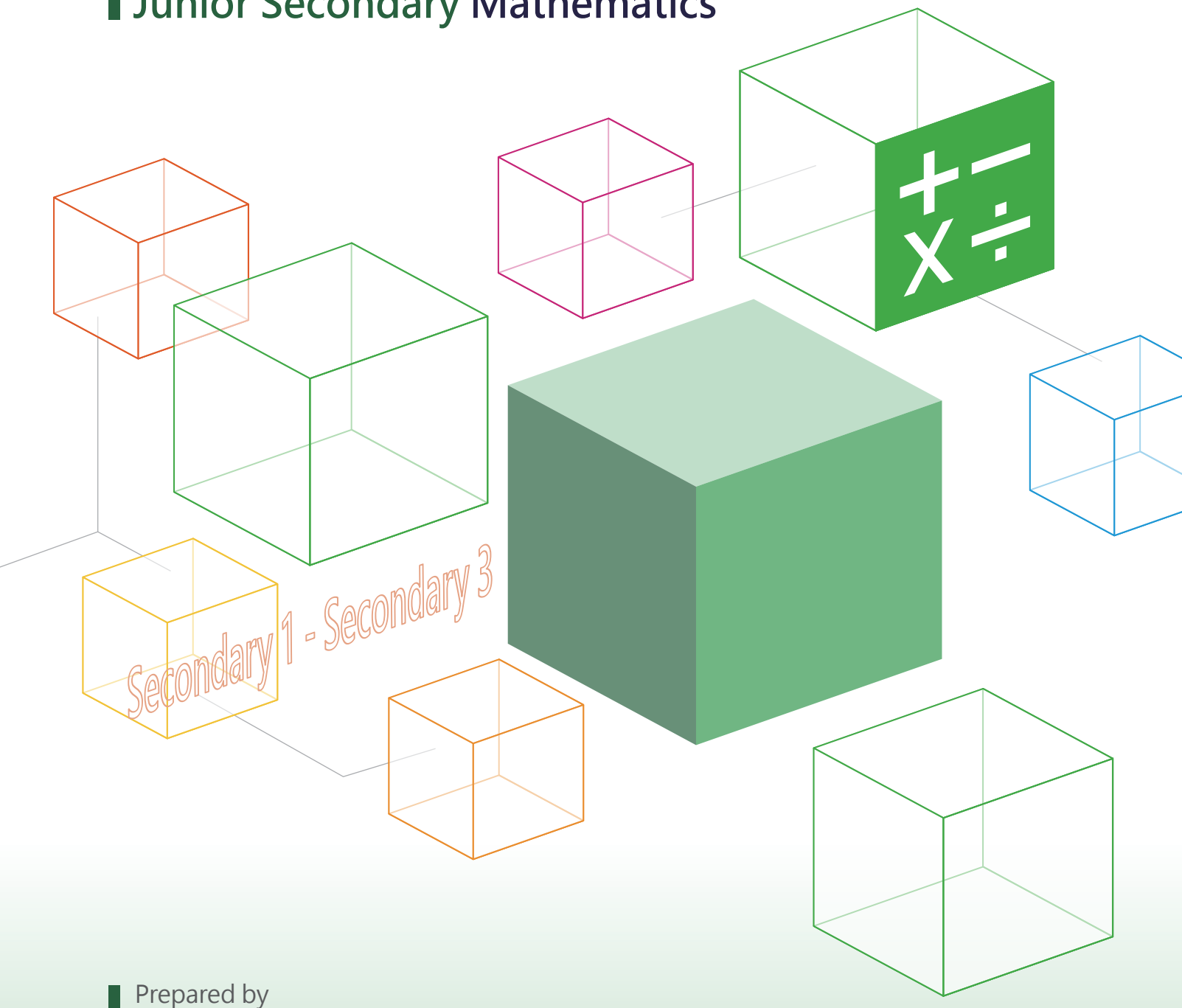
Supplement to Mathematics Education Key Learning Area Curriculum Guide

Learning Content of Junior Secondary Mathematics



Prepared by
The Curriculum Development Council

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Preamble

In response to the need to keep abreast of the ongoing renewal of the school curriculum and the feedback collected from the New Academic Structure Medium-term Review and Beyond conducted from November 2014 to April 2015, and to strengthen vertical continuity and lateral coherence, the Curriculum Development Council Committee on Mathematics Education set up three Ad Hoc Committees in December 2015 to review and revise the Mathematics curriculum from Primary 1 to Secondary 6. The development of the revised Mathematics curriculum is based on the curriculum aims of Mathematics education, guiding principles of curriculum design, and assessment stipulated in *Mathematics Education Key Learning Area Curriculum Guide (Primary 1 - Secondary 6)* (2017).

This booklet is one of the series *Supplement to Mathematics Education Key Learning Area Curriculum Guide (Primary 1 - Secondary 6)* (2017), aiming at providing a detailed account of:

1. the learning targets of the junior secondary Mathematics curriculum;
2. the learning content of the junior secondary Mathematics curriculum; and
3. the flow chart showing the progression pathways for the learning units of junior secondary Mathematics curriculum.

