L-Università ta' Malta

MATSEC
Examinations Board

SEC 23 Syllabus

Mathematics

2025

Updated August 2023

Table of Contents

Introduction

This syllabus is based on the curriculum principles outlined in *The National Curriculum Framework for All* (NCF) which was translated into law in 2012 and designed using the *Learning Outcomes Framework* that identify what students should know and be able to achieve by the end of their compulsory education.

As a learning outcomes-based syllabus, it addresses the holistic development of all learners and advocates a quality education for all as part of a coherent strategy for lifelong learning. It ensures that all children can obtain the necessary skills and attitudes to be future active citizens and to succeed at work and in society irrespective of socio-economic, cultural, racial, ethnic, religious, gender and sexual status. This syllabus provides equitable opportunities for all learners to achieve educational outcomes at the end of their schooling, which will enable them to participate in lifelong and adult learning, reduce the high incidence of early school leaving and ensure that all learners attain key twenty-first century competences.

This programme also embeds learning outcomes related to cross-curricular themes, namely digital literacy; diversity; entrepreneurship creativity and innovation; sustainable development; learning to learn and cooperative learning and literacy. In this way, students will be fully equipped with the skills, knowledge, attitudes and values needed to further learning, work, life and citizenship.

What is Mathematics?

Mathematics is a body of knowledge – a product that consists of a series of rich, interconnected conceptual structures made up of facts, techniques & skills, as well as concepts. At secondary school level, these structures are built around a small set of fundamental notions and their properties: numbers; constants, variables, and functions; two-dimensional and three-dimensional shapes, and measures of physical quantities; data, and measures of the likelihood of events. In the SEC Mathematics syllabus, these conceptual structures are respectively known as the 'Number', 'Algebra', 'Shape, Space & Measures' and 'Data Handling & Chance' strands.

Mathematics is also a way of thinking and a mode of enquiry – a creative process which helps us to discover and understand the world of mathematics and the relationships between the mathematical objects that inhabit this world.

Finally, mathematics is a unique, rich, concise, precise, unambiguous, and universal language whose specialist vocabulary, symbolism, syntax, and semantics allows us to communicate ideas that cannot easily be communicated through other means. Moreover, as an internationally understood means of communication that goes beyond linguistic, cultural, and social barriers it enables us to share our ideas and understanding with others across time and space.

What does the study of Mathematics entail?

There are three issues that one has to consider when identifying what the study of mathematics involves. The first issue deals with the nature of mathematics, the second deals with the aims of mathematics education, while the third deals with the teaching approaches that should be used to help pupils learn mathematics.

The Teaching of Mathematics & the Nature of Mathematics

As seen in the previous section, SEC Mathematics is a body of knowledge that is made up of four interrelated, yet distinct, strands. A brief outline of the knowledge pupils should acquire in each strand by the time they leave compulsory schooling is as follows:

Number: Pupils should develop number sense and computational fluency by understanding the way numbers are represented and the quantities they represent. They should also develop the ability to calculate mentally and on paper, make estimates and approximations, and check the reasonableness of their results.

Algebra: Pupils should recognise patterns and relationships in mathematics and in the real world. They should also develop the ability to use symbols, notation, graphs and diagrams to represent and communicate mathematical relationships and concepts.

Shapes, Space and Measures: Pupils should acquire knowledge of the geometrical properties of 2-D and 3-D shapes. They should also develop spatial awareness as well as the ability to recognise the geometrical properties of everyday objects. Pupils should know and understand systems of measurement.

Data Handling & Chance: Pupils should be able to gather, organise and analyse data. They should also be able to present data in tables, charts and a variety of graphs. Pupils should be able to use data to estimate the likelihood of an event occurring.

Given that mathematics is not only a body of knowledge, but also a way of thinking and a mode of enquiry, as well as a language, the study of mathematics necessarily entails learning the processes, as well as the vocabulary, symbols, syntax, and semantics of the subject. Thus, when helping pupils acquire the programme learning outcomes (see List of Learning Outcomes below on pg.5) SEC Mathematics teachers should give appropriate attention to all product, process, and language facets of the subject in all four strands of the subject. Thus, they need to emphasize not only the facts, skills & techniques, and concepts of the subject but also the processes of mathematics as well as its vocabulary, symbols, associated rules of writing, and meanings.

The processes of mathematics can be classified under three very broad categories:

(a) *Understanding* & *Doing strategies:* simplifying, analysing, observing, pattern spotting, connecting, planning, organizing, designing, devising, implementing, trialling & improving, calculating, estimating, approximating, reviewing, checking, interpreting, and, reflecting.

(b) *Reasoning & Deducing strategies*: generalising, specialising, abstracting, conjecturing, predicting, testing, verifying, justifying, proving, disproving, and, concluding.

(c) *Communicating strategies:* defining, verbalising, talking, describing, discussing, questioning, interpreting, explaining, recording, and, presenting.

The emphasis on product, process, and language aspects of the subject should permeate all aspects of the teaching and learning

The Teaching of Mathematics & the Aims of Mathematics Education

SEC Mathematics teachers should ensure that pupils are acquainted with the two main views of why mathematics should be taught: purist views that look on mathematics as a subject to learn in its own right, one which focuses on: the study of patterns, the relationships between mathematical objects, the logical and deductive reasoning required when doing mathematics, and, the rich, interconnected conceptual structures that make up the subject, and, utilitarian views that look on mathematics as a subject that is a useful tool that can solve problems in a wide range of contexts (Chambers & Timlin, 2013).

These views are associated with the following two aspects of mathematics:

(i) Utilitarian Aspect: Mathematics is useful. It equips learners with the necessary knowledge to help them understand and interact with the world around them. Moreover, it forms the basis of science, technology, architecture, engineering, commerce, industry and banking. It is also increasingly being used in the medical and biological sciences, economics and geography. This pervasiveness makes mathematics one of the most important subjects in the school curriculum.

(ii) Aesthetic Aspect: Mathematics is a beautiful subject with an evolving body of knowledge that is characterised by its order, precision, conciseness and logic. Mathematics is also characterised by a search for pattern and relationships within and between mathematical objects. Indeed, mathematicians seek patterns in numbers, in space and in motion and such random processes as changes in weather. As such, mathematics should offer learners intellectual challenge, excitement, satisfaction, and wonder.

The Teaching of Mathematics & the Teaching & Learning Approaches

There is no single best way of teaching mathematics. Different approaches – including teaching through exposition, teaching through discovery, and teaching through investigation – should be used as each one of these approaches targets different types of learning and different learning outcomes. However, irrespective of which of these approaches is adopted, it is important that all teaching and learning activities should be student-centred rather than teacher-centred.

Thus, SEC Mathematics teachers should ensure that pupils:

- Appreciate the beauty and elegance of Mathematics;
- Recognise that Mathematics has always been an important part of human activity and has contributed greatly to man's advancement in a wide variety of areas;
- Develop a spirit of curiosity and other personal qualities such as confidence and perseverance that enables them to explore the world of Mathematics with profit;
- Develop an ability to work independently and collaboratively when doing Mathematics;
- Develop a positive attitude towards Mathematics and its teaching and learning;
- Are provided with ample opportunities to develop a deep understanding of the concepts within each of the four strands of the subject;
- Understand and appreciate the place and purpose of mathematics as a subject in its own right;
- Apply mathematical knowledge and understanding to solve a wide selection of 'pure mathematics' problems arising from purely abstract considerations;
- Understand and appreciate the place and purpose of mathematics in their own lives and in society;
- Apply mathematical knowledge and understanding to solve several real-life 'applied mathematics' problems arising from situations in their own lives as well as in society;
- Appreciate the interdependence of the different strands of Mathematics;
- Develop the ability to use Mathematics across the curriculum;
- Think and communicate mathematically - precisely, logically, and creatively;
- Make effective, creative, and efficient use of appropriate technology in Mathematics; and,
- Acquire a secure foundation for the further study of Mathematics.

How is SEC Mathematics related to candidate's lives, to Malta, and/or to the world?

The world as we know it would be quite different were it not for the contributions that mathematics has made to a number of fields of knowledge including science, technology, engineering, architecture, commerce, and art amongst others. Mathematics has helped man to measure; to calculate; to approximate; to estimate; to solve problems; to develop logical thinking and reasoning; to conjecture; to justify; to verify; to structure and organise; to seek patterns; to simplify; to generalise; to abstract; to predict outcomes; to assess risks; and, to process and communicate information. The assessment criteria in SEC Mathematics (see section Learning Outcomes and Assessment Criteria below on p.9) have been specifically designed to help pupils acquire all of these abilities, mastery of which will enable them in their efforts to become lifelong learners as well as active participants in the world around them. Moreover, the Extension assessment criteria have been purposely designed to enable candidates to continue studying mathematics at the post-secondary level if they so wish. It is strongly recommended that those pupils who wish to continue studying STEM subjects at higher levels not only learn all of the SEC Mathematics 'Extension' assessment criteria but obtain a grade '1', '2' or '3' in the subject.

List of Subject Foci

- Number – The number system
- Number – Numerical calculations
- Algebra – Fundamentals of algebra
- Algebra – Graphs
- Shape, Space and Measure – Measurement
- Shape, Space and Measure – Lines, angles and shapes
- Shape, Space and Measure – Constructions and loci
- Shape, Space and Measure – Transformations
- Data Handling and Chance – Statistics
- Data Handling and Chance – Probability

List of Learning Outcomes

At the end of the programme, I can demonstrate an understanding of:

LO 1. The structure of the number system and the relationship between numbers.

LO 2. A variety of calculation procedures (mental methods, pen and paper methods, and assistive technology methods) and associated skills.

LO 3. Patterns, sequences, algebraic expressions, formulae, equations and inequalities.

LO 4. Graphical representations of algebraic functions.

LO 5. Forms of measurement dealing with angles, length, area, volume, capacity, mass and time.

LO 6. The properties of lines, segments, parallel lines, perpendicular lines, transversals, angles, 2D and 3D shapes.

