

# Mathematics (Junior Secondary)

## 1. Introduction

The Department of Mathematics at HKUGAC strives to develop students' mathematical skills; their ability to communicate mathematics; their ability to reflect and evaluate; and their ability to develop and apply mathematical and technical knowledge. We aim to foster in our students a positive attitude, an appreciation of mathematics and its significance to everyday life. The programme will incorporate elements to increase intercultural awareness and cross-subject links.

The curriculums are designed based on the following.

S1 – S3	The guiding principles of curriculum design and assessment of mathematics education, which stipulated in Mathematics Education Key Learning Area Curriculum Guide (Primary 1 - Secondary 6) (2017).
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## **1.2 Teaching Methods**

Given students' diverse learning styles, we employ various teaching and assessment strategies to ensure that all of our students have an opportunity to learn and demonstrate their understanding.

The teacher will act as a resource for the student to learn to use. This will require them to take an active part in their own learning. Thus, they are encouraged to ask questions when there is a conflict between their understanding and the feedback that they obtain.

Local and international cultures, as well as the history of mathematics, are incorporated into the syllabus where possible. Throughout the six years of study, students will be assigned problem solving tasks, various projects and modelling assignments that will require them to apply their mathematical knowledge to applications involving problems from the real world. In line with the school's latest policy, the idea of global citizenship will permeate the curriculum through tasks and projects at different levels.

The use of e-resources and technology is incorporated into the curriculum in order to facilitate mathematical learning and assessment. Technology, whenever appropriate, is used in lessons for students to explore mathematical concepts, to be assessed and to perform mathematical experiments. Learning materials are also provided online. STEM activities, wherever found closely related to the syllabus, are also included to help students integrate mathematical concepts with technology and engineering.

We will provide various levels of study groups to ensure that all students are given the academic opportunity and challenge to reach their potential. This is essential in developing students' abilities to express ideas clearly and to think critically, in order for them to become contributing members of society.

For higher ability students, we provide extra training for them to take part in the International Mathematical Olympiad.

## **1.3 Assessment**

Assessment will take various forms that incorporate skills acquisition, class participation, oral discussions, note-taking, worksheets, assignments, projects and written tests.

## 2. Aims & Objectives of Mathematics Education

The aims of mathematics are to enable students to:

- develop a positive attitude toward the continued learning of mathematics
- appreciate the usefulness, power and beauty of mathematics, and recognize its relationship with other disciplines in everyday life
- gain knowledge and develop understanding of mathematical concepts
- develop mathematics skills and apply them in daily life
- develop the ability to communicate mathematics with appropriate symbols and language
- develop the ability to reflect upon and evaluate the significance of their work and the work of others
- share ideas and experience and work cooperatively with others in accomplishing mathematical tasks/activities and solving mathematical problems
- develop patience and persistence when solving mathematical problems
- develop and apply information and communication technology skills in the study of mathematics
- appreciate the international dimensions of mathematics and its varied cultural and historical perspectives

At the end of the course, students should be able to:

- know and understand concepts, and demonstrate skills, from the branches of mathematics
- understand and use a variety of mathematical forms and have the ability to move confidently between them
- select and use appropriate mathematical knowledge, skills and techniques when investigating problems and justify their relationships
- recognize patterns and structures and describe them as relationships or general rules when investigating problems
- draw conclusions consistent with findings
- communicate mathematical facts, ideas, methods, results and conclusions using appropriate language and symbols
- reflect on their methods and processes and be able to consider possible alternative approaches
- evaluate the significance and reliability of their findings and findings of others