Comments and suggestions on this booklet are most welcomed. They may be sent to:

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Chapter 1 Learning targets

Learning Targets of Junior Secondary Mathematics Curriculum		
Number and Algebra Strand	Measure, Shape and Space Strand	Data Handling Strand
Students are expected to:		
• recognise the concepts of negative integers, negative rational numbers and irrational numbers; • further use numbers to formulate and solve problems; • investigate and describe relationships between quantities using algebraic symbols, including patterns of sequences of numbers; • interpret simple algebraic relations from numerical, symbolic and graphical perspectives; • manipulate simple algebraic expressions and relations; and apply the knowledge and skills to formulate and solve simple real-life problems and justify the validity of the results obtained; and	• recognise errors in measurement and apply the knowledge to solve problems; • extend concepts and formulae of measurements of 2-dimensional figures and 3-dimensional figures and apply the knowledge to solve problems; • explore and visualise the geometric properties of 2-dimensional figures and 3-dimensional figures; • use inductive and deductive approaches to study the properties of 2-dimensional rectilinear figures; • perform geometric proofs involving 2-dimensional rectilinear figures with appropriate symbols, terminology and reasons;	• recognise the methods of organising discrete and continuous statistical data; • further choose appropriate statistical charts to represent given data and interpret them; • understand the measures of central tendency; • select and use the measures of central tendency to describe and compare data sets; • investigate and judge the validity of arguments derived from data sets; • recognise the concept of probability and apply the knowledge to solve simple probability problems; and

Learning Targets of Junior Secondary Mathematics Curriculum		
Number and Algebra Strand	Measure, Shape and Space Strand	Data Handling Strand
Students are expected to:		
• apply the knowledge and skills in the Number and Algebra strand to formulate and solve problems in other strands.	• inquire and describe geometric knowledge in 2-dimensional space using algebraic relations and apply the knowledge to solve problems; • inquire and describe geometric knowledge in 2-dimensional space using trigonometric ratios and apply the knowledge to solve problems; and • apply the knowledge and skills in the Measures, Shape and Space strand to formulate and solve problems in other strands.	• integrate the knowledge in statistics and probability to solve simple real-life problems.

Chapter 2 Learning content

Learning Content of Junior Secondary Mathematics Curriculum

Notes:

1. *Learning units are grouped under three strands ("Number and Algebra", "Measures, Shape and Space" and "Data Handling") and a Further Learning Unit.*
2. *Related learning objectives are grouped under the same learning unit.*
3. *The learning objectives underlined are the Non-foundation Topics and the learning objectives with asterisks (**) are the Enrichment Topics.*
4. *The notes in the "Remarks" column of the table may be considered as supplementary information about the learning objectives.*
5. *To aid teachers in judging how far to take a given topic, a suggested lesson time in hours is given against each learning unit. However, the lesson time assigned is for their reference only. Teachers may adjust the lesson time to meet their individual needs.*
6. *The total lesson time for junior secondary Mathematics curriculum is 331 – 413 hours (i.e. 12% – 15% of the total lesson time available for the junior secondary curriculum).*

Learning Unit	Learning Objective	Time	Remarks
Number and Algebra Strand			
1. Basic computation	1.1 recognise the tests of divisibility of 4, 6, 8 and 9	8	At Key Stage 2, students are required to recognise the tests of divisibility of 2, 3, 5 and 10.

Learning Unit	Learning Objective	Time	Remarks
	1.2 understand the concept of power		Computations involving powers are **not** required.
	1.3 perform prime factorisation of positive integers		
	1.4 find the greatest common divisor and the least common multiple		Students are required to use prime factorisation and short division to find the greatest common divisor and the least common multiple. At Key Stage 2, students are required to find the greatest common divisor and the least common multiple of two numbers by listing their multiples and factors, and using short division. The terms “H.C.F.”, “gcd”, etc. can be used.
	1.5 perform mixed arithmetic operations of positive integers involving multiple levels of brackets		

Learning Unit	Learning Objective	Time	Remarks
	1.6 perform mixed arithmetic operations of fractions and decimals		At Key Stage 2, students are required to perform mixed arithmetic operations of three numbers (including fractions and integers). In the mixed operations of addition and subtraction involving three fractions with different denominators, all denominators should not exceed 12. The above restrictions are no longer applicable at Key Stage 3, but complicated operations should be avoided. Note: Teachers are suggested to arrange this learning unit as the first one to be taught at this key stage.
2. Directed numbers	2.1 understand the concept of directed numbers	9	Students are required to represent the directed numbers on the number line. Students are required to compare the magnitude of directed numbers.

Learning Unit	Learning Objective	Time	Remarks
	2.2 perform mixed arithmetic operations of directed numbers 2.3 solve problems involving directed numbers		
3. Approximate values and numerical estimation	3.1 recognise the concept of approximate values 3.2 understand the estimation strategies 3.3 solve related real-life problems	6	Students are required to round off a number to a certain number of significant figures, a certain place and a certain number of decimal places. At Key Stage 2, students are required to round off a whole number to a certain place and round off a decimal to the nearest tenths or hundredths. The estimation strategies include rounding off, rounding up and rounding down.