LO 7. The construction of angles, lines, triangles, circles, others polygons and loci in 2D.

LO 8. Position and movement of shapes in a plane.

LO 9. Measures of central tendency, measures of dispersion and graphical representation of data.

LO 10. The probabilities associated with certain, uncertain and impossible events.

Programme Level Descriptors

This syllabus sets out the content and assessment arrangements for the award of Secondary Education Certificate in Mathematics at Level 1, 2 or 3. First teaching of this programme begins in September 2022. First award certificates will be issued in 2025.

The following levels refer to the qualification levels that can be obtained by candidates sitting for SEC examinations. These are generic statements that describe the depth and complexity of each level of study required to achieve an award at Level 1, 2 or 3 in Mathematics. (Level 1 being the lowest and level 3 the highest).

Level 1: At the end of the programme the candidate will have obtained basic knowledge, skills and competences in the subject such as basic repetitive communication skills and the ability to follow basic, simple instructions to complete tasks. Support is embedded within the task.

Level 2: At the end of the programme the candidate will have obtained good knowledge, skills and competence in the subject such as the interpretation of given information and ideas. The candidate will have developed the ability to carry out complex tasks. Limited support may be embedded within the task.

Level 3: At the end of the programme the candidate will autonomously apply knowledge and skills to a variety of complex tasks. Candidates will utilise critical thinking skills to analyse, evaluate and reflect upon their own work and that of others. Problem solving tasks may be part of the assessment process.

Learning Outcomes and Assessment Criteria

Subject Focus:	**Number – The number system**
Learning Outcome 1: Paper I and Paper II	**At the end of the programme, I can demonstrate an understanding of the structure of the number system and the relationship between numbers.**

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
1.1a Read whole numbers to one billion in figures and words.		
1.1b Write whole numbers to one billion in figures and words.		
1.1c Order whole numbers to one billion in figures and words.		
1.1d Identify whole numbers on a number line.		
1.1e Identify simple fractions on a number line. *E.g.* $\frac{1}{2}, \frac{1}{4}, \frac{3}{5}, \frac{5}{8}, \frac{7}{10}$.		
1.1f Identify mixed numbers on a number line.		
1.1g Identify decimals on a number line.		
1.1h Recognise the place value of any digit in a whole number up to one billion.		

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
1.1i Compare whole numbers up to one billion using symbols such as <, > or =.		
1.1j Identify odd and even numbers.		
1.1k Count forward and backwards in 1s, 2s, 3s, 4s, 5s, 10s and 100s starting from any whole number.		
1.1l Count forward and backwards in steps of 25 (to and from any multiple of 25) and 50 (to and from any multiple of 50).		
1.1m Recall the first ten multiples of all numbers from 2 to 10.		
1.1n List the first five multiples of any whole number up to and including 100.	1.2n Write multiples of numbers using power notation. *E.g.* $2 \times 2 \times 2 \times 2 = 2^4$; $3 \times 3 \times 5 \times 5 \times 5 \times 5 = 3^2 \times 5^4$.	
1.1o Identify common multiples of two numbers.	1.2o Identify the common multiples of three numbers.	
1.1p Identify the least common multiple (LCM) of two numbers.	1.2p Identify the least common multiple (LCM) of three numbers.	
1.1q Identify factors of any two-digit number.	1.2q Identify all factors of any two-digit number. *E.g. factors of 24 are 1,2,3,4,6,8,12,24.*	
	1.2r Identify all the common factors of up to three numbers.	1.3r Identify the highest common factor (HCF) of up to three numbers.
1.1s Work out the square of a number.		

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
1.1t Generate the first ten square numbers.	1.2t Deduce that squares and square roots are inverses of each other.	
1.1u Work out the cube of a number.		
1.1v Generate the first five cube numbers.	1.2v Deduce that cubes and cube roots are inverses of each other.	
1.1w Define what a prime number is.	1.2w Express any integer as a product of prime factors.	
1.1x Identify prime numbers up to 100.		
		1.3y Find the square root of large numbers using prime factorisation.
	1.2z Find the LCM of up to 3 numbers not greater than 20. *E.g. Find the LCM of 4 and 6.*	1.3z Find the LCM of up to 3 numbers using prime factorisation.
		1.3aa Find the HCF of up to 3 numbers using prime factorisation.
1.1ab Express tenths, hundredths and thousandths using decimal notation.		
1.1ac Recognise the place value of tenths, hundredths and thousandths written in decimal form.		
1.1ad Associate 0.5 with one half, 0.25 with one quarter and 0.75 with three quarters.		

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
1.1ae Count forwards and backwards in steps of 0.1, 0.2, 0.25 and 0.5.		
	1.2af Recognise that particular fractions have specific recurring decimal patterns. *E.g.* $\frac{1}{3} = 0.333\ldots = 0.\dot{3}$	
1.1ag Recognise equivalent fractions.		
1.1ah Generate equivalent fractions of proper and/or improper fractions.		
1.1ai Compare fractions using symbols such as <, > or =.		
1.1aj Compare mixed numbers using symbols such as <, > or =.		
1.1ak Compare decimals using symbols such as <, > or =.		
1.1al Write fractions in order.		
1.1am Write mixed numbers in order.		
1.1an Write decimals in order.		
1.1ao Associate a simple fraction which has a denominator which is a factor of 100 to a decimal fraction.		

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
1.1ap Associate 25% with a quarter.		
1.1aq Associate 50% with one half.		
1.1ar Associate 75% with three quarters.		
1.1as Recognise the relationship between fractions and decimals.	1.2as Recognise the relationship between fractions and percentages.	
	1.2at Recognise the relationship between decimals and percentages.	
1.1au State one number lying between two given decimal numbers.	1.2au State one fraction lying between two given fractions.	
1.1av Associate a directed number to a real life situation such as temperature, floor levels and debt.		
1.1aw Represent a directed number on a number line.		
	1.2ax Convert a number ≥1 in ordinary form to standard form.	1.3ax Convert a number <1 in ordinary form to standard form.
	1.2ay Convert a number ≥1 in standard form to ordinary form.	1.3ay Convert a number <1 in standard form to ordinary form.
		1.3az Find the reciprocal of a number.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
1.1ba Use appropriate mathematical terminology such as number line, fraction, percentage, etc.	1.2ba Use appropriate mathematical terminology such as square roots, cubes, improper fractions, prime numbers, Least Common Multiple, etc.	1.3ba Use appropriate mathematical terminology such as standard form, reciprocal, inequalities, highest common factor, etc.
1.1bb Use assistive technology (e.g. tablets and computers) and other learning resources (e.g. number frames, Cuisenaire rods, interlocking cubes, base 10 blocks, fraction wall) to learn about numbers and their properties.	1.2bb Use assistive technology (e.g. tablets and computers and calculators) and other learning resources (e.g. Cuisenaire rods, interlocking cubes, base 10 blocks) to learn about numbers and their properties.	1.3bb Use assistive technology (e.g. tablets and computers and calculators) and other learning resources to learn about numbers and their properties.
1.1bc Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	1.2bc Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	1.3bc Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.
1.1bd Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	1.2bd Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	1.3bd Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).

Subject Focus:	**Number – Numerical Calculations**
Learning Outcome 2: Paper I and Paper II	**At the end of the programme, I can demonstrate an understanding of a variety of calculation procedures (mental methods, pen and paper methods, and assistive technology methods) and associated skills.**

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
2.1a Add by using the nearest multiple of 10, 100 or 1000 then adjusting. *E.g. 14 + 8 = 14 + 10 - 2 = 22.*		
2.1b Subtract by using the nearest multiple of 10, 100 or 1000 then adjusting. *E.g. 17 - 9 = 17 - 10+1 = 8.*		
2.1c Add numbers that involve four digits or less using column addition and/or a calculator.		
2.1d Subtract numbers that involve four digits or less using column subtraction and/or a calculator.		
2.1e Work through situations involving addition and/or subtraction.		
2.1f Recognise that division is the inverse of multiplication. *E.g. If 7×8 = 56 then 56÷8=7 and vice versa.*		
2.1g Multiply any integer by 10, 100, or 1000.		
2.1h Divide any integer by 10, 100, or 1000.		

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
2.1i Recognise unit fractions.		
2.1j Find unit fractions of shapes, numbers, and/or quantities.		
2.1k Associate unit fractions with the unitary method. *E.g. how much is* $\frac{1}{8}$ *of 32? Therefore, how much is* $\frac{5}{8}$ *of 32?*		
2.1l Recognise the relationship between division and fractions. *E.g.* $\frac{2}{3}$ *means 2 ÷ 3 and vice versa.*		
2.1m Find remainders after division.		
2.1n Express the remainder after division as a fraction.		
2.1o Express the remainder after division as a decimal rounded up to two decimal places.		
2.1p Work through situations involving addition, subtraction, multiplication, and/or division.		
2.1q State, without the use of a calculator, the square root of squares up to 100 and/or the cube root of cubes up to 125.	2.2q Work out calculations involving powers and roots without the use of a calculator. *E.g.* $\sqrt{1600}$, 90^2, 20^3, $\sqrt[3]{8000}$	

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
2.1r Find the square root of any number using a calculator.	2.2r Find the cube root of any number using a calculator.	
2.1s Write tenths and/or hundredths in decimal form and vice versa.		
2.1t Add numbers up to three decimal places		
2.1u Subtract numbers up to three decimal places.		
2.1v Add and/or subtract numbers using column methods using numbers up to three decimal places.		
2.1w Derive mentally decimals that total 1 or 10. *E.g. 1 = 0.2 + 0.8; 10 = 1.7 + 0.1 + 8.2*		
2.1x Use pen and paper methods for either one or more of: • ThHTU × U *(E.g. 2176 x 3)* • HTU × TU *(E.g. 804 x 16)* • U.t × U *(E.g. 7.9 x 8)* • TU.t × U *(E.g. 26.7 x 3)* • U.th × U *(E.g. 7.61 x 5)*		
2.1y Use pen and paper methods for either one or more of: • TU ÷ U *(E.g. 32 ÷ 4)* • HTU ÷ U *(E.g. 114 ÷ 3)* • HTU ÷ TU *(E.g. 156 ÷ 12)* • U.t ÷ U *(E.g. 8.4 ÷ 7)* • U.th ÷ U *(E.g. 6.48 ÷ 4)*		