### 3. Curriculum

#### 3.1 Mathematics Curriculum Framework

9 Refined Generic Skills <sup>#</sup>		
Basic Skills: Communication Skills, Mathematical Skills, IT Skills		
Thinking Skills: Critical Thinking Skills, Creativity, Problem Solving Skills		
Personal and Social Skills: Self-management Skills, Self-learning Skills, Collaboration Skills		
Level	Dimensions	Units
S1	Number and Algebra	Basic Computation Directed Numbers Numerical Estimation Basic Algebra (I) Basic Algebra (II) Percentages (I)
	Measure, Shape and Space	Basic Geometry Mensuration (I) Rectangular Coordinate System (I) Angles and Parallel Lines (I) Congruence and Similarity (I)
	Data Handling	Organization and Presentation of Data (I)
S2	Number and Algebra	Operations and Factorization of Polynomials Identities Algebraic Fractions and Formulae Linear Equations in Two Unknowns Rates, Ratios and Proportions Approximation & Errors
	Measure, Shape and Space	Angles and Parallel Lines (II) Congruence and Similarity Polygons Pythagoras' Theorem and Irrational Numbers Trigonometric Ratios

		Mensuration (II)
	Data Handling	Organization and Presentation of Data (II)
S3	Number and Algebra	More about Factorization Law of Integral Indices Linear Inequalities in One Unknown Percentages (II)
	Measure, Shape and Space	More about Triangles Quadrilaterals More about 3-D Figures Mensuration (III) Trigonometric Relations Applications in Trigonometry Rectangular Coordinate System (II)
	Data Handling	Probability Measures of Central Tendency

Remarks: # from “Ongoing Renewal of the School Curriculum – Focusing, Deepening and Sustaining” from CDC of EdB in December 2015.

### 3.2 Delivery Schedule

Time Frame	S1	S2	S3
<b>September</b>	Basic Computation Directed Numbers	Operations and Factorization of Polynomials, Identities	More about Factorization, Law of Integral Indices
<b>October</b>	Directed Numbers Numerical Estimation	Algebraic Fractions and Formulae, Significant Figures	Percentages (II), Linear Inequalities in One Unknown
<b>November</b>	Basic Algebra (I) Basic Algebra (II)	Linear Equations in Two Unknowns,	Linear Inequalities in One Unknown, More about Triangles

		Organization and Presentation of Data (II)	
<b>December</b>	Basic Geometry Mensuration (I)	Rates, Ratios and Proportions	Quadrilaterals, More about 3-D Figures
<b>January</b>	Mensuration (I) Rectangular Coordinate System (I)	Angles and Parallel Lines (II)	Mensuration (III)
<b>February</b>	Rectangular Coordinate System (I) Angles and Parallel Lines (I) [Find]	Congruence and Similarity (II), Polygons	Mensuration (III) Trigonometric Relations
<b>March</b>	Congruence and Similarity (I) Angles and Parallel Lines (I) [Proof]	Polygons Pythagoras' Theorem Trigonometric Ratios	Trigonometric Relations Applications in Trigonometry
<b>April</b>	Angles and Parallel Lines (I) [Proof] Percentages (I)	Trigonometric Ratios, Approximation & Errors	Rectangular Coordinate System (II), Probability
<b>May</b>	Percentages (I) Organization and Presentation of Data (I)	Mensuration (II)	Measures of Central Tendency
<b>June</b>	Revision and Exam	Revision and Exam	Exam and T.S.A.
<b>July</b>	<b>Summer Holidays</b>	<b>Summer Holidays</b>	<b>Summer Holidays</b>

## 4. Assessing students

### 4.1 Formative and Summative Assessment

Formative assessment is an integral part of the learning experience that is designed to measure what students know and what they are learning as they go along; the objectives addressed by specific assessment tasks are shared with students, with feedback taking place. Formative assessment is carried out in various ways including project work, oral presentation, class discussions, homework assignments, and written tests in class or at home. Summative assessment is the judgment made by the teacher of the standard of achievement reached by each student at a particular point in time and at the end of the year.

### 4.2 Assessment Criteria

The students are assessed on four assessment criteria:

“Numerical and Algebraic Skills” (NAS);

“Spatial and Geometric Skills” (SGS);

“Data Handling Skills” (DHS) and

“Application of Mathematical Concepts and Skills” (AM).

