Republic of Namibia

MINISTRY OF EDUCATION, ARTS AND CULTURE

NAMIBIA SENIOR SECONDARY CERTIFICATE (NSSC)

MATHEMATICS SYLLABUS
ORDINARY LEVEL

SYLLABUS CODE: 6131

GRADES 10 - 11

FOR IMPLEMENTATION IN 2019
FOR FIRST EXAMINATION IN 2020

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Mathematic Syllabus Ordinary Level Grades 10 - 11

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1. INTRODUCTION

The Namibia Senior Secondary Certificate Ordinary Level (NSSCO) syllabus is designed as a two-year course leading to examination after completion of the Junior Secondary phase. The syllabus is designed to meet the requirements of the *National Curriculum for Basic Education (NCBE)* and has been approved by the National Examination, Assessment and Certification Board (NEACB).

The main sections of the syllabus are:

- Aims
- Learning Content
- Assessment
- Grade Descriptions

The Namibian National Curriculum Guidelines, applicable at the stage of senior secondary education (Grades 10 - 11) and at equivalent stages of non-formal education, as a part of life-long learning, recognise the uniqueness of the learner and adhere to the philosophy of learner-centred education.

The Namibia National Curriculum Guidelines:

- recognise that learning involves developing values and attitudes as well as knowledge and skills;
- promote self-awareness and an understanding of the attitudes, values and beliefs of others in a multilingual and multicultural society;
- encourage respect for human rights and freedom of speech;
- provide insight and understanding of crucial "global" issues in a rapidly changing world which affects quality of life: the AIDS pandemic, global warming, environmental degradation, distribution of wealth, expanding and increasing conflicts, the technological explosion and increased connectivity;
- recognise that as information in its various forms becomes more accessible, learners need to develop higher cognitive skills of analysis, interpretation and evaluation to use information effectively;
- seek to challenge and to motivate learners to reach their full potential and to contribute positively to the environment, economy and society.

Thus the Namibia National Curriculum Guidelines should provide opportunities for developing essential skills across the various fields of study. Such skills cannot be developed in isolation and they may differ from context to context according to a field of study. The skills marked with an * are relevant to this Syllabus:

The skills are:
Communication skills *
Numeracy skills *
Information skills *
Problem-Solving skills *
Self-Management and Competitive skills *
Social and Cooperative skills *
Physical skills
Work and Study skills *
Critical and Creative Thinking*

2. RATIONALE

Mathematics is a dynamic, living and cultural product. It is more than an accumulation of facts, skills and knowledge. The learning of Mathematics involves conceptual structures and general strategies of problem solving and attitudes towards and appreciation of Mathematics.
Mathematical knowledge and mathematical methods of inquiry constitute an essential part of and contribute to all modern science and engineering.
Today's learners will live and work in an era dominated by computers, worldwide communication and by a global economy. Mathematics is the key to success in this world where the economy requires workers who are prepared to absorb new ideas, to perceive patterns and to solve unconventional problems.
The senior secondary curriculum strives to prepare learners to function effectively in the 21st century by providing a basis to use Mathematics in their personal and professional lives.

3. AIMS

The aims of the syllabus are the same for all learners. These are set out below and describe the educational purposes of a course in Mathematics for the NSSC examination. They are not listed in order of priority.

The aims are to enable leaners to:

1. consolidate and extend their elementary mathematical skills, and use these in the context of more advanced techniques;
2. further develop their knowledge of mathematical concepts and principles, and use this knowledge for problem solving;
3. appreciate the interconnectedness of different branches Mathematics;
4. acquire a foundation appropriate to their further study of Mathematics and of other disciplines;
5. devise mathematical arguments and use and present them precisely and logically;
6. integrate Information Technology (IT) to enhance the mathematical experience;
7. develop the confidence to apply their mathematical skills and knowledge in appropriate situations;
8. develop creativity and perseverance in the approach to problem solving;
9. derive enjoyment and satisfaction from engaging in mathematical pursuits, and gain an appreciation of the beauty, power and usefulness of Mathematics;
10. apply Mathematics in everyday situations and develop an understanding of the part which Mathematics plays in the world around them;
11. recognise when and how a situation may be represented mathematically, identify and interpret relevant factors and, where necessary, select an appropriate mathematical method to solve the problem;
12. use Mathematics as a means of communication with emphasis on the use of clear expression;
13. develop the ability to apply Mathematics in other subjects, particularly science and technology.