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
2.1z Use pen and paper methods for multiplication and/or division by 10 and 100 including decimals.	2.2z Use pen and paper methods for multiplication and/or division of numbers by up to 2 digits. • HTU x U.t *(E.g. 175 × 1.4)* • TU.t x U.t *(E.g. 18.6 × 2.7)* • U.t ÷ U.t *(E.g. 2.4 ÷ 0.6)* *Limited to single digit decimal divisor in the case of division.*	
2.1aa Derive doubles and/or halves of numbers up to 1 d.p. *E.g. double 7.6 is 15.2; half of 13 is 6.5.*		
	2.2ab Use the four operations (addition, subtraction, multiplication and/or division) with directed numbers.	
2.1ac Evaluate expressions involving whole numbers, one or more of the four operations, and brackets. *E.g. find the value of 4 + (2 x 3);* *find the value of (15 - 3) ÷ (2 + 1).*	2.2ac Use the BIDMAS rule with integers.	
2.1ad Find fractions of numbers, shapes and/or quantities.		
2.1ae Reduce a fraction to its simplest form.		
2.1af Change an improper fraction into a mixed number and / or vice versa.	2.2af Change mixed numbers into decimals and /or vice versa.	
2.1ag Interpret scales involving whole numbers.	2.2ag Interpret scales involving decimals.	

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
	2.2ah Add two fractions (including mixed numbers) with different denominators using equivalent fractions.	
	2.2ai Subtract two fractions (including mixed numbers) with different denominators using equivalent fractions.	
	2.2aj Multiply two fractions (including mixed numbers).	
	2.2ak Divide two fractions (including mixed numbers).	
	2.2al Work through situations involving the addition, subtraction, multiplication and / or division of fractions (including mixed numbers).	
	2.2am Find the percentage of a quantity where the percentage <100%). *E.g. (i) Find 62% of €88.00* *E.g. (ii) 2.5 % of 250 l of water is lost. How much water is lost?*	2.3am Find the percentage of a quantity where the percentage ≥100%. *E.g. (i) Find 120% of 95 m.* *E.g. (ii) The population of a small village is 850. After one years it increased by 140%. How many new people went to live in the village during this year?*
	2.2an Convert percentages to fractions and/or decimals and/or vice versa where the percentage <100%.	2.3an Convert percentages to fractions and/or decimals and/or vice versa where the percentage ≥100%.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
	2.2ao Express a quantity as a percentage of another where the percentage < 100%. *E.g. (i) Express 4 cm a percentage of 20 cm.* *E.g. (ii) The cost price of an item is €45. It is sold for €50.40. Calculate the percentage profit made.* *E.g. (iii) Find percentage increase / decrease / change (excluding percentage error)*	2.3ao Express a quantity as a percentage of another where the percentage ≥ 100% and the percentage error > 0%. *E.g. (i) Express 550 m as percentage of 80 m.* *E.g. (ii) 20 years ago, the price of gold was €9.61 per gram and now it is €56.07 per gram. Calculate the percentage change in the price of gold per gram.* *E.g. (iii) I thought 70 people would turn up to the concert, but in fact 80 did. What is my percentage error?*
	2.2ap Calculate an amount after a percentage increase/decrease where the percentage <100%. E.g. *The price of a tea set is €170 plus VAT. The rate of VAT is 18%. Calculate the cost of the tea set.*	2.3ap Calculate an amount after a percentage increase where the percentage ≥100%. E.g. *When Mark was born, he weighed 3.2 kg. In one year, his weight increased by 180%. Calculate his new weight?*
		2.3aq Work out reverse percentage calculations. *E.g. the cost of a T.V. set including VAT at 18% is €472. Calculate the cost excluding VAT.*
		2.3ar Work through situations involving successive percentage changes
	2.2as Work out the simple interest using the simple interest formula.	2.3as Work out the principal, the rate, the time, or the amount using the simple interest formula.
		2.3at Work out the compound interest, the appreciation and/or depreciation, working step by step.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		2.3au Work out the compound interest, the appreciation and/or depreciation, using the formula. $$A = P\left(1 \pm \frac{r}{100}\right)^n$$ ***where A – final amount; P – principal initial balance; r – interest rate; n - number of times interest applied per time period.***
		2.3av Work out the number of repayments needed to repay a loan.
2.1aw Convert euro to cent and/or vice versa.	2.2aw Convert from one currency to another, using published exchange rates.	2.3aw Convert from one currency to another, using published exchange rates. *Including the use of buying and/or selling rates.*
2.1ax Work through situations that involve finding the correct change.		
2.1ay Work through simple situations involving special offers. *E.g. find the total cost of two items when the cheaper item is sold at half price.*	2.2ay Work through simple situations involving directed numbers, personal and household finance. *E.g. pocket money accrued, how much it will cost to prepare a meal, which item is the best buy when items come in various sizes e.g. oil in one litre bottles vs oil in two litre bottles.*	2.3ay Work through complex situations involving personal and household finance. *E.g. earnings, simple interest, income tax and VAT.* *Excluding loans and compound interest.*
	2.2az Write ratios in their simplest form (including decimal numbers and numbers with different units).	
	2.2ba Find one quantity of a ratio given the other.	

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
	2.2bb Divide a quantity in a given ratio.	
		2.3bc Work through complex situations involving ratios. *Excluding area and volume.* *E.g. A mixture of 900 g contains sugar and flour in the ratio 1:2. How much sugar should be added to change the ratio of the mixture to 2:3?*
	2.2bd Draw scale drawings. *E.g. 2D plans.*	2.3bd Draw scale drawings involving bearings; angles of elevation and depression.
	2.2be Interpret scale drawings. *E.g. 2D plans and maps.*	2.3be Interpret scale drawings. *E.g. bearings; angles of elevation and depression.*
	2.2bf Interpret simple proportion using ratio notation. *E.g. what is the value of □ in: 1:3 = □:6?*	
2.1bg Work through simple situations that involve direct proportion using the unitary method (including price, distance, time, mass, and capacity).		2.3bg Work through situations that involve direct and / or inverse proportion.
	2.2bh Use the rules for multiplying and dividing integer powers of numbers (positive indices) *E.g.* $7^8 \times 7^2 = 7^{10}$, $6^5 \div 6^2 = 6^3$, $(2^3)^5 = 2^{15}$.	2.3bh Use the rules for multiplying and dividing integer powers of numbers (positive, negative and zero indices) *E.g.* $7^8 \times 7^{-5} \div 7 = 7^2$, $6^5 \div 6^{-2} = 6^7$, $(2^3)^{-5} = 2^{-15}$, $9^0 = 1$
		2.3bi Use the rules for multiplying and dividing fractional powers of numbers (positive, negative indices).

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
	2.2bj Evaluate numbers given in index form (positive indices). *E.g. $3^4 = 81$; $2^3 \times 5^2 = 200$.*	2.3bj Evaluate numbers given in index form (positive, negative, zero and **fractional** indices). E.g. $7^0 = 1$; $2^{-1} = ½$; $8^{-2/3} = ¼$.
		2.3bk Apply the four rules on numbers in standard form.
2.1bl Give a rough approximation of calculations involving two-step situations requiring any of the four operations. *E.g. what is the approximate change received after buying three yoghurts costing 26c each, when paying with a €1 coin? Change ≈ 100 – (25x3) = 25c.*	2.2bl Give a rough approximation of calculations requiring any of the four operations. *E.g. $37 \times 5.8 \approx 40 \times 6 = 240$.*	2.3bl Give a rough approximation of the answer of any given calculation. *E.g. $\sqrt{80} \approx 9$; $1.8^3 \approx 8$.*
2.1bm Round any whole number to the nearest powers of ten.		
2.1bn Round up or down decimal numbers to the nearest whole number, depending on the context. *E.g. how many 50 seater buses are needed to transport 130 students? → 130 ÷ 50 = 2.6 rounded up to 3 buses; E.g. how many yoghurts can one buy with €10 if each yoghurt costs €1.15? → €10 ÷ €1.15 = 8.695 rounded down to 8 yoghurts.*		
2.1bo Round a decimal number with two decimal places to the nearest tenth or to the nearest whole number.	2.2bo Round any decimal number up to a given number of decimal places.	2.3bo Round any number to a given number of significant figures.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
2.1bp Use appropriate mathematical terminology such as rough estimate, nearest 10, add, subtract, improper fraction, proportion, etc	2.2bp Use appropriate mathematical terminology such as, decimal places, square root, equivalent fractions, etc.	2.3bp Use appropriate mathematical terminology such as simple interest, scale drawing, inverse proportion, significant figures, etc.
2.1bq Use assistive technology (e.g. tablets and computers) and other resources (e.g. Cuisenaire rods, Unifix cubes, base 10 blocks, fraction wall, euro coins and notes) appropriate to this level to calculate and to learn about numerical calculations.	2.2bq Use assistive technology (e.g. tablets, computers and calculators) and other resources (e.g. Cuisenaire rods, Unifix cubes, base 10 blocks) appropriate to this level to calculate and to learn about numerical calculations.	2.3bq Use assistive technology (e.g. tablets, computers and calculators) and other resources appropriate to this level to calculate and to learn about numerical calculations.
2.1br Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	2.2br Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	2.3br Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.
2.1bs Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	2.2bs Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	2.3bs Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).