Learning Unit	Learning Objective	Time	Remarks
	3.4 **design numerical estimation strategies according to the contexts and judge the reasonableness of the results obtained		
4. Rational and irrational numbers	4.1 recognise the concept of *n*th root	7	Computations involving *n*th roots are **not** required. Students are required to evaluate expressions such as $\sqrt[3]{-8}$.
	4.2 recognise the concepts of rational and irrational numbers		Students are required to represent rational and irrational numbers on the number line.
	4.3 perform mixed arithmetic operations of simple quadratic surds $a\sqrt{b}$		In the simple quadratic surds $a\sqrt{b}$, a is a rational number, b is a positive rational number and $a\sqrt{b}$ is an irrational number. The computations such as the following examples are required:

Learning Unit	Learning Objective	Time	Remarks
	4.4 **explore the relation between constructible numbers and rational and irrational numbers		• $\sqrt{3}+\sqrt{12}=3\sqrt{3}$ • $\frac{8}{3\sqrt{2}}=\frac{4\sqrt{2}}{3}$ The complicated mixed arithmetic operations are not required, for example, $\frac{1}{2+\sqrt{3}}=2-\sqrt{3}$.
5. Using percentages	5.1 understand the concept of percentage changes	15	Percentage increase and percentage decrease are required. Percentage change can also be called "percentage of change".

Learning Unit	Learning Objective	Time	Remarks
	5.2 solve related real-life problems		The problems include those about discount and profit or loss, growth and depreciation, simple and compound interests, successive and component changes, and salaries tax.
6. Rates, ratios and proportions	6.1 understand the concepts of rates, ratios and proportions 6.2 solve problems involving rates, ratios and proportions	8	Direct and inverse proportions are required. Students are required to solve problems about plans involving scales. Problems involving similar figures are tackled in Learning Objectives 18.3 and 22.3. Teachers may consider using real-life examples or related learning elements in Science Education or Technology Education KLAs to enhance learning and teaching.

Learning Unit	Learning Objective	Time	Remarks
7. Algebraic expressions	7.1 represent word phrases by algebraic expressions	7	Notations such as ab representing $a \times b$, $\frac{a}{b}$ representing $a \div b$, are required. Students are required to use algebraic expressions to represent formulae, for example, the formula of the area of a triangle $A = \frac{bh}{2}$ that was learnt at Key Stage 2.
	7.2 represent algebraic expressions by word phrases		
	7.3 recognise the concept of sequences of numbers		Students are required to guess the next term of a sequence and give explanations. Students are required to find a particular term from the general term of a sequence. Sequences of odd numbers, even numbers, square numbers, and triangular numbers are required.

Learning Unit	Learning Objective	Time	Remarks
	7.4 recognise the preliminary idea of functions		The concept of input-processing-output is required. Note: The algebraic expressions discussed in this Learning Unit are confined to expressions involving addition, subtraction, multiplication, division and powers of numbers or variables.
8. Linear equations in one unknown	8.1 solve linear equations in one unknown 8.2 formulate linear equations in one unknown from a problem situation 8.3 solve problems involving linear equations in one unknown	7	
9. Linear equations in two unknowns	9.1 understand the concept of linear equations in two unknowns and their graphs	12	Students should understand: • the graph of a linear equation in two

Learning Unit	Learning Objective	Time	Remarks
			unknowns is a straight line • the coordinates of every point lying on a straight line satisfy the corresponding linear equation in two unknowns • the coordinates of every point not lying on a straight line do not satisfy the corresponding linear equation in two unknowns
	9.2 solve simultaneous linear equations in two unknowns by the graphical method		Students are required to recognise that the exact values of the solutions may not be obtained by the graphical method.
	9.3 solve simultaneous linear equations in two unknowns by the algebraic methods		The algebraic methods include substitution and elimination. The simultaneous equations include those with: • no solutions

Learning Unit	Learning Objective	Time	Remarks
	9.4 formulate simultaneous linear equations in two unknowns from a problem situation 9.5 solve problems involving simultaneous linear equations in two unknowns		• only one solution • more than one solution
10. Laws of integral indices	10.1 understand the laws of positive integral indices	11	The laws of positive integral indices include: • $a^p a^q = a^{p+q}$ • $\frac{a^p}{a^q} = a^{p-q}$ • $(a^p)^q = a^{pq}$ • $a^p b^p = (ab)^p$ • $\frac{a^p}{b^p} = \left(\frac{a}{b}\right)^p$

Learning Unit	Learning Objective	Time	Remarks
	10.2 understand the definitions of zero exponent and negative exponents		
	10.3 understand the laws of integral indices		The above laws of positive integral indices also apply to integral indices.
	10.4 understand scientific notations		Teachers may consider using real-life examples or related learning elements in Science Education or Technology Education KLAs to enhance learning and teaching.
	10.5 understand the binary number system and the denary number system		Interconversion between binary numbers and denary numbers is required. Teachers may consider using real-life examples or related learning elements in Science Education or Technology Education KLAs to enhance learning and teaching.
	10.6 **understand other numeral systems, such as the hexadecimal number system		