Assessment Criteria	Topics involved	
	S1 Term 1	S1 Term 2
NAS	<ul style="list-style-type: none"><li>• Basic Computation</li><li>• Directed Numbers</li><li>• Numerical Estimation</li><li>• Basic Algebra</li></ul>	<ul style="list-style-type: none"><li>• Percentages</li></ul>
SGS	<ul style="list-style-type: none"><li>• Basic Geometry</li><li>• Mensuration (I)</li></ul>	<ul style="list-style-type: none"><li>• Rectangular Coordinate System (I)</li><li>• Angles and Parallel Lines (I)</li><li>• Congruence and Similarity (I)</li></ul>
DHS	Not assessed	<ul style="list-style-type: none"><li>• Organization and Presentation of Data (I)</li></ul>
AM	<ul style="list-style-type: none"><li>• Cross-topic assessment</li></ul>	Not assessed

Assessment Criteria	Topics involved	
	S2 Term 1	S2 Term 2
NAS	<ul style="list-style-type: none"> <li>• Polynomials</li> <li>• Identities</li> <li>• Formulae</li> <li>• Significant figures</li> <li>• Linear Equations in Two Unknowns</li> <li>• Rates, Ratios and Proportions</li> </ul>	<ul style="list-style-type: none"> <li>• Approximation and Errors</li> </ul>
SGS	Not assessed	<ul style="list-style-type: none"> <li>• Angles and Parallel Lines (II)</li> <li>• Congruence and Similarity (II)</li> <li>• Polygons</li> <li>• Pythagoras' Theorem and Irrational Numbers</li> <li>• Trigonometric Ratios</li> <li>• Mensuration (II)</li> </ul>
DHS	<ul style="list-style-type: none"> <li>• Organization and Presentation of Data (II)</li> </ul>	Not assessed
AM	<ul style="list-style-type: none"> <li>• Cross-topic assessment</li> </ul>	Not assessed



Assessment Criteria	Topics involved	
	S3 Term 1	S3 Term 2
NAS	<ul style="list-style-type: none"> <li>• Factorization</li> <li>• Laws of Indices</li> <li>• Percentages</li> <li>• Inequalities</li> </ul>	Not assessed
SGS	<ul style="list-style-type: none"> <li>• Deductive Geometry</li> <li>• Quadrilaterals</li> </ul>	<ul style="list-style-type: none"> <li>• 3-D Figures</li> <li>• Mensuration (III)</li> <li>• Trigonometry</li> <li>• Coordinate Geometry</li> </ul>
DHS	Not assessed	<ul style="list-style-type: none"> <li>• Probability</li> <li>• Measures of Central Tendency</li> </ul>
AM	<ul style="list-style-type: none"> <li>• Cross-topic assessment</li> </ul>	Not assessed

## 4.2 Components of Year Grade

	Weighting
Continuous Assessment <sup>#</sup>	60%
Exam	40%

<sup>#</sup> Continuous Assessment includes homework, projects, quizzes and unit tests, as well as other non-traditional modes of assessment.

## 4.4 Reference Level Descriptors and Boundaries

Level	Boundaries of Levels
5**	90% or above
5*	85% to 89%
5	75% to 84%
4	65% to 74%
3	50% to 64%
2	35% to 49%
1	34% or below

The marks are rounded off to the nearest %.

The actual boundaries may vary depending on the performance of students.

#### 4.5 Requirement of Taking Extended Modules in S4

Based on our experiences of our graduates' past performances in the HKDSE, if students cannot achieve a satisfactory standard in the S3, they tend to struggle to keep up in the compulsory part and the extended module in mathematics. To help students focused on the compulsory part and obtain a better grade in the HKDSE, we have set the following benchmark and recommendations for those wishing to take the extended module in S4:

S3 year grade	65% or above	Students are highly encouraged to take the extended module.
	50% to 64%	Students are not recommended to take the extended module. If students would like to make a special request for taking the extended module in S4, they need to meet with their mathematics teachers and seek teachers' advice. In addition, a parent's letter is required for such a request.
	Below 50%	Students are forbidden to take the extended module.

## **5. Homework and Assignments**

### **5.1 Parents' role**

Parents are encouraged to talk to their children about their work in class, what they are currently learning and check the aims and objectives of the unit being studied. They should also discuss the results obtained by their children and to regularly check their diaries.