Subject Focus:	**Algebra – Fundamentals of Algebra**
Learning Outcome 3: **Paper I and Paper II**	**At the end of the programme, I can demonstrate an understanding of patterns, sequences, algebraic expressions, formulae, equations and inequalities.**

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
3.1a Recognise pictorial patterns, linear number sequences and square number sequences.		
3.1b Extend pictorial patterns, linear number sequences and square number sequences.		
3.1c Write a sequence given the first term and the rule.		
3.1d Tabulate the terms corresponding to the first few stages of a pictorial pattern.	3.2d Determine the terms in the next stages of a pictorial pattern.	
		3.3e Generate the terms of a sequence given the n^{th} term.
		3.3f Describe the n^{th} term of a linear sequence using an algebraic expression. *E.g. $-3n - 1$*
3.1g Evaluate linear expressions by substituting pictures with positive numbers. E.g. Evaluate *△ + 3 x □, given that △=6 and □= 2.*	3.2g Evaluate linear expressions by substituting directed numbers.	3.3g Evaluate non-linear expressions by substituting directed numbers.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
	3.2h Represent unknowns, variables and constants in algebraic expressions using letters. *E.g. If x represents the number of blue boxes and y represents the number of red boxes, give an expression for the total number of boxes. Given that a blue box costs 2 euro and a red box costs 3 euro, write an expression to represent the total cost of buying x blue boxes and y red boxes.*	
	3.2i Simplify linear algebraic expressions by collecting like terms.	3.3i Simplify non-linear algebraic expressions by collecting like terms.
	3.2j Simplify algebraic expressions by multiplying linear terms. *E.g.* $-4 \times 5b$; $-2a \times -3b$ *and* $p \times (-3p)$.	
	3.2k Expand a linear algebraic expression by multiplying a number over a bracket *E.g. Expand:* $-2(a + 3)$; $3(x + 4) + 2(x - 1)$; $2(1 - x) - 3(x + 2)$.	3.3k Expand a non-linear algebraic expression by multiplying a single term over a bracket. *E.g. Expand* $2x(3x + 4y) - x(x - y)$.
		3.3l Expand two brackets of the form $(ax \pm b)(cx \pm d)$ **and** $(ax \pm b)^2$
		3.3m Factorise expressions by using the common factor method. *E.g. Factorise* $3x^2y + 9xy^2$
		3.3n Factorise quadratic expressions involving trinomials and/or difference of two squares.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		3.3o Simplify algebraic fractions with numerical denominators.
		3.3p Use the four operations on algebraic fractions with numerical denominators.
		3.3q Simplify algebraic fractions with linear algebraic denominators. *E.g. Simplify:* $\frac{4}{2x+4}$;
		3.3r Add algebraic fractions with linear and quadratic algebraic denominators.
		3.3s Subtract algebraic fractions with linear and quadratic algebraic denominators.
		3.3t Use the rules for multiplying and dividing integer powers (positive, negative, zero and **fractional** indices). *E.g. (i)* $2a^8 \times 3a^{-5} = 6a^3$ *E.g. (ii)* $6y^5 \div 3y^{-2} = 2y^7$ *E.g. (iii)* $(2c^3)^5 = 32c^{15}$ *E.g. (iv)* $x^0 = 1$ *E.g. (v)* $x^{-2} = \frac{1}{x^2}$ *E.g. (vi)* $x^{-\frac{2}{3}} = \frac{1}{\sqrt[3]{x^2}}$
	3.2u Change the subject of a formula that uses one or two operations.	3.3u Change the subject of the formula that includes squares and square roots.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		3.3v Change the subject of the formula when the same subject letter occurs more than once.
	3.2w Form an equation involving unknown and whole numbers on both sides.	3.3w Form linear equations involving an unknown and integers or fractions on both sides.
3.1x Work through an equation where there are pictures instead of numbers. *E.g. If □ + 6 =16, then □ = 10* *E.g. If □ + □ =24, then □ = 12*	3.2x Solve an equation involving unknown and whole numbers on both sides using the balancing method or other methods.	
	3.2y Solve simple linear equations involving brackets. *E.g. Solve for x: $4(x – 1) = 2x + 6$.*	3.3y Solve linear equations involving fractions with numerical denominators.
	3.2z Work through situations leading to the solution of linear equations in one unknown. *E.g. mystery numbers, geometric shapes, etc.*	
		3.3aa Solve two simultaneous linear equations algebraically.
		3.3ab Solve two simultaneous equations, one linear and one quadratic, algebraically.
		3.3ac Solve quadratic equations by factorisation.
		3.3ad Solve quadratic equations by using the formula.
		3.3ae Solve equations involving algebraic fractions with linear algebraic denominators.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		3.3af Solve equations involving algebraic fractions with quadratic algebraic denominators.
		3.3ag Find approximate solutions to equations for which there is not a simple method of solution using the trial and improvement method. ***E.g. Solve for x: $x^3 - 2x = 100$.***
		3.3ah Solve simple equations using indices when x is a power. ***E.g. Solve for x: $2^x = 8$; $9^x = 3^{x+1}$.***
		3.3ai Represent a simple linear inequality on a number line. *E.g. represent $x \leq 9$ on a number line.*
		3.3aj Solve simple linear inequalities in one variable with one inequality sign. ***E.g. $2x + 5 > 7$.***
		3.3ak Work through situations that use direct and inverse variation ($y \propto x^n$ for n = ±1, ±2, ±3, $\pm\frac{1}{2}$, $\pm\frac{1}{3}$).
3.1al Use appropriate mathematical terminology such as sequence, square numbers, etc.	3.2al Use appropriate mathematical terminology such as term, sequence, evaluate, simplify, expand, subject of the formula, solve the equation, number machine, etc.	3.3al Use appropriate mathematical terminology such as sequence, nth term, simplify, factorise, difference of two squares, index form, subject of the formula, trial and improvement, simultaneous equations, etc.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
3.1am Use assistive technology (e.g. tablets and computers and other resources (e.g. equation balance) appropriate to the level to learn about the fundamentals of algebra.	3.2am Use assistive technology (e.g. tablets and computers and other resources (e.g. equation balance) appropriate to the level to learn about the fundamentals of algebra.	3.3am Use assistive technology (e.g. tablets and computers and other resources (e.g. equation balance) appropriate to the level to learn about the fundamentals of algebra.
3.1an Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	3.2an Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	3.3an Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.
3.1ao Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	3.2ao Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	3.3ao Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).

Subject Focus:	**Algebra – Graphs**
Learning Outcome 4: **Paper I and Paper II**	**At the end of the programme, I can demonstrate an understanding of graphical representations of algebraic functions.**

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
4.1a Read coordinates from a grid in the first quadrant.	4.2a Read coordinates from a grid in all four quadrants.	
4.1b Plot points on a grid in the first quadrant given their coordinates.	4.2b Plot points on a grid in all four quadrants given their coordinates.	
	4.2c Write the coordinates of a set of points for equations of the form y = ± m*x* ± c.	
	4.2d Construct tables of values for linear functions.	4.3d Construct tables of values for quadratic functions.
		4.3e Construct tables of values for cubic and reciprocal functions.
	4.2f Plot the graph of a linear function from a table of values.	4.3f Plot the graph of a quadratic function from a table of values
		4.3g Plot the graph of a cubic function and a reciprocal function from a table of values.
	4.2h Explain what the gradient of a line represents.	

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
	4.2i Recognise that parallel lines have equal gradients.	
	4.2j Recognise that the y-intercept represents the point where a line cuts the y-axis.	
	4.2k Recognise that for the equation $y = mx + c$ the value of m determines the gradient of the graph and the value of c determines the y-intercept.	
	4.2l Find the gradient of a line from the coordinates of any two points on the line.	
	4.2m Write the equation of a straight line given the gradient and the y-intercept.	4.3m Write the equation of a straight line given a pair of coordinates or the line graph.
	4.2n Verify whether a line passes through a point.	
	4.2o Use straight-line graphs to find the value of one coordinate given the other.	
	4.2p Interpret straight-line graphs arising from real life situations. *E.g. conversion graphs, distance–time graph, etc.*	4.3p Interpret non-linear graphs arising from real life situations.
		4.3q Compare information from two or more straight line graphs concerning real life situations.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		4.3r Interpret rates of change in linear graphs. *E.g. speed, distance and time.*
		4.3s Solve two simultaneous linear equations graphically.
		4.3t Solve two simultaneous equations, one linear and one quadratic, graphically.
		4.3u Solve two simultaneous equations, one linear and one cubic, graphically.
		4.3v Solve two simultaneous equations, one linear and one reciprocal, graphically.
		4.3w Identify the maximum value or the minimum value from a quadratic graph.
		4.3x Find the value of a coordinate given the other from a quadratic graph.
		4.3y Solve quadratic equations graphically.
4.1z Use appropriate mathematical terminology such as coordinates, quadrant.	4.2z Use appropriate mathematical terminology such as gradient, intercept, conversion graph.	4.3z Use appropriate mathematical terminology such as plot, straight-line graph, speed, etc.
4.1aa Use assistive technology (e.g. tablets and computers) and other resources appropriate to the	4.2aa Use assistive technology (e.g. tablets and computers) and other resources appropriate to the	4.3aa Use assistive technology (e.g. tablets and computers) and other resources appropriate to the

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
level to learn about graphical representations of algebraic functions.	level to learn about graphical representations of algebraic functions.	level to learn about graphical representations of algebraic functions.
4.1ab Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	4.2ab Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	4.3ab Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.
4.1ac Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	4.2ac Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	4.3ac Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).

Subject Focus:	**Shape, Space and Measure – Measurement**
Learning Outcome 5: Paper I and Paper II	**At the end of the programme, I can demonstrate an understanding of forms of measurement dealing with angles, length, area, volume, capacity, mass and time.**

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
5.1a Label the eight compass points.		
		5.3b Interpret three figure bearings.
		5.3c Interpret diagrams involving three figure bearings.
		5.3d Draw diagrams involving three figure bearings.
5.1e Illustrate that a whole turn is the same as 4 right angles while half a whole turn is the same as 2 right angles.		
5.1f Define an angle as a measure of turn.		
5.1g Illustrate that an angle is a measure of turn.		
5.1h Estimate angles up to 180^0.	5.2h Estimate angles up to 360^0.	
5.1i Sketch angles up to 180^0.	5.2i Sketch angles up to 360^0.	