Learning Unit	Learning Objective	Time	Remarks
11. Polynomials	11.1 understand the concept of polynomials	15	Students are required to understand the concepts of terms, monomials, binomials, orders, powers, constant terms, like terms, unlike terms and coefficients. Students are required to arrange the terms of a polynomial in ascending order or descending order.
	11.2 perform addition, subtraction, multiplication and their mixed operations of polynomials		The operations of polynomials involving more than one variable are required.
	11.3 factorise polynomials		Students are required to understand that factorisation can be regarded as a reverse process of expansion of polynomials. The following methods are required: • extracting common factors (and grouping of terms) • cross-method

Learning Unit	Learning Objective	Time	Remarks
12. Identities	12.1 understand the concept of identities	8	Students are required to understand the differences between equations and identities, and to prove identities.
	12.2 use identities to expand algebraic expressions		The identities include: • Difference of two squares $(a - b)(a + b) \equiv a^2 - b^2$ • Perfect square $(a \pm b)^2 \equiv a^2 \pm 2ab + b^2$
	12.3 use identities to factorise polynomials		The identities include: • Difference of two squares $a^2 - b^2 \equiv (a - b)(a + b)$ • Perfect square $a^2 \pm 2ab + b^2 \equiv (a \pm b)^2$

Learning Unit	Learning Objective	Time	Remarks
13. Formulae	13.1 perform operations of algebraic fractions 13.2 use substitution to find the values of unknowns in the formulae 13.3 change the subject of formulae not involving radical signs	9	Algebraic fractions are confined to those having denominators as products of linear factors. Note: Teachers may consider using real-life examples or related learning elements in Science Education or Technology Education KLAs to enhance learning and teaching.
14. Linear inequalities in one unknown	14.1 understand the concept of inequalities	6	The following are required: • use inequalities to represent word phrases • represent the following inequalities on the number line: $x > a$, $x \geq a$, $x < a$, $x \leq a$

Learning Unit	Learning Objective	Time	Remarks
	14.2 recognise the basic properties of inequalities		The properties include • if $a > b$ and $b > c$, then $a > c$ • if $a > b$, then $a \pm c > b \pm c$ • if $a > b$ and c is positive, then $ac > bc$ and $\frac{a}{c} > \frac{b}{c}$ • if $a > b$ and c is negative, then $ac < bc$ and $\frac{a}{c} < \frac{b}{c}$ where "$>$" and "$<$" in the above properties can be replaced by "$\geq$" and "$\leq$" respectively.
	14.3 solve linear inequalities in one unknown		Students are required to represent solutions of inequalities on the number line.
	14.4 solve problems involving linear inequalities in one unknown		

Learning Unit	Learning Objective	Time	Remarks
Measures, Shape and Space Strand			
15. Errors in measurement	15.1 recognise the concept of errors in measurement 15.2 recognise the concepts of maximum absolute errors, relative errors and percentage errors 15.3 solve problems related to errors 15.4 **design estimation strategies in measurement according to the contexts and judge the reasonableness of the results obtained	6	
16. Arc lengths and areas of sectors	16.1 understand the formula for arc lengths of circles 16.2 understand the formula for areas of sectors of circles	8	Students are required to understand the property that the arcs are proportional to their corresponding angles at the centre. "Find the diameter or radius of a circle from its area" is **not** required in the primary Mathematics curriculum.

Learning Unit	Learning Objective	Time	Remarks
	16.3 solve problems related to arc lengths and areas of sectors of circles 16.4 **recognise the Circle Dissection Algorithm of the ancient Chinese mathematician Liu Hui and further recognise Huilu and Tsulu (approximations of π)		The problems on finding perimeters and areas of composite figures are required.
17. 3-D figures	17.1 recognise the concepts of right prisms, right circular cylinders, right pyramids, right circular cones, regular prisms, regular pyramids, polyhedra and spheres 17.2 recognise the sections of prisms, circular cylinders, pyramids, circular cones, polyhedra and spheres	5	Students are required to recognise the concept of regular tetrahedra. Students are required to recognise: • different sections of the 3-D figure can have different sizes and shapes • the concept of uniform cross sections At Key Stage 2, students are required to recognise that the sizes and shapes of the

Learning Unit	Learning Objective	Time	Remarks
			cross sections of prisms and cylinders are the same as that of the bases if they are parallel to the bases, but the term "uniform cross sections" is not introduced.
	17.3 sketch the 2-D representations of 3-D figures		Students are required to sketch the 2-D representations of right prisms, right circular cylinders, right pyramids and right circular cones. Students may use the tools such as oblique grids and isometric grids to learn the sketching of 2-D representations. Three orthographic views of 3-D figures are **not** required.
	17.4 **recognise the three orthographic views of 3-D figures		
	17.5 **recognise Euler's formula and explore the number of regular polyhedra (Platonic solids)		

Learning Unit	Learning Objective	Time	Remarks
18. Mensuration	18.1 recognise the formulae for volumes of prisms, circular cylinders, pyramids, circular cones and spheres	15	Students are required to recognise the projection of a point on a plane and the concept of height of a 3-D figure.
	18.2 find the surface areas of right prisms, right circular cylinders, right pyramids, right circular cones and spheres		Students are required to recognise the formula for surface areas of spheres.
	18.3 recognise the relations among lengths, areas and volumes of similar figures and solve related problems		Students are required to recognise the concept of similar 3-D figures. The concept of similar 2-D figures is dealt with in Learning Objective 22.3. Students are required to recognise frustums and solve problems related to their surface areas and volumes.
	18.4 solve problems involving volumes and surface areas		

Learning Unit	Learning Objective	Time	Remarks
	18.5 **explore ways to form a container with the greatest capacity by folding an A4-sized paper with squares cutting from its four corners		Note: Students are required to understand 2-D representations of 3-D figures.
19. Angles and parallel lines	19.1 understand the concepts and properties of adjacent angles on a straight line, vertically opposite angles and angles at a point	11	The properties include: • the sum of adjacent angles on a straight line is equal to a straight angle • vertically opposite angles are equal • the sum of angles at a point is equal to a round angle Students are required to recognise the concepts of complementary angles and supplementary angles.