4. ADDITIONAL INFORMATION

Guided learning hours

The NSSCO level syllabuses are designed on the assumption that learners have about 130 guided learning hours per subject over the duration of two years, but this is for guidance only. The number of hours required to gain the qualification may vary according to local conditions and the learners' prior experience of the subject. The National Curriculum for Basic Education (NCBE) indicates that this subject will be taught for 8 periods of 40 minutes each per 7-day cycle, or 6 periods of 40 minutes each per 5-day cycle, over two years.

Prior learning

It is recommended that learners who are beginning this course should have previously studied *Mathematics* at Junior Secondary (JS) level.

Progression

NSSCO levels are general qualifications that enable learners to progress either directly to employment, or to proceed to further qualifications. Learners who are awarded grades C to A* in NSSCO are well prepared to follow courses leading to Namibia Senior Secondary Certificate Advanced Subsidiary (NSCCAS) level *Mathematics*.

4.4 Grading and reporting

NSSCO results are shown by one of the grades A, B, C, D, E, F or G indicating the standard achieved, grade A being the highest and grade G the lowest. 'Ungraded' indicates that the candidate has failed to reach the minimum standard required for a pass at NSSCO level.

Support materials and approved textbooks

NSSCO syllabuses, question papers and examiner reports are sent to all schools. Assessment manuals in subjects, where applicable are sent to schools. Approved learning support materials are available on the Senior Secondary Textbook Catalogue for Schools. The Senior Secondary Textbook Catalogue is available on the institution's (NIED) website (http://www.nied.edu.na).

5. LEARNING CONTENT

5.1 Introduction to learning content

The learning content for Mathematics NSSCO level covers the following topics

TOPIC 1: NUMBERS AND OPERATIONS

(a) Real number system
(b) Squares, cubes and roots
(c) Directed numbers
(d) Vulgar and decimal fractions and percentages
(e) Ordering
(f) Standard form
(g) Four basic operations
(h) Estimations
(i) Limits of accuracy
(j) Ratio, proportion and rate
(k) Money and finance

TOPIC 2: SET LANGUAGE AND NOTATIONS

Set language and notations

TOPIC 3: MEASURES

SI units of measures

TOPIC 4: MENSURATION

Perimeters, areas and volumes

TOPIC 5: GEOMETRY

(a) Geometrical terms and relationships
(b) Geometrical constructions
(c) Symmetry
(d) Angle properties
(e) Locus

TOPIC 6: ALGEBRA

(a) Algebraic representation and formulae
(b) Algebraic manipulation
(c) Polynomials
(d) Equations and inequalities
(e) Indices
(f) Sequences
(g) Logarithms

TOPIC 7: FUNCTIONS AND GRAPHS

(a) Graphs in practical situations
(b) Linear programming
(c) Functions
(d) Graphs of functions

TOPIC 8: COORDINATE GEOMETRY

Graphs and Cartesian coordinates

TOPIC 9: VECTORS AND TRANSFORMATION

(a) Vectors in two dimension

(b) Transformations

TOPIC 10: MATRICES

Operations with matrices

TOPIC 11: BEARINGS AND TRIGONOMETRY

Three-figure bearings and trigonometric ratios

TOPIC 12: STATISTICS AND PROBABILITY

(a) Statistics

(b) Probability

5.2 Learning content

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
TOPIC 1: NUMBERS AND OPERATIONS	
(a) Real number system	
• know how to classify and use real numbers	• classify different types of numbers as natural numbers, whole numbers, integers, rational numbers, irrational numbers and real numbers • identify and use natural numbers, integers, prime numbers, square numbers, cube numbers, common factors (including HCFs) and common multiples (including LCMs), rational and irrational numbers (e.g. π , $\sqrt{2}$ etc.) and real numbers
(b) Squares, cubes and roots	
• develop further understanding of squares, cubes and their roots	• calculate squares, square roots, cubes and cube roots of real numbers
(c) Directed numbers	
• extend their knowledge of directed numbers	• apply the four basic operations on directed numbers • use directed numbers in practical situations (e.g. change in temperature, flood levels etc.)