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
5.1j Measure angles up to 180^0 with a protractor.	5.2j Measure angles up to 360^0 with a protractor.	
5.1k Draw angles up to 180^0 with a protractor.	5.2k Draw angles up to 360^0 with a protractor.	
5.1l Distinguish between acute, right and obtuse angles.	5.2l Distinguish between right, acute, obtuse, and reflex angles.	
		5.3m State Pythagoras' Theorem.
		5.3n Apply Pythagoras' Theorem in 2D shapes to find the length of missing sides.
		5.3o Apply Pythagoras' Theorem in 3D shapes to find the length of missing sides.
		5.3p State the Converse of Pythagoras' Theorem.
		5.3r Apply the Converse of Pythagoras' Theorem to check whether a triangle is right-angled.
		5.3s Recognise that a triangle whose sides are in the ratio of 3:4:5 or in the ratio of 5:12:13 is a right-angled triangle.
		5.3t Define the trigonometric ratios (sine, cosine and tangent) as the ratios of sides in a right-angled triangle.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		5.3u Find unknown lengths and angles in right-angled triangles using the trigonometric ratios.
		5.3v Interpret angles of elevation and depression.
		5.3w Use trigonometric ratios in 2D situations involving angles of elevation/depression and/or bearings.
		5.3x Use trigonometric ratios in 3D situations involving angles of elevation/depression and/or bearings. ***(E.g. Find the angle between a line and a plane; Find the angle between two planes.)***
		5.3y Solve any triangle using the sine and/or the cosine rule.
5.1z Measure line segments.		
5.1aa Define perimeter as the boundary of a 2D shape.		
5.1ab Measure the perimeters of regular and/or irregular polygons.		
5.1ac Calculate the perimeters of regular and/or irregular polygons.		
5.1ad Define the area as the amount of surface of a 2D shape.		

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
5.1ae Use the metric units of area (square kilometres, square metres, square centimetres, square millimetres) including their abbreviations.		
5.1af Recognise that 1 square unit is the area occupied by a square of side length 1 unit. *E.g. 1 square metre (1 m^2) is equivalent to the area of a square of side 1 m.*	5.2af Recognise that 1 cubic unit is the volume occupied by a cube of side length 1 unit. *E.g. 1 cubic centimetre (1 cm^3) is equivalent to the volume of a cube of side 1 cm.*	
5.1ag Express metric measures of area using decimal notation.		
	5.2ah Convert between larger and smaller metric units of mass (kg, g) length (km, m, cm, mm) and capacity (l, ml).	5.3ah Convert between larger and smaller metric units of area and volume.
5.1ai Find the areas of irregular and/or regular shapes by counting unit squares on a grid.		
5.1aj Work out the area of squares and/or rectangles using the formula: Length x breadth.	5.2aj Derive the formula to find the area of a square and/or rectangle.	5.3aj Derive the formula to find the area of a trapezium $A = ½ h(a+b)$.
5.1ak Work out the area of a right-angled triangle by considering it as half a rectangle.	5.2ak Derive formulae to find the area of a parallelogram ($A = bh$), a triangle ($A = bh/2$).	**5.3ak Derive the formula $A = ½ ab \sin C$ for the area of acute-angled and obtuse-angled triangles.**
	5.2al Use formulae to find the area of a parallelogram, a triangle and/or a trapezium.	**5.3al Find the area of acute-angled and obtuse-angled triangles using $A = ½ ab \sin C$.**
5.1am Work out the area of compound shapes that are made up of squares and rectangles	5.2am Calculate the area of compound shapes that include triangles, parallelograms and/or trapezia.	
	5.2an Define the notion of π as the ratio of the circumference to the diameter.	

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
	5.2ao Calculate the circumference of a circle using the appropriate formulae.	
	5.2ap Calculate the area of a circle using the appropriate formula.	
	5.2aq Define the surface area of a solid shape as the total amount of surface of the shape.	
	5.2ar Calculate the surface area of cubes and cuboids.	
	5.2as Define the volume of a solid shape as the amount of space that it occupies.	
	5.2at Calculate the volume of cubes and cuboids using the appropriate formulae.	
	5.2au Calculate the volume of compound shapes made of cubes and cuboids.	
		5.3av Calculate the length of an arc of a circle.
		5.3aw Calculate the area of a sector and/or **segment** of a circle.
		5.3ax Calculate the area of compound shapes that include sectors and/or **segments** of circles.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		5.3ay Derive the formulae for the curved surface area and/or total surface area of a cylinder.
		5.3az Calculate the curved surface area and/or total surface area of a cylinder and/or prism.
		5.3ba Derive the formulae for the volume of a prism and/or a cylinder using the cross-sectional area and height.
		5.3bb Calculate the volume of a prism and/or cylinder.
		5.3bc Calculate the surface area of: a square based right-pyramid, right circular cone and sphere.
		5.3bd Calculate the volume of a: square-based right-pyramid, frustum of a square-based right-pyramid, right circular cone, frustum of a right circular cone, sphere.
		5.3be Calculate the **surface area** and/or volume of compound 3D shapes involving cubes, cuboids, cylinders and/or prisms.
		5.3bf Find missing dimensions of 3D shapes. E.g. A cube has a volume of 1000cm^3. Calculate the length of the side of the cube.
		5.3bg Give appropriate upper and lower bounds for measurement data to a specified accuracy. ***E.g. measured lengths and masses.***

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		5.3bh Obtain appropriate upper and lower bounds to solutions of simple calculations.
5.1bi Convert between larger and smaller units of time (hours, minutes, seconds).	5.2bj Convert between larger and smaller units of time (year, days, hours, minutes, seconds).	
5.1bk Read time to the hour/half hour/quarter hour using terms ‘o’clock’, ‘half past’, ‘quarter past’, and ‘quarter to’.		
5.1bl Write time to the hour/half hour/quarter hour using terms ‘o’clock’, ‘half past’, ‘quarter past’, and ‘quarter to’.		
5.1bm Read, the 12-hour clock (analogue and digital) to 1 minute also using the terms ‘past’ and ‘to’.		
5.1bn Write the 12-hour clock (analogue and digital) to 1 minute also using the terms ‘past’ and ‘to’.		
5.1bo Read the 24-hour clock (analogue and digital).		
5.1bp Convert 12-hour to 24-hour clock times and vice versa.		
5.1bq Interpret a time table, a timeline and/or a calendar.		
5.1br Workout the duration of a time interval, the starting time and/or the finishing time.		
5.1bs Estimate time using seconds, minutes and/or hours.	5.2bs Determine time intervals in days, hours and/or minutes.	

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
5.1bt Measure time using seconds, minutes and/or hours.		
5.1bu Work through situations involving addition and subtraction of time given in hours and minutes.	5.2bu Work through situations involving addition and subtraction of time given in days, hours, minutes and seconds.	5.3bu Interpret time zones.
5.1bv Use appropriate mathematical terminology such as perimeter, area, squares, rectangles, cm^2, compass points, acute angle, obtuse angle, right angle, hours, minutes, seconds, as o'clock, half past, quarter to, timeline, etc.	5.2bv Use appropriate mathematical terminology such as triangle, parallelogram, trapezium, cuboid, volume, acute angle, obtuse angle, reflex angle, protractor, analogue, time interval, calendar, etc.	5.3bv Use appropriate mathematical terminology such as segment, sector, prism, bearings, angle of depression, sine, cosine, tangent etc.
5.1bw Use assistive technology (e.g. tablets, computers and calculators) and other resources (e.g. plastic money, cardboard clocks, 2D and 3D plastic shapes, measuring instruments) appropriate to this level to learn about measures.	5.2bw Use assistive technology (e.g. tablets, computers, and calculators) and other resources (e.g. plastic money, cardboard clocks, 2D and 3D plastic shapes, measuring instruments) appropriate to this level to learn about measures.	5.3bw Use assistive technology (e.g. tablets, computers, and calculators) and other resources appropriate to this level to learn about measures.
5.1bx Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	5.2bx Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	5.3bx Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.
5.1by Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	5.2by Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	5.3by Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).

Subject Focus:	**Shape, Space and Measures – Lines, angles and shapes.**
Learning Outcome 6: **Paper I and Paper II**	**At the end of the programme, I can demonstrate an understanding of the properties of lines, segments, parallel lines, perpendicular lines, transversals, angles, 2D and 3D shapes.**

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
6.1a Identify examples of horizontal and/or vertical lines.	6.2a Explain the difference between a line and a line segment.	
6.1b Draw examples of horizontal and/or vertical lines.		
6.1c Draw examples of parallel lines.		
6.1d Draw examples of perpendicular lines.		
	6.2e Explain what a transversal is in relation to a set of parallel lines.	
	6.2f Identify examples of transversals drawn across a set of parallel lines.	
	6.2g Draw examples of transversals across a set of parallel lines.	
	6.2h Identify vertically opposite angles within a pair of intersecting lines.	
	6.2i Identify alternate angles within sets of parallel lines and transversals.	

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
	6.2j Identify corresponding angles within sets of parallel lines and transversals.	
	6.2k Identify interior angles within sets of parallel lines and transversals.	
	6.2l Work out the size of missing angles in situations involving vertically opposite angles.	
	6.2m Work out the size of missing angles in situations involving alternate angles.	
	6.2n Work out the size of missing angles in situations involving corresponding angles.	
	6.2o Work out the size of missing angles in situations involving interior angles within sets of parallel lines and transversals.	
6.1p State that angles around a point add up to 360°.		
6.1q Work out the size of missing angles in diagrams showing angles at a point.		
6.1r Deduce that the angles on a straight line add up to 180°.		
6.1s Work out the size of missing angles in diagrams showing angles on a straight line.		