Learning Unit	Learning Objective	Time	Remarks
	19.2 understand the concepts of corresponding angles, alternate interior angles and interior angles		Students are required to recognise transversals.
	19.3 recognise the conditions for two straight lines being parallel		The conditions include: • alternate interior angles are equal • corresponding angles are equal • interior angles are supplementary
	19.4 recognise the angle properties associated with parallel lines		The properties include: • alternate interior angles of parallel lines are equal • corresponding angles of parallel lines are equal • interior angles of parallel lines are supplementary
	19.5 understand the properties of the interior and		The properties include:

Learning Unit	Learning Objective	Time	Remarks
	exterior angles of triangles		• the angle sum of a triangle is equal to a straight angle • the exterior angle of a triangle is equal to the sum of the interior opposite angles of the triangle Students are required to recognise the concepts of acute-angled triangles and obtuse-angled triangles.
20. Polygons	20.1 understand the concept of regular polygons 20.2 understand the formula for the sum of the interior angles of a polygon 20.3 understand the formula for the sum of the exterior angles of a convex polygon 20.4 appreciate the triangles, quadrilaterals, and regular polygons that tessellate in the plane	8	

Learning Unit	Learning Objective	Time	Remarks
	20.5 construct equilateral triangles and regular hexagons with compasses and straightedge		Teachers may let students recognise the basic knowledge of construction with compasses and straightedge. Students may use information technology for construction.
	20.6 **explore ways to construct regular pentagons with compasses and straightedge		
21. Congruent triangles	21.1 understand the concept of congruent triangles	14	
	21.2 recognise the conditions for congruent triangles		The conditions include: SAS, SSS, ASA, AAS and RHS.
	21.3 understand the property of isosceles triangles		The property refers to: the base angles of an isosceles triangle are equal. Teachers may allow students to recognise the proof of equal base angles in isosceles triangles by means of SAS.

Learning Unit	Learning Objective	Time	Remarks
	21.4 understand the condition for isosceles triangles 21.5 construct angle bisectors, perpendicular bisectors, perpendicular lines, parallel lines, special angles and squares with compasses and straightedge 21.6 recognise the concept of congruent 2-D figures 21.7 **explore the angles that can be constructed with compasses and straightedge		The condition refers to: if two angles of a triangle are equal, then the triangle is isosceles. Students may use information technology for construction.
22. Similar triangles	22.1 understand the concept of similar triangles 22.2 recognise the conditions for similar triangles	9	The conditions include： • AAA (AA) • corresponding sides are proportional • two corresponding sides proportional and their included angles equal

Learning Unit	Learning Objective	Time	Remarks
	22.3 recognise the concept of similar 2-D figures 22.4 **explore shapes of fractals		Students are required to recognise that quadrilaterals with corresponding sides proportional are not necessarily similar.
23. Quadrilaterals	23.1 understand the properties of parallelograms 23.2 understand the properties of rectangles, rhombuses and squares	13	The properties include: • opposite sides equal, opposite angles equal and diagonals bisect each other The properties of rectangles include: • all the properties of parallelograms • the two diagonals equal • the diagonals bisect each other into four equal line segments The properties of rhombuses include: • all the properties of parallelograms

Learning Unit	Learning Objective	Time	Remarks
			• the diagonals are perpendicular to each other • the diagonals bisect the opposite angles The properties of squares include: • all the properties of rectangles • all the properties of rhombuses • the diagonals form a 45° with the sides of the squares
	23.3 understand the conditions for parallelograms		The conditions include: • opposite sides are equal • opposite angles are equal • diagonals bisect each other • there is a pair of sides that are both equal and parallel

Learning Unit	Learning Objective	Time	Remarks
	23.4 use the above properties or conditions to perform simple geometric proofs 23.5 understand the mid-point theorem and the intercept theorem 23.6 **explore the conditions for congruent quadrilaterals		Note: • Students are required to recognise logical relations such as "squares are figures having four equal sides, but figures having four equal sides are not necessarily squares". • Teachers may let students recognise the deductive method in Euclid's *Elements*.