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
(d) Vulgar and decimal fractions and percentages	
• know and use the relationships between 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 • calculate a given percentage of a quantity • express one quantity as a percentage of another • calculate percentage increase and decrease • perform calculations involving reverse percentages, e.g. finding the cost price given the selling price and the percentage profit.
(e) Ordering	
• extend their knowledge of ordering quantities by magnitude	• order quantities in ascending and descending order using relationship signs i.e. $=, \neq, >, <, \geq, \leq$
(f) Standard form	
• know how to express very large and very small numbers in standard form	• express numbers in standard form $A \times 10^n$ where n is an integer (including zero), and $1 \leq A < 10$ • perform the four basic operations with expressions written in standard form
(g) Four basic operations	
• develop further understanding of the application of four basic operations to numbers	• apply the four basic operations to perform calculations with integers , decimal fractions and vulgar (and mixed) fractions, including correct order of operations and use of brackets

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
(h) Estimation	
• know how to estimate numbers and quantities	• make estimates of numbers and quantities • give approximations to specified numbers of significant figures and decimal places • round off answers to reasonable accuracy in the context of a given problem
(i) Limits of accuracy	
• know that estimated values have specified bounds of acceptance	• give appropriate upper and lower bounds for data given to a specified accuracy (e.g. any measured quantities) • obtain appropriate upper and lower bounds to solutions involving all four basic operations (e.g. the calculation of the perimeter or area of a rectangle) given data to specified accuracy
(j) Ratio, proportion and rate	
• understand the use of ratio, rate and proportion	• apply the ideas and notation of ratio, direct and inverse proportion and rate to practical situations • divide a quantity in a given ratio • increase and decrease a quantity by a given ratio • use scales in practical situations • calculate average speed • solve problems involving common measures of rate • express direct and inverse variation in algebraic terms and use this form of expression to find unknown quantities (contextually or algebraically)
(k) Use of an electronic calculator	
• know how and when to use an electronic calculator	• use an electronic calculator efficiently • apply appropriate checks of accuracy

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
(l) Money and household finance	
• know and understand issues involved in personal and household finances	• solve problems involving money and convert from one currency to another • use given data to solve problems on personal and household finance involving earnings, rate of charge, simple interest and compound interest, discount, profit and loss • extract data from tables and charts • calculate personal income through wages, salaries, piece-work and commission • interpret and perform calculations involving simple bills and payment receipts (e.g. telephone and cell phone bills, till receipt bills, municipal bills and clothing account statements) • interpret personal income tax tables and determine the tax payable on an amount earned

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
TOPIC 2: SET LANGUAGE AND NOTATIONS	
Set language and notations	
• understand the use of set language and notations	• define sets by listing and describing and by using set builder notation 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 and interpret the following set notations $A \cup B$ 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 …" A' complement of set A Ø the empty set $\mathscr{E}$ or **U** 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 sets and Venn diagrams to solve problems involving not more than three subsets of the universal set

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
TOPIC 3: MEASURES	
SI units of measures	
• develop further understanding of the use of metric (SI) units of measure	• use metric units of mass, length, area, volume and capacity in practical situations • express quantities in terms of larger or smaller units • use notations of time and calculate time in terms of the 24-hour and 12-hour clock • read clocks, dials and timetables
TOPIC 4: MENSURATION	
Perimeters, areas and volumes	
• extend their knowledge of determining perimeter, area and volume • gain further knowledge of circular measure, surface area and volume of simple solid bodies	• perform calculations and solve problems involving - the perimeter and area of triangles and quadrilaterals - the circumference and area of circles - the surface area and volume of cubes, cuboids, cylinders and other prisms • solve problems involving the arc length and sector area as fractions of the circumference and area of circles • solve problems involving the surface area and volume of spheres, pyramids and cones (given formulae for the sphere, pyramid and cone)

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
TOPIC 5: GEOMETRY	
(a) Geometrical terms and relationships	
• know and use geometrical terms and the vocabulary of simple plane figures and simple solids	• define, use and interpret the geometrical terms: point, line, angle, parallel, intersecting, bearing, right angle, acute, obtuse and reflex angles, perpendicular, similarity, congruence • use and interpret vocabulary of triangles, quadrilaterals, circles, polygons • use and interpret vocabulary of solid figures i.e. cube, cuboids, prism, cylinder, pyramid, cone, including their nets • solve problems and give simple explanations involving similarity and congruence • use the relationships between areas of similar triangles, with corresponding results for similar figures and extension to volumes and surface areas of similar solids
(b) Geometrical constructions	
• gain further knowledge of how to perform geometrical constructions	• measure lines and angles • construct simple geometrical figures and nets from given data using protractors, set squares, straight edges and compasses as necessary • construct angle bisectors and perpendicular bisectors using straight edges and compasses only • read and make scale drawings