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
6.1t Classify a triangle according to the length of its sides and/or the size of its angles.		
6.1u State that the sum of the interior angles of a triangle is 180°.		6.3u Prove that the sum of interior angles of a triangle is 180˚.
6.1v Work out the size of missing interior angles in triangles.	6.2v Use the properties of one or more types of triangles (i.e. equilateral, isosceles, scalene, and/or right-angled triangles).	
	6.2w Use the result that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices.	6.3w Prove that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices.
		6.3x Explain the concept of congruency.
		6.3y Identify congruent shapes.
		6.3z Prove that two triangles are congruent using either one or other of the following properties of congruent triangles: SSS; SAS; ASA; RHS.
		6.3aa Use the fact that two triangles are congruent to find the lengths of missing sides and/or angles in one or the other.
		6.3ab Explain the concept of similarity.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		6.3ac Identify similar shapes.
		6.3ad Prove that two triangles are similar using either one or other of the following properties of similar triangles: (i) the angles of one are respectively equal to the angles of the other (AAA); (ii) the ratio of the three sides of the first triangle is equal to the ratio of the corresponding sides of the other; (iii) one angle of one triangle is equal to one angle of the other triangle and the sides about these equal angles are in the same ratio.
		6.3ae Find missing elements (length and/or angle) in triangles and other flat shapes using similarity.
		6.3af Find missing elements (area and/or volume) in 2D and/or 3D shapes using similarity.
6.1ag Describe the properties of a square and/or rectangle.	6.2ag Describe the properties of a rhombus, parallelogram, trapezium and/or kite.	
	6.2ah Recognise that any 2D shape with four sides is a quadrilateral.	
	6.2ai Classify a quadrilateral according to its properties. *Limited to: square, rectangle, rhombus, parallelogram, trapezium and/or kite.*	.
	6.2aj State that the sum of the interior angles of a quadrilateral is 360°.	6.3aj Prove that the sum of interior angles of a quadrilateral is 360˚.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
	6.2ak Work out the size of missing interior angles of a quadrilateral.	
	6.2al Use the properties of one or more types of quadrilaterals (squares, rectangles, rhombuses, parallelograms, trapeziums, kites, and/or any other quadrilateral).	
6.1am Name a polygon using the number of sides (from 3 to 10 sides).		
6.1an Classify polygons using the number of sides.		
6.1ao Identify between a regular and an irregular polygon.	6.2ao Define a regular polygon as a polygon with all sides equal and all interior angles equal.	
		6.3ap Describe the symmetrical properties of a regular polygon in terms of reflective and/or rotational symmetry.
		6.3aq Derive the sum of the interior angles of any polygon.
		6.3ar Derive the sum of the exterior angles of any polygon.
		6.3as Find missing interior angles using the sum of the interior angles of a polygon.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		6.3at Find missing exterior angles using the sum of the exterior angles of a polygon.
6.1au Identify one or more of the main components of a circle (i.e. centre, radius, diameter, and circumference).		6.3au Identify one or more of the additional main components of a circle (chord, tangent, arc, sector, and segment).
6.1av Name one or more of the main components of a circle (i.e. centre, radius, diameter, and circumference).		6.3av Name one or more of the additional main components of a circle (chord, tangent, arc, sector, and segment).
6.1aw Draw one or more of the main components of a circle (i.e. centre, radius, diameter, and circumference).		6.3aw Draw one or more of the additional main components of a circle (chord, tangent, arc, sector, and segment).
		6.3ax Apply Circle Theorem 1: The angle in a semicircle is a right angle.
		6.3ay Apply Circle Theorem 2: The angle which an arc of a circle subtends at the centre is twice that which it subtends at any other point on the remaining part of the circumference.
		6.3az Apply Circle Theorem 3: Angles in the same segment of a circle are equal.
		6.3ba Apply Circle Theorem 4: The opposite angles of a cyclic quadrilateral are supplementary.
		6.3bb Apply Circle Theorem 5: The exterior angle of a cyclic quadrilateral is equal to the interior opposite angle.
		6.3bc Apply Circle Theorem 6: The angle between the radius and the tangent at the point of contact is a right angle.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		6.3bd Apply Circle Theorem 7: Equal chords are equidistant from the centre.
		6.3be Apply Circle Theorem 8: Chords which are equidistant from the centre of a circle are equal.
		6.3bf Apply Circle Theorem 9: The perpendicular bisector of a chord passes through the centre.
		6.3bg Apply Circle Theorem 10: A straight line drawn from the centre of a circle to bisect a chord is at right angles to the chord.
		6.3bh Apply Circle Theorem 11: If two tangents are drawn to a circle from a point outside the circle, then: (a) the tangents are equal in length; (b) the angle between the tangents is bisected by the line joining the point of intersection of the tangents to the centre; and, (c) this line also bisects the angle between the radii drawn to the points of contact.
		6.3bi Apply Circle Theorem 12: If a straight line touches a circle, and from the point of contact a chord is drawn, the angle which the chord makes with the tangent is equal to the angle in the alternate segment.
6.1bj Recognise a simple 3D shape (i.e. cylinder, cone, sphere, triangular prism and square-based right pyramid).		
6.1bk Name a simple 3D shape (i.e. cylinder, cone, sphere, triangular prism and square-based right pyramid).		

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
6.1bl Recognise a simple 3D shape (i.e. cube, cuboid, cylinder, cone, sphere, triangular prism and square-based right pyramid) from a 2D drawing.		
	6.2bm Draw the plan of a simple 3D shape (i.e. cube and/or cuboid).	6.3bm Draw the plan of a simple 3D shape (i.e. cylinder, cone, triangular prism, and **square-based right pyramid** from a 2D drawing).
	6.2bn Draw the front elevation of a simple 3D shape (i.e. cube, cuboid).	6.3bn Draw the front elevation of a simple 3D shape (i.e. cylinder, cone, triangular prism, and **square-based right pyramid** from a 2D drawing).
	6.2bo Draw the side elevation of a simple 3D shape (i.e. cube, cuboid).	6.3bo Draw the side elevation of a simple 3D shape (i.e., cylinder, cone, triangular prism, and **square-based right pyramid** from a 2D drawing).
6.1bp Identify the faces, edges and/or vertices of simple 3D shape (i.e. cube, cuboid, triangular prism, and pyramid) from a 2D drawing and/or a 3D model.		
6.1bq Identify the flat and curved surfaces of the cylinder, the cone and the sphere from a 2D drawing and/or a 3D model.		
6.1br Count the faces, edges and/or vertices of simple 3D shape (i.e. cube, cuboid, triangular prism, and pyramid) from a 2D drawing and/or a 3D model.		
6.1bs Count the flat and curved surfaces of the cylinder, the cone and the sphere from a 2D drawing and/or a 3D model.		
6.1bt Identify a net as being either that of a closed cube, or that of an open cube, or of neither.	6.2bt Identify a net as being either that of a cuboid, triangular prism, square-based right pyramid, or of neither.	6.3bt Draw the net of a cube, a cuboid, a triangular prism, and/or a square-based right pyramid.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
6.1bu Use appropriate mathematical terminology such as scalene triangle, isosceles triangle, equilateral triangle, right-angled triangle, regular polygon, pentagon, hexagon, horizontal, vertical, perpendicular lines, circle, parallel lines, cylinder, cone, triangular prism, vertices, edges, faces, etc.	6.2bu Use appropriate mathematical terminology such as rhombus, trapezium, kite, vertically opposite, alternate angles, corresponding angles, interior angles, transversal line, centre, circumference, radius, diameter, net of a solid shape, square based pyramid, etc.	6.3bu Use appropriate mathematical terminology such as cyclic quadrilateral, supplementary, complementary, tangent of a circle, equidistant, chord, line, line segment, similar, congruent, hypotenuse, Pythagoras' theorem, side elevation, front elevation, plan of a solid shape, triangular prism, etc.
6.1bv Use assistive technology and other resources (e.g. 2D and 3D plastic shapes) appropriate to this level to learn about lines, angles and shapes.	6.2bv Use assistive technology (and other resources (e.g. 2D and 3D plastic shapes) appropriate to this level to learn about lines, angles and shapes.	6.3bv Use assistive technology and other resources appropriate to this level to learn about lines, angles and shapes.
6.1bw Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	6.2bw Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	6.3bw Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.
6.1bx Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	6.2bx Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	6.3bx Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).

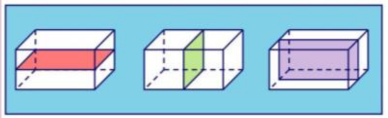
Subject Focus:	**Shape, Space and Measures – Constructions and loci**
Learning Outcome 7: **Paper I and Paper II**	**At the end of the programme, I can demonstrate an understanding of the construction of angles, lines, triangles, circles, others polygons and loci in 2D.**

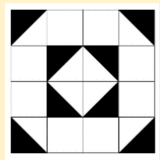
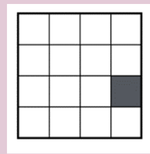
Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
7.1a Construct a circle of a given radius using a pencil, a ruler, and a pair of compasses only.		
	7.2b Construct a 60° angle using a pencil, a straight-edge, and a pair of compasses only.	
	7.2c Construct a 90° angle using a pencil, a straight-edge, and a pair of compasses only.	
	7.2d Construct the perpendicular bisector of a line segment using a pencil, a straight-edge, and a pair of compasses only.	
	7.2e Construct the perpendicular from a point to a line using a pencil, a straight-edge, and a pair of compasses only.	
	7.2f Construct the perpendicular at a point on a line using a pencil, a straight-edge, and a pair of compasses only.	
	7.2g Construct the angle bisector of a pair of intersecting lines using a pencil, a straight-edge, and a pair of compasses only.	