Learning Unit	Learning Objective	Time	Remarks
24. Centres of triangles	24.1 understand the properties of angle bisectors and perpendicular bisectors	8	The properties include: • if a point lies on the angle bisector, then it is equidistant from the two sides of the angle, and the converse • if a point lies on the perpendicular bisector of a line segment, then it is equidistant from the two end points of the line segment, and the converse
	24.2 understand the concurrence of angle bisectors and the concurrence of perpendicular bisectors of a triangle		Students are required to recognise the concepts of the incentre and the circumcentre of a triangle, and the following properties: • the incentre of a triangle is equidistant from the three sides of the triangle, and a circle inside the triangle can be constructed with this distance as its radius and the incentre as its centre

Learning Unit	Learning Objective	Time	Remarks
	24.3 recognise the concurrence of medians and the concurrence of altitudes of a triangle		• the circumcentre of a triangle is equidistant from the three vertices of the triangle and a circle passing through the vertices can be constructed with this distance as its radius and the circumcentre as its centre Students are required to recognise the concepts of the centroid and the orthocentre of a triangle. Teachers may use information technology to help students understand the proofs of concurrence of medians and concurrence of altitudes.
25. Pythagoras' theorem	25.1 understand the Pythagoras' theorem	6	Teachers may introduce different proofs of Pythagoras' theorem, for example, the proof by the ancient Chinese mathematician Liu Hui and the proof in Euclid's *Elements*.

Learning Unit	Learning Objective	Time	Remarks
			Teachers may introduce the Pythagorean school and its related history, including the history of the first mathematical crisis.
	25.2 recognise the converse of Pythagoras' theorem		Teachers may introduce the proofs of the converse of Pythagoras' theorem.
	25.3 solve problems related to Pythagoras' theorem and its converse		
	25.4 **explore Pythagorean triples		
26. Rectangular coordinate system	26.1 recognise the rectangular coordinate system	19	Students are required to • represent the position of a point by its coordinates • mark the point with given coordinates
	26.2 find the distance between two points on a horizontal line and the distance between two points on a vertical line		

Learning Unit	Learning Objective	Time	Remarks
	26.3 find areas of polygons in the rectangular coordinate plane		
	26.4 recognise the effect of transformations on a point in the rectangular coordinate plane		Transformations include: • translation • reflection in a line parallel to the *x*-axis or *y*-axis • clockwise or anti-clockwise rotation about the origin through $n \cdot 90°$, where *n* is a positive integer
	26.5 understand the distance formula		
	26.6 understand the mid-point formula and the formula for the internal point of division		
	26.7 understand the slope formula and solve related problems		Students are required to recognise the concept of intercepts.

Learning Unit	Learning Objective	Time	Remarks
			Besides finding slopes, students are required to use the slope formula to find x-coordinates or y-coordinates of points on straight lines, x-intercepts or y-intercepts of straight lines, from given conditions, for example: • given the coordinates of the two points on a straight line, find the x-intercept or y-intercept of the straight line
	26.8 recognise the relation between the slopes of parallel lines and the relation between the slopes of perpendicular lines, and solve related problems		Students are required to identify parallel lines and perpendicular lines from their slopes. The relation between slope and inclination in the rectangular coordinate plane is dealt with in the Compulsory Part at Key Stage 4.
	26.9 use coordinate geometry to perform simple geometric proofs		

Learning Unit	Learning Objective	Time	Remarks
	26.10 **explore the formula for the external point of division		
27. Trigonometry	27.1 understand sine, cosine and tangent of angles between 0° and 90° 27.2 understand the properties of trigonometric ratios	18	The trigonometric ratios of 0° and 90° are **not** required. The properties include: For $0° < \theta < 90°$, • as θ increases, the values of $\sin\theta$ and $\tan\theta$ increase and that of $\cos\theta$ decreases • $0 < \sin\theta < 1$ • $0 < \cos\theta < 1$ • $\tan\theta > 0$ • $\frac{\sin\theta}{\cos\theta} = \tan\theta$

Learning Unit	Learning Objective	Time	Remarks
			• $\sin^2\theta + \cos^2\theta = 1$ • $\sin(90° - \theta) = \cos\theta$ • $\cos(90° - \theta) = \sin\theta$ • $\tan(90° - \theta) = \frac{1}{\tan\theta}$
	27.3 understand the exact values of trigonometric ratios of 30°, 45° and 60°		
	27.4 solve problems related to plane figures		
	27.5 solve problems involving gradients, angles of elevation, angles of depression and bearings		Students are required to recognise the relation between gradients and inclinations. Students are required to recognise two kinds of bearing such as 010° and N10°E.

Learning Unit	Learning Objective	Time	Remarks
Data Handling Strand			
28. Organisation of data	28.1 recognise the concepts of discrete data and continuous data 28.2 recognise organisation of data without grouping 28.3 recognise organisation of data in groups	4	Note: Students are required to recognise the organisation of data using frequency distribution tables.
29. Presentation of data	29.1 recognise stem-and-leaf diagrams and histograms	17	Students are required to construct simple stem-and-leaf diagrams and histograms using paper and pen. When constructing stem-and-leaf diagrams and histograms of a larger amount of data, students may use information technology. Students are required to recognise the

Learning Unit	Learning Objective	Time	Remarks
			construction of statistical charts in appropriate scales.
	29.2 interpret stem-and-leaf diagrams and histograms		
	29.3 interpret statistical charts representing two different sets of data in daily life		Example: Temperature and rainfall charts
	29.4 recognise frequency polygons, frequency curves, cumulative frequency polygons and cumulative frequency curves		Construction of statistical charts is required.
	29.5 interpret frequency polygons, frequency curves, cumulative frequency polygons and cumulative frequency curves		Students are required to find the following from cumulative frequency polygons and cumulative frequency curves: • medians, quartiles (upper quartiles, lower quartiles) and percentiles • the positions of individual data in the populations