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
(c) Symmetry	
• develop further understanding of symmetrical properties for simple plain figures	• recognise line and rotational symmetry (including order of rotational symmetry) in two dimensions • recognise and use properties of triangles, quadrilaterals and circles directly related to their symmetries • use the following symmetry properties of circles: - equal chords are equidistant from the centre - the perpendicular bisector of a chord passes through the centre of a circle - tangents from the same external point are equal in length
(d) Angle properties	
• extend their knowledge of angle properties	• calculate unknown angles using the following geometrical properties (reasons may be required but no formal proofs): - angles at a point - angles on a straight line and intersecting straight lines - angles formed within parallel lines - angle properties of triangles and quadrilaterals - angle properties of regular and irregular polygons - angle in a semi-circle - angle between tangent and radius of a circle - angle at the centre of a circle is twice the angle at the circumference - angles in the same segment are equal - angles in opposite segments are supplementary

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
(e) Locus	
• know how to determine the locus (path) of a point under certain conditions	• construct and use the following loci and the method of intersecting loci for sets of points in two dimensions: - which are at a given distance from a given point - which are at a given distance from a given straight line - which are equidistant from two given points - which are equidistant from two given intersecting straight lines
TOPIC 6: ALGEBRA	
(a) Algebraic representation and formulae	
• gain further understanding of algebraic representation and use algebraic formulae	• use letters to express generalised numbers and express basic arithmetic processes algebraically • substitute numbers for words and letters in formulae • construct linear equations and inequalities and simple expressions from given situations • transform simple formulae (linear formulae) and complex formulae (those involving roots, powers, fractions and factorisation)

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
(b) Algebraic manipulation	
• know how to manipulate algebraic expressions	• multiply a monomial by a polynomial • use brackets and extract common factors • expand products of algebraic expressions • factorise where possible expressions of the form: - $ax + ay$ - $ax + bx + kay + kby$ - $a^2x^2 - b^2y^2$ - $a^2 + 2ab + b^2$ - $ax^2 + bx + c$ • manipulate algebraic fractions, e.g. - $\frac{x}{3} + \frac{x-4}{2}$, - $\frac{2x}{3} - \frac{2}{x-3}$ - $\frac{3a}{4} \times \frac{5ab}{3}$ - $\frac{1}{x-2} - \frac{2}{x-3}$ • factorise and simplify expressions such as: $\frac{x^2 - 2x}{x^2 - 5x + 6}$; $\frac{x^2 - 3x - 10}{x^2 - 4x + 5}$ • write quadratic expressions in the form $a(x + p)^2 + q$

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
(c) Polynomials	
• know how to manipulate polynomials	• carry out operations of addition, subtraction and multiplication of polynomials • carry out division of a polynomial by a binomial expression, and identify the quotient and the remainder
(d) Equations and inequalities	
• know how to solve equations and inequalities	• solve simple linear equations with one unknown • solve simultaneous linear equations with two unknowns • solve quadratic equations given in factorized form, e.g. $(x-2)(x+3)=0$ • find solutions to quadratic equations by factorising, by formula and by completing the square • solve equations with fractions, e.g. $\frac{x-2}{x-1}=1-\frac{x-8}{x+14}$ • solve simultaneous equations; one linear and one quadratic • solve linear inequalities in one unknown
(e) Indices	
• know how to perform simple operations with indices	• interpret and use the laws of indices including positive, negative, fractional and zero indices • simplify expressions involving indices e.g. $\frac{3^{x-y}\times 3^{x+y}}{3^{2x}}$ • use indices to solve exponential equations e.g. $2^{x}=\frac{1}{4}$

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
(f) Sequences	
• know how to identify patterns in a sequence • understand and use arithmetic and geometrical sequences	• recognise patterns in sequences • find the n^{th} term of sequences • distinguish between arithmetic and geometric sequences • use the formulae for the n^{th} term and the sum of the first n terms to solve problems involving arithmetic and geometric progressions
(g) Logarithms	
• understand the connection between logarithm and indices • know how to use laws of logarithm	• identify the relationship between logarithms and indices (excluding ln x and e^x) • use the laws of logarithms of base 10 to simplify expressions • use logarithms to solve simple exponential equations e.g. $a^x = b$
TOPIC 7: FUNCTIONS AND GRAPHS	
(a) Graphs in practical situations	
• understand the use of graphs in practical situations	• use 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 graphs, speed-time graphs, acceleration and deceleration • calculate distance travelled as area under a linear speed-time graph
(b) Linear programming	
• understand how to represent inequalities graphically	• represent inequalities graphically and use this representation in the solution of simple linear programming problems (the convention of using broken lines for strict inequalities and shading unwanted regions will be expected)