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
	7.2h Construct a triangle given the length of one side and two angles using a pencil, a ruler, and a protractor only.	
	7.2i Construct a triangle given the length of two sides and the included angle using a pencil, a ruler, and a protractor only.	
	7.2j Construct a triangle given the length of three sides using a pencil, a ruler, and a pair of compasses only.	7.3j Construct a triangle given various conditions using a pencil, a ruler and a pair of compasses only.
	7.2k Construct a triangle containing a 60° angle using a ruler and a pair of compasses only.	
	7.2l Construct a right-angled triangle using a ruler and a pair of compasses only.	
	7.2m Construct a regular hexagon using a ruler and a pair of compasses only.	7.3m Construct a regular polygon using some of the following tools: a pencil, a ruler, a protractor, and a pair of compasses.
		7.3n Explain what a locus of a point is.
		7.3o Use a ruler and a pair of compasses only to construct the locus of a point which is at a fixed distance from a given point.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		7.3p Use a ruler and a pair of compasses only to construct the locus of a point which is equidistant from a straight line and/or line segment.
		7.3q Use a ruler and a pair of compasses only to construct the locus of a point which is equidistant from two given points.
		7.3r Use a ruler and a pair of compasses only to construct the locus of a point which is equidistant from two intersecting straight lines and/or line segments.
		7.3s Work through situations involving intersecting loci and regions using appropriate loci constructions.
	7.2t Use appropriate mathematical terminology such as construct, straight-edge, compasses, etc.	7.3t Use appropriate mathematical terminology such as angle bisector, locus, etc.
7.1u Use assistive technology (e.g. tablets, computers, mathematical instruments) and other resources appropriate to this level to learn about constructions.	7.2u Use assistive technology (e.g. tablets, computers, mathematical instruments) and other resources appropriate to this level to learn about constructions.	7.3u Use assistive technology (e.g. tablets, computers, mathematical instruments) and other resources appropriate to this level to learn about constructions.
7.1v Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	7.2v Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	7.3v Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.
7.1w Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	7.2w Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	7.3w Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).

Subject Focus:	**Shape, Space and Measures - Transformations**
Learning Outcome 8: **Paper I and Paper II**	**At the end of the programme, I can demonstrate an understanding of position and movement of shapes in a plane.**

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
8.1a Recognise reflective symmetry in regular polygons.		
8.1b Identify lines of symmetry in 2D shapes and pictures. *E.g. flags and dominoes.*		
8.1c Draw lines of symmetry in 2D shapes and pictures. *E.g. flags and dominoes.*		**8.3c Identify planes of symmetry in simple 3D shapes.** 
8.1d Classify triangles using reflective symmetry.	8.2d Classify quadrilaterals (square, rectangle, parallelogram, trapezium, rhombus and kite) using reflective symmetry.	
8.1e Complete symmetrical patterns given one and/or two lines of symmetry at right angles.	8.2e Draw reflections in the x-axis, y-axis, y = ±c and/or x = ±c.	8.3e Draw reflections in the line y = ±x.
		8.3f Explain informally that reflections preserve length and angle.
	8.2g Describe reflections in the x-axis, y-axis, y = ±c and/or x = ±c.	8.3g Describe reflections in the line y = ±x.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
8.1h Recognise clockwise and/or anticlockwise rotations in multiples of 45° based on the 8 compass points. *E.g. if you are facing South what direction will you face if you turn 90° clockwise?*	8.2h State the order of rotational symmetry of a regular polygon.	
	8.2j State the order of rotational symmetry of 2D shapes and/or partly shaded 2D shapes. *E.g.*  	8.3j Complete the shading of a given 2D shape to obtain a shape of a required order of rotational symmetry. *E.g. Shade the least number of squares in this shape so that it has a rotational symmetry of order 4.* 
	8.2k Draw the rotation of a simple shape about any vertex of the shape and/or about the origin by angles of 90° and/or 180° using transparencies or otherwise.	**8.3k Find the centre of rotation by inspection and/or by construction.** *Limited to angles of rotation of 90^o and 180^o.*
	8.2l Describe the rotation of a simple shape about any vertex and/or about the origin using angles of 90°and/or 180°.	8.3l Explain informally that rotations preserve length and angle.
8.1m Move a point right, left, up and/or down on a grid.	8.2m Draw translations using a column translation vector.	
	8.2n Describe translations using a column translation vector.	8.3n Explain informally that translations preserve length and angle.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		8.3o Describe enlargements of a simple shape by a scale factor about a centre of enlargement.
		8.3p Draw the enlargement of a shape, given the centre of enlargement, using positive scale factors (integral and/or fractional).
		8.3q Explain informally that enlargements preserve angle but not length.
		8.3r Distinguish between reflection, rotation, translation and enlargement in terms of congruency and/or similarity.
		8.3s Transform 2D shapes by a combination of reflections, rotations, translations and enlargements.
	8.2t Create tessellating shapes.	
	8.2u Draw a tessellation.	
8.1v Use appropriate mathematical terminology such as lines of symmetry, clockwise, left, right, rotation, etc.	8.2v Use appropriate mathematical terminology such as translation, reflection, rotational symmetry, etc.	8.3v Use appropriate mathematical terminology such as tessellation, scale factor, centre of rotation, enlargement, etc.
8.1w Use assistive technology (e.g. tablets and computers) and other resources (e.g. 2D and 3D plastic shapes) appropriate to this level to learn about transformation geometry.	8.2w Use assistive technology (e.g. tablets and computers) and other resources (e.g. 2D and 3D plastic shapes) appropriate to this level to learn about transformation geometry.	8.3w Use assistive technology (e.g. tablets and computers) and other resources (e.g. 2D and 3D plastic shapes) appropriate to this level to learn about transformation geometry.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
8.1x Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	8.2x Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	8.3x Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.
8.1y Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	8.2y Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	8.3y Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).

Subject Focus:	**Data Handling and Chance - Statistics**
Learning Outcome 9: **Paper I and Paper II**	**At the end of the programme, I can demonstrate an understanding of measures of central tendency, measures of dispersion and graphical representation of data**.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
9.1a Collect data.		9.3a Distinguish between discrete and continuous data.
9.1b Classify data according to given criteria. *E.g. Classify numbers according to whether they are odd or even.*		9.3b Represent data in the form of an inequality. *E.g. The age P in years of Under 21 players should be at least 16 years but less than 21 i.e. 16 ≤ P < 21.*
9.1c Sort data. *E.g. Sort a deck of playing cards according to criteria selected by the learner (picture vs non picture cards).*		
9.1d Read a frequency table.		**9.3d Read a cumulative frequency table and/or a cumulative frequency graph.**
9.1e Interpret a frequency table.		**9.3e Interpret a cumulative frequency table and/or a cumulative frequency graph.**
		9.3f Compare two cumulative frequency tables and/or cumulative frequency graphs.
9.1g Construct a frequency table using a tally column.	9.2g Construct a frequency table with grouped and/or ungrouped discrete data.	9.3g Construct a frequency table using grouped continuous data.
		9.3h Construct a cumulative frequency table.
		9.3i Draw a cumulative frequency graph from a cumulative frequency table.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
9.1j Read a bar chart and/or line graph.	9.2j Interpret a bar chart and/or line graph.	9.3j Interpret stacked and/or clustered bar charts. *Limited to a maximum of 3-section stacked/clustered bar charts.*
9.1k Construct a bar chart and/or line graph.	9.2k Construct a bar chart using grouped and/or ungrouped discrete data from a frequency table.	9.3k Construct stacked and/or clustered bar charts. *Limited to a maximum of 3-section stacked/clustered bar charts.*
9.1l Read a pictograph where the symbol represents a number of units.		
9.1m Interpret a pictograph where the symbol represents a number of units.		
9.1n Draw a pictograph where the symbol represents a number of units.		
	9.2o Interpret pie charts.	
	9.2p Construct pie charts.	
		9.3q Interpret a histogram with equal class intervals.
		9.3r Construct a histogram with equal class intervals.
		9.3s Interpret a histogram with unequal class intervals.
		9.3t Construct a histogram with unequal class intervals.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
9.1u Interpret a given Carroll diagram.		
9.1v Complete a Carroll diagram.	9.2v Construct a Carroll diagram.	
	9.2w Work through a situation involving data in tables and/or statistical diagrams.	
	9.2x Compare data from two tables and/or statistical diagrams.	
9.1z Find the mean of a set of ungrouped data.	9.2z Find the mean of a set of ungrouped data from a frequency table.	
		9.3aa Find an estimate of the mean of a set of grouped data from a frequency table.
9.1ab Work out the total amount given the mean and the number of items.	9.2ab Differentiate between the mean, median, mode of a set of ungrouped data.	
	9.2ac Work through situations involving the mean, mode, median and/or range.	
	9.2ad Decide when best to use each type of average using words like “outlier”.	
9.1ae Find the median of a set of ungrouped data.	9.2ae Find the median of a set of ungrouped data from a frequency table.	

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		9.3af Find the class interval in which the median of a set of data lies from a grouped frequency table.
9.1ag Find the mode of a set of ungrouped data.	9.2ag Find the mode of a set of ungrouped data from a frequency table.	9.3ag Identify the modal class from a grouped frequency table.
9.1ah Find the range of a set of ungrouped data.	9.2ah Find the range of a set of ungrouped data from a frequency table.	
		9.3ai Explain what the median, quartiles and/or the interquartile range of a set of data represent.
		9.3aj Estimate the median, the quartiles and/or the interquartile range from a cumulative frequency graph.
		9.3ak Interpret box-and-whisker plots.
		9.3al Draw box-and-whisker plots.
9.1am Use appropriate mathematical terminology such as tally, pictograph, mean, Carroll diagram, etc.	9.2am Use appropriate mathematical terminology such as median, mode, data, bar chart, pie-chart, etc.	9.3am Use appropriate mathematical terminology such as discrete data, continuous data, histogram, stacked bar-chart, clustered bar-chart, etc.
9.1an Use assistive technology (e.g. tablets and computers) and other learning resources to learn about statistics.	9.2an Use assistive technology (e.g. tablets, computers and calculators) and other learning resources to learn about statistics.	9.3an Use assistive technology (e.g. tablets, computers and calculators) and other learning resources to learn about statistics.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
9.1ao Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	9.2ao Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	9.3ao Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.
9.1ap Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	9.2ap Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	9.3ap Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).

