I.B. Middle Years Programme

Course outline: Mathematics

Years 10 & 11

2010-2012

Aims: the main aims of the Mathematics MYP course 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 and every day life.
- Gain knowledge and develop understanding of mathematical concepts.
- Develop mathematical skills and apply them.
- 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.
- Develop patience and persistence when solving problems.
- Develop and apply information and communication technology skills in the study of mathematics.

The prescribed framework for MYP mathematics outlines five branches of mathematical study. These branches are: number, algebra, geometry and trigonometry, statistics and probability and discrete mathematics.

The curriculum taught at HAEC is a spiralling curriculum. The schemes of work are structured in such a way that all five branches of mathematics are addressed in each of the two years of the programme. In class time, students will practice mathematical skills; they will investigate new concepts and apply their knowledge in context situations. Where possible, links are made with other subject areas and the Areas of Interaction.

Objectives:

Knowledge and Understanding

At the end of the course the students should:

- Know and understand concepts, and demonstrate skills from the five branches of mathematics number, algebra, statistics and probability, geometry and trigonometry, and discrete mathematics.
- Be able to understand and use a variety of mathematical forms and should have the ability to move confidently among them.

Application and Reasoning

At the end of the course the students should:

- Select and use appropriate mathematical knowledge when investigating problems.
- Select and apply appropriate mathematical skills and techniques when solving problems.
- Recognize patterns and structures and describe them as relationships or general rules when investigating problems.
- Draw conclusions consistent with findings as they relate to the real world.
- Justify mathematical relationships when investigating problems

Communication

At the end of the course students should be able to communicate mathematical facts, ideas, methods, results and conclusions using:

- Appropriate language and symbols
- A variety of media and technologies

Reflection and Evaluation

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

- Reflect on their methods and processes
- Consider possible alternative approaches
- Evaluate the significance and reliability of their findings and the findings of others

Internationalism

One of the aims of this course is to enable candidates to appreciate the international dimensions of mathematics and the multiplicity of its cultural and historical perspectives, although these aims are not explicitly written into the syllabus. It is hoped that teachers will take every opportunity to fulfill this aim by discussing relevant issues as they arise and making reference to appropriate background information. For example, it may be appropriate to discuss:

- Differences in notation.
- The lives of mathematicians set in a historical and /or social content.
- The cultural content of mathematical discoveries.
- The ways in which certain mathematical discoveries were made (in chronological order) in terms of the techniques used.
- The attitudinal divergence of different societies towards certain areas of mathematics.
- The universality of mathematics as language.

Addressing the Areas of Interaction

At HOCKERILL, we believe that it is as important to develop an understanding of each distinctive area of human knowledge (of which Mathematics is one) as it is to develop an understanding of how these areas are linked. Knowledge from any area properly understood, can be applied to other areas. One of the prime purposes of high school mathematics is for students to be able to synthesize knowledge and use it in a new or unusual situation.

Mathematics is a subject where new knowledge is often built from previous knowledge so it is important that students ensure sound understanding of every day's work. We believe that

mathematics should be perceived as a process of abstraction, (involving inductive reasoning and investigation as well as deduction) and that its symbolic form of representation should be viewed as a language.

Our vision is in line with that of the IB/MYP mathematics ideal, where students are encouraged to develop their knowledge and understanding of the subject, their problem solving, thinking skills and their mathematical awareness in other disciplines. The programme also aims at ensuring that students learn to communicate effectively and correctly in mathematics and provides opportunity to practice IT skills. The programme endeavors to relate mathematics to all other subjects and to the world, emphasizing the country in which they currently reside. This is done with the help of a series of projects, investigations and activities, (and whenever possible), by making explicit the connection between mathematics and MYP areas of interaction. These areas of interaction are:

- Approaches to learning;
- Community service;
- Health and social education;
- Environment and
- Human Ingenuity