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
(c) Functions	
• develop an understanding of functions and their inverses	• describe the terms function, one-one function, inverse function and composite function • use the function notations f(x) = $2x + 3$ and f : $x \to 2x + 3$, with f $^{-1}$ for the inverse of f • find the inverse of one-one function and form composite of two given functions as defined by gf (x) = g (f(x) = gof(x)
(d) Graphs of function	
• gain further understanding of drawing and interpreting graphs of functions • gain an understanding of how to find the turning point and make sketch graphs of quadratic functions	• construct tables of values for functions of the form $y = ax + b$, $y = \pm ax^2 + bx + c$, $y = \frac{a}{x}\ (x \neq 0)$ where a, b and c are integers • draw and interpret such graphs • find the gradient of a straight line graph and determine the equation of a straight line in the form $y = mx + c$ • solve linear and quadratic equations approximately by graphical methods • construct tables of values for functions of the form $y = ax^n$ 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 for functions of the form $y = a^x$ where a is a positive integer • draw and interpret such graphs and solve associated equations approximately by graphical methods • estimate the gradient of a curve by drawing tangents at a given point on the curve • find the maximum or minimum value of the quadratic function by any method, including expressing $ax^2 + bx + c$ in the form $a(x + p)^2 + q$ • sketch the graph of a quadratic function using the turning point and the intercepts

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
TOPIC 8: COORDINATE GEOMETRY	
Graphs and Cartesian coordinates	
• know how to solve problems involving coordinate geometry	• calculate the distance between two points given in coordinate form, the gradient of the line-segment joining them, and the coordinates of their midpoint • find the equation of a straight line given sufficient information (e.g. the coordinates of two points on it or one point on it and its gradient) • interpret and use equations of the form $ax + by + c = 0$, including knowledge of the relationships involving gradients of parallel and perpendicular lines • apply coordinate geometry to quadrilaterals

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
TOPIC 9: VECTORS AND TRANSFORMATIONS	
(a) Vectors in two dimension	
• understand vectors in two dimensions and perform calculations involving vectors	• describe a translation of point by using a vector • use standard notations for vectors, i.e. $\begin{pmatrix} x \\ y \end{pmatrix}$, $\overrightarrow{AB}$, **a**, $\underline{a}$ • add and subtract vectors • multiply a vector by a scalar and interpret these relationships in geometrical terms • 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 as $\left\|\overrightarrow{AB}\right\|$ or $\|\underline{a}\|$) • represent vectors by directed line segment • use the sum and difference of two vectors to express given vectors in terms of two coplanar vectors • use position vectors
(b) Transformations	
• know how to transform simple plane figures and describe these transformations	• reflect simple plane figures in horizontal and vertical lines • rotate simple plane figures about any point, through multiples of 90^{o} • construct given translations, and enlargements (including negative and fractional scale factors) of simple plane figures • recognise and describe fully, reflections, rotations, translations and enlargements • use the following transformations of the plane: reflection, rotation, translation and enlargement and their combinations • identify and give precise descriptions of transformations connecting given figures

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
TOPIC 10: MATRICES	
Operations with matrices	
• develop an understanding of matrices and basic operations	• represent information in the form of a matrix of any order and interpret the data in a given matrix • calculate the product of a scalar quantity and a matrix • solve problems involving the calculation of the - sum and difference of any matrices not exceeding 3 × 3 - product of matrices not exceeding 2 × 2 e.g. $\begin{pmatrix}1 & 2\end{pmatrix}\begin{pmatrix}2 & 3\\ -4 & 0\end{pmatrix} = \begin{pmatrix}-6 & 3\end{pmatrix}$; $\begin{pmatrix}1 & 3\\ 0 & -2\end{pmatrix}\begin{pmatrix}2 & 3\\ -4 & 0\end{pmatrix} = \begin{pmatrix}-10 & 3\\ 8 & 0\end{pmatrix}$ $\begin{pmatrix}1 & 2\end{pmatrix}\begin{pmatrix}4\\ 5\end{pmatrix} = \begin{pmatrix}14\end{pmatrix}$; $\begin{pmatrix}1 & 2\end{pmatrix}\begin{pmatrix}4\\ 5\end{pmatrix}\begin{pmatrix}x & y\end{pmatrix} = \begin{pmatrix}28 & 42\\ 12 & 18\end{pmatrix}$ where $x = 4$ and $y = 6$ • use the zero and identity matrix • calculate the determinant and inverse of a non-singular 2 × 2 matrix • solve simultaneous linear equations by matrix method

