

Mathematics (iAL)

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 their 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.

S5 – S6	Pearson Edexcel International Advanced Subsidiary/Advanced Level in Mathematics, Further Mathematics and Pure Mathematics – Specification – Issue 3 – April 2019
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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 wherever 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.

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.

1.3 Assessment

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

2. Aims & Objectives of Mathematics Education

The aims for 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 with 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 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 relationship
- 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

Module	Units
Pure Math 1 (P1)	Algebraic Expressions Quadratics Equations and Inequalities Graphs and Transformations Straight Line Graphs Trigonometric Ratios Radians Differentiation Integration
Pure Math 2 (P2)	Algebraic Methods Coordinate Geometry in the (x, y) Plane Exponentials and Logarithms The Binomial Expansion Sequences and Series Trigonometric Identities and Equations Differentiation Integration
Pure Math 3 (P3)	Algebraic Methods Functions and Graphs Trigonometric Functions Trigonometric Addition Formulae Exponentials and Logarithms Differentiation Integration Numerical Methods
Pure Math 4 (P4)	Proof Partial Fractions Coordinate Geometry in the (x, y) Plane Binomial Expansion Differentiation Integration Vectors
Mechanics 1 (M1)	Mathematical Models in Mechanics Constant Acceleration Vectors in Mechanics Dynamics of a Particle Moving in a Straight Line Forces and Friction Momentum and Impulse Statics of a Particle Moments

Statistics 1 (S1)	Mathematical Modelling Measures of Location and Spread Representations of Data Probability Correlation and Regression Discrete Random Variables The Normal Distribution
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3.2 Delivery Schedule

S5

Time Frames	iAL
September	P1 Algebraic Expressions Quadratics Equations and Inequalities Graphs and Transformations Straight Line Graphs Trigonometric Ratios Radians Differentiation Integration
October	P2 Algebraic Methods Coordinate Geometry in the (x, y) Plane Exponentials and Logarithms The Binomial Expansion
November	P2 Sequences and Series Trigonometric Identities and Equations Differentiation Integration
December	Revision for public exam
January	Public Exam (P1)
February	M1 Mathematical Models in Mechanics Constant Acceleration

	Vectors in Mechanics Dynamics of a Particle Moving in a Straight Line
March	M1 Forces and Friction Momentum and Impulse Statics of a Particle Moments
April	P3 Algebraic Methods Functions and Graphs Trigonometric Functions Trigonometric Addition Formulae
May	Revision for public exam
June	Public Exam (P2, M1)
July	Summer Holidays

Time Frames	iAL
September	P3 Exponentials and Logarithms Differentiation Integration Numerical Methods
October	P4 Proof Partial Fractions Coordinate Geometry in the (x, y) Plane Binomial Expansion
November	P4 Differentiation Integration Vectors
December	Revision for public exam
January	Public Exam (P3)
February	S1 Mathematical Modelling Measures of Location and Spread Representations of Data Probability
March	S1 Correlation and Regression Discrete Random Variables The Normal Distribution
April	Revision for public exam

May	Revision for public exam
June	Public Exam (P4, S1)

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 International Advanced Level in Mathematics will be graded on a six-point scale A* to E. A* is usually awarded to the top achievers of grade A.

4.3 Weighting of Component Parts

	S5 Weighting
Continuous Assessment [#]	40%
Mock Exams	60%
Total	100%

[#] Continuous Assessment includes homework, quizzes and unit tests.

4.4 Reference Level Descriptors and Boundaries

Levels	Boundaries of Levels
A*	90% or above
A	80% to 89%
B	65% to 79%
C	50% to 64%
D	35% to 49%
E	34% or below

The marks are rounded off to the nearest %.

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

5. Parents' role and 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, good study habits and helps teachers assess the performance of students. Teachers will assign homework at a suitable level of difficulty and related appropriately to specific objectives. 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.

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.