Learning Unit	Learning Objective	Time	Remarks
	29.6 choose appropriate statistical charts to present data 29.7 recognise the uses and abuses of statistical charts in daily life		Statistical charts include stem-and-leaf diagrams and histograms, and those that are dealt with at Key Stage 2, including bar charts, pie charts and broken line graphs. Teachers may consider using real-life examples or related learning elements in Science Education or Technology Education KLAs to enhance learning and teaching.
30. Measures of central tendency	30.1 understand the concepts of mean, median and mode/modal class	10	Students are required to understand the features and limitations of each measure, for example, a single extreme datum may have a great influence on the mean, and the median is not affected by a single extreme datum. Mean can also be called “average”. At Key Stage 2, students are required to recognise the concept of average.

Learning Unit	Learning Objective	Time	Remarks
	30.2 calculate mean, median and mode of ungrouped data 30.3 calculate mean, median and modal class of grouped data 30.4 recognise the uses and abuses of mean, median and mode/modal class in daily life 30.5 understand the effects of the following operations on the mean, median, and mode: (i) adding a common constant to each item of the set of data (ii) multiplying each item of the set of data by a common constant		Students are required to understand that mean and median of grouped data are estimations only.

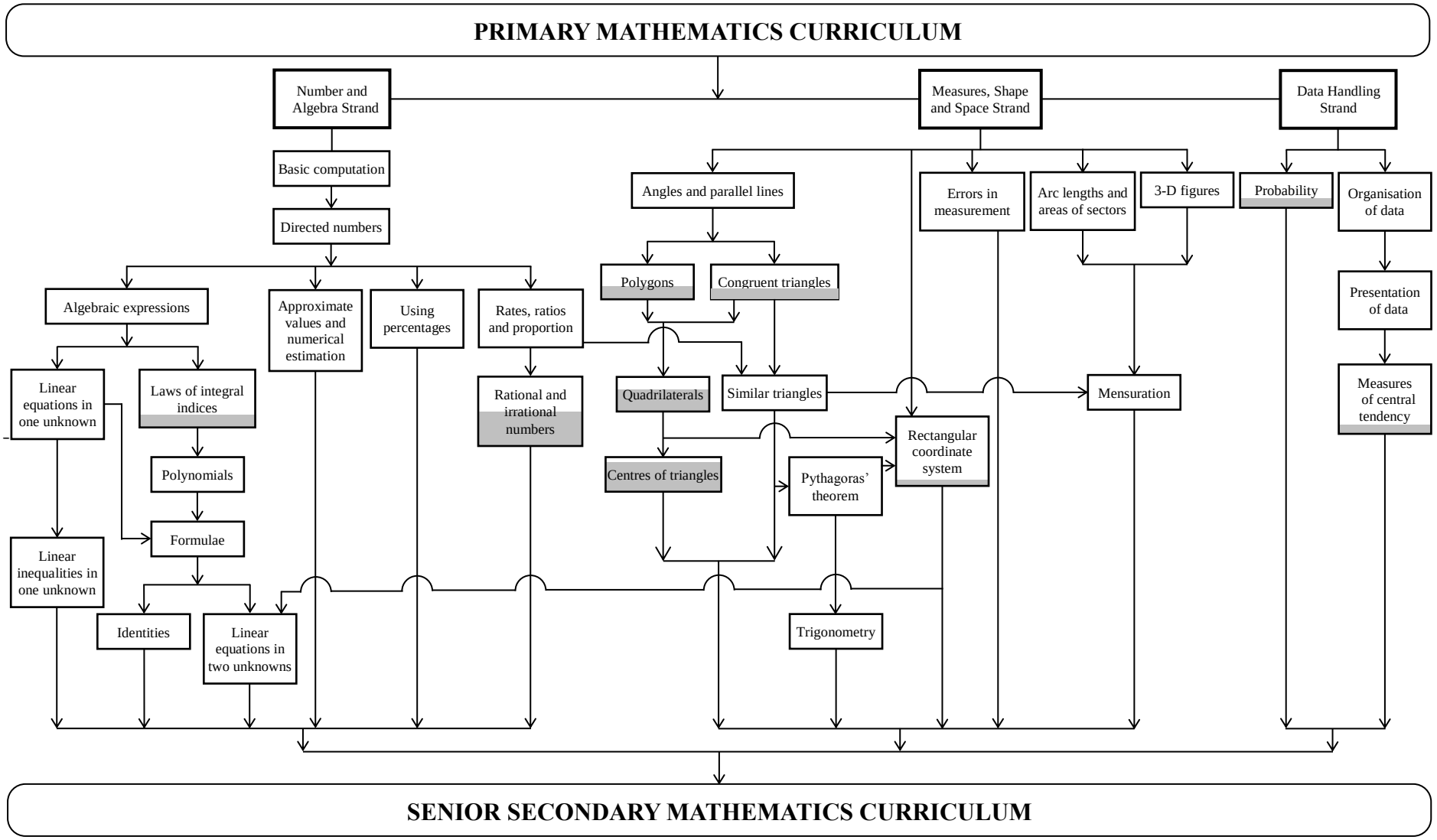
Learning Unit	Learning Objective	Time	Remarks
	30.6 recognise the concept of weighted mean		Real-life applications are required, for example: the methods for calculating average scores for report cards and scores for university admissions.
	30.7 solve problems involving weighted mean		
31. Probability	31.1 recognise the concepts of certain events, impossible events and random events	12	
	31.2 recognise the concept of probability		Geometric probability is **not** required. Students may use diagrams such as Venn diagrams to understand the concept of sample space.
	31.3 calculate probabilities of events by listing the sample space and counting		Students are required to use tables or tree diagrams to list sample spaces.
	31.4 solve problems involving probability		