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
TOPIC 11: BEARINGS AND TRIGONOMETRY	
Three-figure bearings and trigonometric ratios	
• understand and use three-figure bearings and trigonometric ratios	• interpret and use three-figure bearings measured clockwise from the north (i.e. 000° – 360°) • 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) • solve trigonometrical problems in two dimensions involving angles of elevation and depression • extend trigonometrical ratios to angles between 90° and 360° • solve problems using sine and cosine rules for any triangle and the formula: area of triangle $= \frac{1}{2}ab \sin C$ • solve simple trigonometrical problems in three dimensions including angle between a line and a plane **NOTE: When decimals are involved in bearings e.g. 142.5°, 42.3° decimal digits are not counted as figures even if they appear in the answer. Therefore the three-figure bearings will be written as 142.5° and 042.3° respectively.**

GENERAL OBJECTIVES *Learners will:*	**SPECIFIC OBJECTIVES** *Learners should be able to:*
TOPIC 12: STATISTICS AND PROBABILITY	
(a) Statistics	
• develop further understanding of data representation and measures of central tendency	• collect, classify and tabulate statistical data • read, interpret and draw simple inferences (conclusions) from tables and statistical diagrams • construct and use bar charts, pie charts, pictograms and simple frequency distributions • calculate the range, mean, median and mode for discrete data and distinguish between the purposes for which they are used • construct and read histograms with equal and unequal intervals (areas proportional to frequencies and vertical axis labelled 'frequency density') • construct and use cumulative frequency diagrams • estimate and interpret the median, percentiles, quartiles and inter-quartile range • calculate an estimate of the mean for grouped and continuous data • identify the modal class from a grouped frequency distribution
(b) Probability	
• understand and use probability	• calculate the probability of a single event as either a fraction or a decimal (not ratio) • use the probability scale from 0 to 1 • interpret the probability of an event occurring as [1 – (the probability of the event not occurring)] • use addition and multiplication of probabilities, as appropriate, in simple cases • apply probability in practice, e.g. relative frequency • calculate the probability of simple combined events, using possibility diagrams, tree diagrams and Venn diagrams where appropriate **NOTE: 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.**

6. ASSESSMENT OBJECTIVES

The assessment will include, wherever appropriate, personal, social, environmental, economic and technological applications of Mathematics in modern society. Learners are required to demonstrate the assessment objectives in the context of the content and skills prescribed. Within each of the assessment objectives the assessment must take account of the learners' ability to communicate clearly and logically and apply conventions where appropriate.

The abilities to be assessed in the NSSC Mathematics Ordinary Level examination cover a single assessment objective, technique with application. The examination will test the ability of learners to:

1. organise, interpret and present information accurately in written, tabular, graphical and diagrammatic forms;
2. perform calculations by suitable methods;
3. use an electronic calculator;
4. understand systems of measurement in everyday use and make use of them in the solution of problems;
5. estimate, approximate and work to degrees of accuracy appropriate to the context;
6. use mathematical and other instruments to measure and to draw to an acceptable degree of accuracy;
7. interpret, transform and make appropriate use of mathematical statements expressed in words or symbols;
8. recognise and use spatial relationships in two and three dimensions, particularly in solving problems;
9. recall, apply and interpret mathematical knowledge in the context of everyday situations;
10. make logical deductions from given mathematical data;
11. recognise patterns and structures in a variety of situations, and form generalisations;
12. respond to a problem relating to a relatively unstructured situation by translating it into an appropriately structured form;
13. analyse a problem, select a suitable strategy and apply an appropriate technique to obtain its solution;
14. apply combinations of mathematical skills and techniques in problem solving;
15. set out mathematical work, including the solution of problems, in a logical and clear form using appropriate symbols and terminology.

The assessment objectives above can be assessed in any question in Paper 1 and 2.

7. SCHEME OF ASSESSMENT

All learners will take two written papers as follows

(a) Paper 1 Short answer questions

(b) Paper 2 Structured questions

DESCRIPTION OF PAPERS

PAPER	Marks	Duration	Weighting across all components
Paper 1	80 marks	2 hours	40%
Paper 2	120 marks	3 hours	60%
Total	**200 marks**		**100%**

NOTES:

1. There will be no choice of questions.

2. The syllabus prescribes that learners will be in possession of non-programmable scientific electronic calculator for papers.

3. Three significant figures will be required if the degree of accuracy is not specified, and if the answer is not exact. Answers in degrees must be given correct to one decimal place.