Subject Focus:	**Data Handling and Chance - Probability**
Learning Outcome 10: Paper I and Paper II	**At the end of the programme, I can demonstrate an understanding of the probabilities associated with certain, uncertain and impossible events.**

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
10.1a Mention events that are certain to happen, and others that are impossible.		
10.1b Identify events as certain, very likely, likely, equally likely (even chance), unlikely, very unlikely and/or impossible.		
	10.2c Estimate the probability of an event by experiment.	
	10.2d Determine the probability of an event. *E.g. the probability of getting 4 when throwing a die = 1/6; the probability of not getting a 4 when throwing a die = 5/6.*	10.3d Determine the probability of an event from a frequency table.
	10.2e Distinguish between experimental and theoretical probability.	
	10.2f Deduce that the probability of a certain event is 1 and the probability of an impossible event is 0.	
	10.2g Mark the probability on a probability scale.	

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
	10.2h Identify the set of all possible outcomes of a single event. *E.g. Picking a counter from a bag containing two red counters (R_1, R_2) and one blue counter (B). The possible outcomes are: picking R_1, picking R_2 or picking B.*	
	10.2i Identify the set of all possible outcomes of two independent events. *E.g. One bag contains two red counters (R_1, R_2) and a blue counter (B). Another bag contains a red counter (R_3) and a green counter (G). One counter is picked from each bag. The possible outcomes are six: R_1R_3; R_1G; R_2R_3; R_2G; BR_3; and BG.*	
	10.2j Deduce that the probability of all mutually exclusive outcomes adds up to 1.	10.3j Work out the probability of mutually exclusive events.
	10.2k Construct a possibility space for two independent events.	
	10.2l Work out the probability of two independent events using a possibility space.	
		10.3m Distinguish between dependent and independent events.
		10.3n Construct a probability tree (tree diagram) for up to three independent and/or dependent events.

Assessment Criteria (Level 1)	Assessment Criteria (Level 2)	Assessment Criteria (Level 3)
		10.3o Use a probability tree (tree diagram) to work out the probability of up to three independent and/or dependent events.
10.1p Use appropriate mathematical terminology such as event, likely, even chance, certain, etc.	10.2p Use appropriate mathematical terminology such as event, likely, even chance, certain, outcome, possibility space, etc.	10.3p Use appropriate mathematical terminology such as mutually exclusive, etc.
10.1q Use assistive technology (e.g. tablets, computers, and calculators) and other learning resources to learn about probability.	10.2q Use assistive technology (e.g. tablets, computers and calculators) and other learning resources to learn about probability.	10.3q Use assistive technology (e.g. tablets, computers and calculators) and other learning resources to learn about probability.
10.1r Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	10.2r Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.	10.3r Use appropriate mathematical processes to work on tasks and/or activities that are related to mathematical content at this level and which involve one or more modes of assessment such as solving, investigating, modelling, maths trails, and research projects.
10.1s Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	10.2s Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).	10.3s Work on tasks and/or activities, including word-problems, that are related to mathematical content at this level (through the use of assistive technology or mental work).

Scheme of Assessment

School candidates

The assessment consists of Paper I and Paper II. Paper I consists of unmoderated school-based assessment (SBA) that is to be set and assessed by the school. Paper II consists of a controlled assessment that will take place at the end of the three-year programme.

School-based assessment (SBA): is any type of assessment of a candidate made by the school relevant to the respective SEC syllabus contributing to the final level awarded in the subject.

Controlled assessment: is comprised of a two-hour written exam set at the end of the programme and differentiated between three tiers:

a. Levels 1 and 2;
b. Levels 2 and 3;
c. Levels 3 and 3*.

Candidates are to satisfy the examiner in Paper I and Paper II to obtain a level higher than 1.

Paper I – School Based Assessment: 30% of the total marks;

The school-based assessment shall be marked out of 100 each year (9, 10 and 11). The assessment for each year will contribute to 10% of the overall mark and will be reported to MATSEC by the school in Year 11. Therefore, each year will equally contribute to the final mark of the school-based assessment. The school-based assessment shall reflect the MATSEC syllabus covered in Year 9, Year 10 and Year 11.

School-based assessment can be pegged at either of two levels:

- SBA at level 1-2 must identify assessment criteria from these two levels. It is suggested that ACs are weighted at a ratio of 40% at Level 1 and 60% at Level 2.
- SBA at level 1-2-3 must identify assessment criteria from each of Levels 1, 2, and 3. It is suggested that ACs are weighted at a ratio of 30% at each of Levels 1 and 2, and 40% at Level 3.

The mark for SBA at level 1-2 presented for a qualification at level 2-3 is to be recalculated to 60% of the original mark. The mark stands in all other cases.

Paper II: Controlled Assessment (70% of the total mark)

Written Examination (100 marks; 2 hours)

- Controlled Assessment:
  - will cover all learning outcomes;
  - be marked out of 100 and all questions are compulsory - answers are to be written on the examination paper provided.
    - Controlled Paper 1-2 will consist of 10 – 15 questions:
      - 40% of the marks allotted will be based on Assessment Criteria from Level 1
      - 60% of the marks allotted will be based on Assessment Criteria from Level 2
    - Controlled Paper 2-3 will consist of 10 – 15 questions:
      - 40% of the marks allotted will be based on Assessment Criteria from Level 2
      - 60% of the marks allotted will be based on Assessment Criteria from Level 3
    - Controlled Paper 3-3* will consist of 9 – 13 questions:
      - 40% of the marks allotted will be based on Assessment Criteria from Level 3
      - 60% of the marks allotted will be based on **Extension Assessment Criteria** at Level 3

Private Candidates

Private candidates will not be expected to carry out any school-based assessment as school candidates. Instead, private candidates need to sit for another Controlled paper as an alternative to the school-based assessment. Private candidates will be assessed through the means of **TWO** Controlled papers, one of which is common with school candidates.

Paper I : Controlled Assessment I – Private Candidates Only (30% of the total mark)

Written Examination (100 marks; 2 hours)

Paper I for private candidates shall be a controlled assessment assessing levels 1, 2 and 3 as described in the respective syllabus and set and marked by MATSEC. It shall mainly focus on the learning outcomes marked in the respective syllabi as suggested for school-based assessment.

Learning outcomes with assessment criteria in the psychomotor domain can be assessed by asking questions in pen-and-paper format seeking understanding of the activity.

- Controlled Assessment:
  - Will consist of 12-15 questions at levels 1-2-3
  - will be marked out of 100 and all questions are compulsory - answers are to be written on the examination paper provided;

Paper II is common with school candidates.

General notes

- Candidates who intend to further their study in Mathematics and Science subjects at Intermediate Level or Advanced Level are STRONGLY advised to sit for Paper 3-3*.
- Questions will be set in English and must be answered in English.
- Candidates are expected to abide by the following principles of good mathematical practice:
  - inclusion of justifications in solutions whenever appropriate;
  - inclusion of all appropriate steps in solutions to problems.
- Questions will typically involve numerical calculations, approximations, estimations, data and graphical interpretations, application of formulae, recall and applications of properties of shapes, recall and applications of mathematical facts.
- To answer these questions, particularly those involving numerical calculations, candidates are advised to choose and use the more efficient techniques (mental and pencil-and-paper). They are expected to have a range of strategies to aid mental calculations of unknown facts from facts that can be rapidly recalled.
- Candidates are allowed to use mathematical instruments and scientific calculators with statistical functions. Programmable calculators are not allowed.
- Candidates are allowed to use transparencies for drawing transformations.
- It is very important that candidates see and make connections between strands.
- The overall weighting (±6%) in the controlled papers for each of the four strands is shown below:

	Number	**Algebra**	**Shape, Space & Measures**	**Data Handling & Chance**
Paper 3-3*	20%	35%	30%	15%
Paper 2-3	20%	35%	30%	15%
Paper 1-2	35%	20%	35%	10%

Results

School Candidates

School Candidates sitting for Paper II **Level 1-2** may qualify for Grades **6**, **7 or 8**. The results for candidates who do not obtain at least a Grade **8** shall remain Unclassified (**U**).

School Candidates sitting for Paper II **Level 2-3** may qualify for Grades **4, 5, 6 or 7**. The results for candidates who do not obtain at least a Grade **7** shall remain Unclassified (**U**).

School Candidates sitting for Paper II **Level 3-3* (Extension Assessment Criteria)** may qualify for Grades **1, 2, 3, 4, or 5**. The results for candidates who do not obtain at least a Grade **5** shall remain Unclassified (**U**).

Private Candidates

Private Candidates sitting for Controlled Assessment I, **Level 1-2-3**, and Controlled Assessment II, **Level 1-2,** may qualify for Grades **6**, **7 or 8**. The results for candidates who do not obtain at least a Grade **8** shall remain Unclassified (**U**).

Private Candidates sitting for Controlled Assessment I **Level 1-2-3**, and Controlled Assessment II, **Level 2-3,** may qualify for Grades **4, 5, 6** or **7**. The results for candidates who do not obtain at least a Grade **7** shall remain Unclassified (**U**).

Private Candidates sitting for Controlled Assessment I **Level 1-2-3**, and Controlled Assessment II, **Level 3-3* (Extension Assessment Criteria),** may qualify for Grades **1, 2, 3, 4 or 5**. The results for candidates who do not obtain at least a Grade **5** shall remain Unclassified (**U**).

Table of Formulae

A table of the formulae reproduced below will be provided for the use of the candidates. These formulae will be provided for Paper 3 – 3* (Extension Assessment Criteria) only.

Area of a Triangle	½ $ab \sin C$
Curved Surface Area of Right Circular Cone	πrl
Surface Area of a Sphere	$4\pi\, r^2$
Volume of a Pyramid /Right Circular Cone	$\frac{1}{3} base\ area\ \times\ perpendicular\ height$
Volume of Sphere	$\frac{4}{3}\pi r^3$
Solutions of ax^2 + bx + c = 0	$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
Sine formula	$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
Cosine formula	$a^2\ = b^2 + c^2 - 2bc\ cosA$
Compound Interest / Appreciation & Depreciation	$A = P\left(1 \pm \frac{r}{100}\right)^n$