Homework is a valuable aid to help students make the most of their school experience. Homework consolidates, reinforces and strengthens concepts learnt in class, encourages students to develop responsibility, time management skills, and good study habits which help teachers assess the performance of students. Teachers will assign homework that is related appropriately to specific objectives at a suitable level of difficulty. A homework load of around 30 minutes will be assigned on the day of each mathematics lesson.

### **5.2 Homework Policy**

As a measure to train students to be responsible for completing homework in a timely manner, late submission will result in zero marks given. Students who hand in homework late will be required to complete the unfinished work after school and the homework will receive their teachers' feedback as usual.

Homework assigned by teachers will be entered into eHomework on the eClass system, from where parents can access their child's homework progress and completion record.

## **6. Guideline on AI-assisted Learning**

Artificial intelligence (AI), including Generative AI, could serve as an effective tool for learning mathematics. This section provides examples of using AI to assist learning in mathematics and general reminders.

### **6.1 Areas Where AI Can Enhance Learning in Mathematics**

#### Personalized Practice and Tutoring

AI-driven platforms can provide customized exercises based on a student's performance, helping to address individual knowledge gaps and reinforcing areas of weakness. These tools can adapt to the learner's pace, offering more challenging problems as they improve or revisiting foundational concepts as needed.

#### Instant Feedback on Problems

AI-based math solvers can offer immediate feedback on mathematical problems, helping students identify mistakes in real time. By receiving step-by-step solutions, students can learn how to approach problems methodically.

#### Conceptual Understanding and Visualization

AI can generate graphs, charts, and visual aids that help students understand complex mathematical concepts like functions, geometry, and calculus. These visualizations make abstract concepts more tangible and easier to comprehend.

#### Exploration of Multiple Problem-Solving Methods

AI tools can present different approaches to solving the same problem, exposing students to a variety of mathematical methods or techniques, which can enhance their problem-solving flexibility.

#### Supplementary Learning Resources

AI can recommend additional learning resources such as video tutorials, articles, or practice exercises based on a student's current level of understanding. This helps students explore topics in greater depth or revisit areas where they need more practice.

### **6.2 Important Considerations When Using AI in Mathematics**

#### Verify the Information Generated

AI tools are not infallible and can sometimes provide incorrect or incomplete information. Always cross-check the solutions generated by AI with your textbook, classroom notes, or by consulting your teacher. Don't rely solely on AI-generated answers without understanding the underlying concepts.

### Understand the Process, Not Just the Answer

AI can provide answers quickly, but the goal of learning mathematics is to understand the process. Use AI to guide and help you work through problems, but avoid using it as a shortcut to merely obtain the final solution. Make sure you can explain the steps involved in reaching the solution on your own.

### Practice Without AI

While AI is a useful tool, it's essential to practice solving problems independently. Over-reliance on AI can hinder your ability to develop critical problem-solving skills. Balance AI-assisted learning with traditional methods, such as working through problems by hand and discussing solutions with peers or teachers.

## **6.3 Ethical Use of AI in Mathematics Learning**

### Do Not Use AI to Cheat

It can be tempting to use AI to quickly solve homework problems or complete assignments. However, this defeats the purpose of learning. AI should be used as a learning aid, not as a replacement for your own efforts. Using AI to generate answers without engaging with the problem is academically dishonest and can result in disciplinary consequences.

### Acknowledge AI Assistance Where Required

If you've used AI to help understand a problem or generate part of a solution, make sure to acknowledge that assistance where appropriate, especially in formal assessments or reports. This ensures transparency and academic integrity.

### Respect Data Privacy

When using AI platforms, be mindful of the personal data you share. Ensure that the tools you are using are from trusted sources and comply with data privacy regulations. Avoid sharing sensitive personal information with AI tools unnecessarily.

### Avoid Plagiarism

If you use AI-generated content in your work, ensure you paraphrase, modify, and adequately cite the ideas, where applicable. Copying and pasting AI-generated solutions or explanations without understanding and reworking them into your own words can be considered plagiarism.