4. Learners are encouraged to use the value of π from their calculators if their calculator provides this. For other learners, the value of 3.142 will be given on the front page of the question paper only.

8. GRADE DESCRIPTIONS

The scheme of assessment is intended to encourage positive achievement by all learners. Grade descriptions are therefore provided for judgmental grades A, C, E and G to give a general indication of the standards of achievement likely to have been shown by learners awarded particular grades. The description must be interpreted in relation to the content specified by the Mathematics syllabus but are not designed to define that content. The grade awarded will depend in practice upon the extent to which the learner has met the assessment objective overall. Shortcomings in some aspects of the assessment may be balanced by better performance in others.

It must be clearly understood that a learner who meets the demands of a particular grade, by implication also meets the demands of all lower grades, e.g. a candidate who achieves a Grade A, by implication also fulfils the criteria set for Grades C, E and G.

At Grade A the learner is expected to:

- Express any number to 1, 2 or 3 significant figures. Relate a percentage change to a multiplying factor and vice versa, e.g. multiplication by 1.03 results in a 3% increase.

- Relate scale factors to situations in both two and three dimensions. Calculate actual lengths, areas and volumes from scale models. Carry out calculations involving the use of right-angled triangles as part of work in three dimensions.

- Add, subtract, multiply and divide algebraic fractions. Manipulate linear, simultaneous and quadratic algebraic equations. Use positive, negative and fractional indices in both numerical and algebraic work. Write down algebraic formulae and equations from a description of a situation.
  Make clear, concise and accurate mathematical statements, demonstrating ease and confidence in the use of symbolic forms and accuracy in algebraic or arithmetic manipulation. Solve problems relating to 2×2 matrices. Solve problems involving coordinate geometry.

- Process data, discriminating between necessary and redundant information. Make quantitative and qualitative deductions from distance-time and speed-time graphs.

At Grade C the learner is expected to:

- Perform calculations involving several operations. Calculate percentage change. Use a calculator fluently. Give a reasonable approximation to a calculation involving the four rules. Do compound interest calculations. Use and understand the standard form of a number. Apply ratio and proportion concepts. Use set and Venn diagrams to solve problems.

- Use area and volume units. Find the volume and surface area of a prism and a cylinder. Use a scale diagram to solve a two-dimensional problem. Calculate the length of the third side of a right-angled triangle. Apply trigonometry to solve problems involving triangles. Calculate angles in geometrical figures. Use constructions to solve a locus problem.

- Recognise, and in simple cases formulate, rules for generating a pattern or sequence. Solve simple simultaneous linear equations in two unknowns. Solve quadratic equations. Transform simple formulae. Substitute numbers in complex formulae and evaluate the remaining term.

- Construct a pie-chart from simple data. Plot and interpret graphs, including graphs of linear and simple quadratic functions.

At Grade E a learner is expected to:

- Apply the four rules of numbers to positive and negative integers, decimals and vulgar fractions. Identify cube and prime numbers. Calculate a quantity as a percentage of another quantity. Convert between currencies. Use natural numbers as indices. Interpret simple set language and notations. Understand and apply simple proportion. Find average speed.

- Find the perimeter and area of rectilinear shapes. Find the volume and surface area of a cuboid. Calculate angles in triangles and quadrilaterals. Use a map and scales to find distances and bearings. Construct triangles and nets of cuboids and triangular prisms. Recognise reflections, rotations and enlargements.

- Continue a sequence progressing into negative numbers. Write a simple expression using two variables. Simplify a linear expression using two variables. Substitute numbers into formulae and evaluate the remaining term. Use brackets and extract common factors from algebraic expressions. Solve simple linear equations.

- Use and understand the concepts mean, median and mode. Interpret a simple pie chart. Draw and interpret straight line graphs, including conversion and travel graphs

At Grade G a learner is expected to:

- Perform the four rules on positive integers and decimal fractions using a calculator where necessary. Convert simple fractions to decimals and percentages. Identify square numbers. Give factors of numbers. Order a list of decimal numbers. Calculate simple percentages. Perform simple money calculations. Work out the time of a simple journey. Do simple estimations. Identify the smallest integer in a list containing negative numbers.

- Recognise and name simple plane figures and common solid shapes. Measure a line or an angle accurately. Find the perimeter of rectilinear shapes. Find the area of a rectangle and the volume of a cuboid. Draw the line of symmetry in a shape. Draw the reflection of a shape about a given vertical or horizontal mirror line.