Learning Unit	Learning Objective	Time	Remarks
	31.5 recognise the concept of expectation 31.6 solve problems involving expectation		
Further Learning Unit			
32. Inquiry and investigation	Through various inquiry activities and mathematical modelling learning activities, construct and apply mathematical knowledge, further improve the ability to inquire, communicate, reason, conceptualise mathematical concepts and apply mathematics	20	This is **not** an independent and isolated learning unit. Teachers may make use of the suggested lesson time to engage students in various learning activities, such as activities related to enrichment topics, cross-learning unit activities, and cross-KLA activities based on mathematical topics. Among the learning activities, teachers should plan about 2–3 hours of mathematical modelling learning activities for students in each school year.

Total lesson time: 331 hours

Chapter 3 Flow chart

Flowchart : Junior Secondary Mathematics Curriculum



Represents Non-foundation Topics.

Membership of the CDC Committee on Mathematics Education

(From September 2015 to August 2017)

Chairperson:	Mr LAM Ka-yiu	(from September 2016)
	Mr SUM Sing-wah	(until August 2016)
Vice-chairperson:	Mr WAI Kwok-keung (EDB)	(from March 2016)
	Mr LEE Pak-leung (EDB)	(until February 2016)
Members:	Dr CHAN Wai-hong	
	Prof CHENG Zi-juan	
	Ms CHEUNG Yuet-mei	(until August 2016)
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	Ms CHONG Hiu-li, Jackie	
	Mr CHU Kan-kong (HKEAA)	
	Dr LAW Huk-yuen	
	Mr LEE Wing-yeong	
	Mr MOK Sui-kei	(from October 2016)
	Mr NG Siu-kai (EDB)	
	Mr POON Wai-hoi, Bobby	
	Mr SHUM Yiu-kwong	
	Mr SIU Kwok-leong	
	Mr TANG Hok-shu	
	Mr TSANG Kin-fun	
	Ms TSUI Kwan-yuk	
	Ms TSUI Fung-ming, Karin	
	Ms WONG Chui-han, Ellen	
	Ms WONG Tin-ling	(from October 2016)
Secretary:	Dr NG Yui-kin (EDB)	

Membership of the CDC Committee on Mathematics Education

(From September 2017 to August 2019)

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	Dr CHAN Wai-hong
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	Ms CHUNG Po-loi
	Dr LEE Man-sang, Arthur
	Ms LEE Yuk-kit, Kitty
	Mr LEUNG Kwok-kei
	Dr LIU Kam-moon, Lester
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	Ms WONG Chui-han, Ellen
	Mr YOUNG Chun-piu
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Secretary:	Dr NG Yui-kin (EDB)

Membership of the CDC-HKEAA Committee on Mathematics Education

(From September 2015 to August 2017)

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Vice-chairperson:	Mr WAI Kwok-keung (EDB)	(from March 2016)
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	Mr CHIU Kwok-sing	
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	Ms POON Suet-fan	
	Dr SHIU Wai-chee	
	Mr WONG Kwong-wing	
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Secretary:	Dr NG Yui-kin (EDB)	

Membership of the Ad Hoc Committee on Secondary Mathematics Curriculum (Junior Secondary and Compulsory Part of Senior Secondary)

(From December 2015)

Convenor	Mr LEE Kin-sum (EDB)	
Members:	Dr CHAN Yip-cheung	
	Mr CHIU Hong-ming	
	Mr CHIU Kwok-sing	
	Mr CHOW Kong-fai	
	Mr CHU Kan-kong (HKEAA)	
	Mr IP Che-ho	
	Mr LEE Wing-yeong	
	Mr LIU Hon-man	
	Dr LIU Kam-moon, Lester	
	Mr SIU Kwok-leong	
	Ms TSUI Fung-ming, Karin	
	Mr WONG Kwong-wing	
Secretary:	Mr LEE Chun-yue (EDB)	(from August 2017)
	Ms SIU Yuet-ming (EDB)	(until July 2017)

Membership of the Ad Hoc Committee for Integrating Mathematical Modelling into Secondary Mathematics Curriculum

(From October 2026)

Convenor:	Mr LEE Kin-sum (EDB)
Members:	Dr CHAN Yip-cheung
	Prof LAU Chun-pong
	Mr LEUNG Yee-ho Genthew
	Dr TSUI Ming-yan
	Dr YIM Man-shun
	Mr POON Wai-hoi Bobby
	Ms YEUNG Fung-hing
	Ms LEE Wing-yan
Secretary:	Mr LAM Ho-yeung (EDB)

