use a frequency table to construct a pie chart. They need to understand and construct a scatter diagram and apply this to a judgment of the correlation existing between two quantities.

Grade A

Candidates who are awarded grade A should have shown the ability to make clear, concise and accurate statements, demonstrate ease and confidence in the use of symbolic forms and accuracy or arithmetic manipulation. They should apply the Mathematics they know in unfamiliar and contexts. In addition, candidates in this category should be able to:

- Apply their knowledge of rounding to determine the bounds of intervals, which may follow calculations of, for example, areas. They should show an understanding of the use of direct and inverse proportion. A further understanding of percentages should be evident by relating percentage change to change to a multiplying factor and vice-versa, e.g. multiplication by 1.03 results in 3% increase.

- Apply their knowledge of the four rules for fractions to the simplification of algebraic fractions. They should build on their knowledge of algebraic manipulation to manipulate linear, simultaneous and

quadratic equations. Their ability to use positive, negative and fractional indices in both numerical and algebraic work, and interpret the description of a situation in terms of algebraic formula and equations should be evident. They should be able to extend their knowledge of graphs of algebraic functions to the intersections and gradients of these graphs.

- Extend the basic knowledge of scale factor to two and three dimensions and apply to the calculation of length, areas and volumes between actual values and scale models. Apply the basic right-handed trigonometry knowledge to the three dimensional situations as well as being an understanding of and solving problems on non-right angled triangles.

- Process data, discriminate between necessary and redundant information. Extend basic work o n graphs in practical situations to making quantitative and qualitative deductions from distance/time and speed graphs.

Grading and certification

Grades for LGCSE Mathematics are A*, A, B, C, D, E. F or G. These indicate the standard achieved. A* is the highest available grade and G the lowest. Candidates who fail to achieve grade G will be ungraded. This will be reported on the statement of results, but will not appear on the certificate. The letter Q (results pending) and X (no result) may also appear on the statement of results but not on the certificate.

Only a syllabus in which a candidate has been awarded a grade will appear on the certificate

Inclusion of all candidates

The curriculum is available for all candidates, including private candidates. Candidates with special learning needs should make arrangement with ECoL to enable them to access the assessments and receive recognition for their achievements. Access arrangements might be denied if it gives these candidates unfair advantage over others or they compromise the set assessment standards.

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