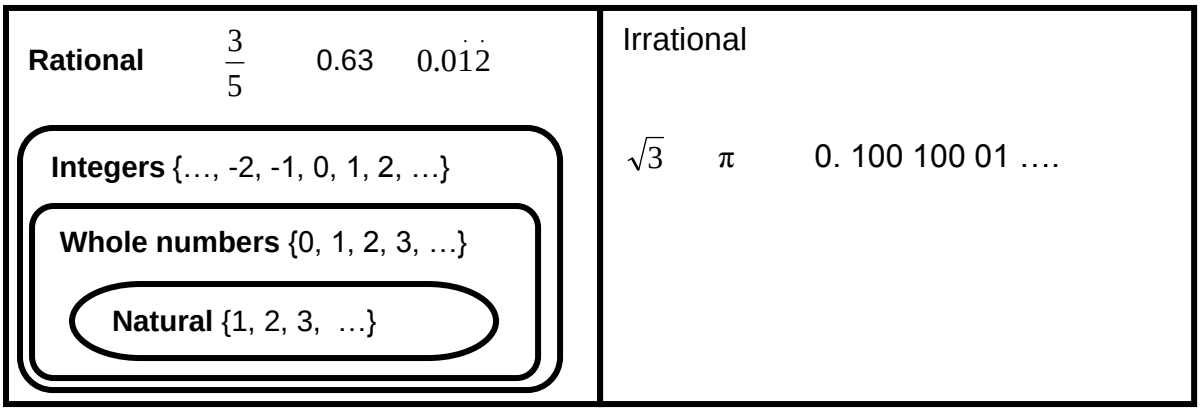
- Continue a sequence in numbers or diagrams. Substitute numbers into simple formulae.

- Interpret tables. Draw and interpret a bar chart. Calculate the mean of a small set of discrete data. Identify the mode from a set of discrete data or a bar chart. Plot or give coordinates of points in the first quadrant

9. MATHEMATICAL NOTATIONS AND OTHER RELEVANT INFORMATION

The following list summarises the notation useful to NSSCO Level Mathematics content. Although not all of these notations are used in the teaching of NSSCO Level Mathematics, most of the notations are useful.

Real number system



NB: when the root is irrational e g. $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ etc., it is called a surd

Set Notations

$\in$	"…is an element of…"
$\notin$	"…is not an element…"
$\{x_1, x_2, \ldots\}$	the set with elements $x_1, x_2, \ldots$
$\{x : \ldots\}$	the set of x such that ….
n(A)	the number of elements in set A
$\emptyset$	the empty set
$\mathscr{E}$ or **U**	universal set
A'	compliment of set A
$\mathbb{N}$	set of natural numbers, {1,2,3,…}
$\mathbb{Z}$	set of integers, {0, ±1, ±2, ±3, …}
$\mathbb{Q}$	the set of rational numbers
$\mathbb{Q}'$	the set of irrational numbers
$\mathbb{R}$	the set of real numbers
$\subseteq$	is a subset of
$\subset$	is a proper subset of
$\not\subseteq$	is not a subset of
$\not\subset$	is not a proper subset of
$\cup$	union
$\cap$	intersection

Miscellaneous symbols

$=$	is equal to
$\neq$	is not equal to
$\equiv$	is identical or is congruent to
$\approx$	is approximately equal to
$\propto$	is proportional to
$<$	is strictly less than
$\leq$	is less than or equal to
$>$	is strictly greater than
$\geq$	is greater than or equal to

Operations

$a + b$	a plus b
$a - b$	a minus b
$a \times b$, ab, $a.b$	a multiplied by b
$a \div b$, $\frac{a}{b}$, a/b	a divided by b
$a : b$	the ratio of a to b
$\sqrt{a}$	the positive square root of the real number a

Matrices

$\mathbf{M}$	a matrix $\mathbf{M}$
$\mathbf{M}^{-1}$	the inverse of the square matrix $\mathbf{M}$
det $\mathbf{M}$	the determinant of square matrix $\mathbf{M}$

Functions

f	function f
f (x)	the value of the function f at x
f $A \rightarrow B$	f is a function under which each element of set A has an image in set B
f : $x \rightarrow y$	the function f maps the element x to the element y
f^{-1}	the inverse of the function f
gf	the composite function of f and g which is defined by gf (x) = g(f(x)) = gof(x)

10. Test Record Form for NSSCO Mathematics: Term 1, 2, and 3

	Test Marks								**Ave Total Marks**
	Term 1			**Term 2**			**Term 3**		
	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6	Test 7	Test 8	
Maximum Test Mark									
Date									
Name									

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