Examples of the Areas of Interaction through both years of Mathematics

<table>
<tr><th>Approaches to Learning</th><th>Community and Service</th><th>Health and Social Education</th><th>Environment</th><th>Human Ingenuity</th></tr>
<tr><td>Development of effective study skills.</td><td>Identify an issue of importance to the community; collect, collate and present data on the issue and suggest, or even carry out, corrective action.</td><td>Mathematical knowledge and enquiry are fundamental to the understanding of such information.</td><td rowspan="3">Mathematical research and analyzing data from their own investigations and those of others, students could examine the environmental impact of a particular development that has been made, and suggest action to rectify any problems.</td><td>Study the history of the subject and the philosophers who have contributed to the development of mathematical thought throughout history.</td></tr>
<tr><td>Engage in problem solving exercises, and have opportunities to share and discuss the variety of approaches taken and solutions found leading to awareness of and a respect for different ways of thinking.</td><td>Encouraged to take an active role in their school community.</td><td>Discrete mathematics provides students with different forms of representation to illustrate ideas, issues and data.</td><td>Addressing the fundamental concept of intercultural awareness, mathematics courses could challenge students to research different number systems and ways of writing and counting numbers</td></tr>
<tr><td>Develop a positive attitude to discovering and learning</td><td rowspan="3">Older students could tutor younger ones.</td><td rowspan="3">Issues such as population growth, a study of the appropriateness of statistics and probability could be undertaken, linking with Human Ingenuity. Number and geometry and trigonometry offer opportunities for students to carry out health related measurements on issues such as living space and comparisons of growth rates.</td><td>Opportunities may exist to involve students in managing their own local environment, either in school or at home.</td><td rowspan="3">Projects seeking the links between geometry and art, or investigations into the shapes and motifs of different cultures, are encouraged to address Human Ingenuity as an interdisciplinary theme.</td></tr>
<tr><td>Capacity for solving problems and making decisions.</td><td rowspan="2">Practical work in geometry and trigonometry may involve students in projects such as town planning, designing and making models of real or imagined buildings, or other space management applications. Exploration of the historical issues of the application of geometry such as the “Golden Ratio” used in the construction of some ancient buildings.</td></tr>
<tr><td>Engagement in intellectually rigorous activities promoting the development of these skills, thought processes and capacities.</td></tr>
<tr><td>Independent and cooperative skills.</td><td rowspan="3">More proficient language students could help others by developing and publishing a translation dictionary of mathematical terms.</td><td rowspan="3">Students may work on the association between mental health and time management, linking with approaches to learning pattern recognition, from a study of algebra, is a necessary skill in making sense of data and being able to make informed decisions.</td><td rowspan="3">Awareness of the power of mathematics to mislead, criticize and destroy.</td></tr>
<tr><td>Develop mathematical skills, organize work effectively, use a variety of media and technologies to collect, collate and present data.</td></tr>
<tr><td>Explore the historical aspects of mathematics to give opportunities to explore cultural differences in mathematical thinking.</td></tr>
</table>

Course Organisation

SUBJECT: MATHEMATICS (EDEXCEL)

The importance of Mathematics to the individual's life today and in the future should not be under-estimated. A sound knowledge and understanding of the applications of the subject in the home, to Science and Technology as well as business, commerce and industry is clearly in evidence in everyday life. The communication of information through the use of diagrams, tables, graphs and symbols demands the ability to read and interpret information. Mathematics is fundamentally a problem solving activity which requires the interpretation of a comprehensive network of interrelated ideas: it requires flexibility of mind, initiative and imagination.

Students are taught Mathematics in appropriate ability groups, based upon past performance, reports and Key Stage 3 assessments. The students are offered breadth and depth of experience using a variety of approaches to emphasise the broad range of applications of mathematical knowledge and understanding as a single subject.

The Mathematics course at Key Stage 4 is presented in four Attainment Targets as outlined in the National Curriculum:

Using and Applying	**(Ma 1)**	**Number & Algebra**	**(Ma 2)**
Shape & Space	**(Ma 3)**	**Data Handling**	**(Ma 4)**

Assessment
Students will follow a 'Linear' course and the assessment of students' ability in Mathematics is based upon written papers representing 100% of the marks. Overall differentiation is achieved within the syllabus by allowing level of entry in two overlapping tiers.

Higher Level entry makes grades A* to D available.
Foundation Level entry makes grades C to G available.

Career Opportunities
A high level of numeracy is required for entrance to many professions and higher education courses, particularly Business and Management, Computing, Accountancy and Finance. By encouraging positive attitudes towards Mathematics and high expectations of each individual student academically and personally, we aim to enable each individual to enjoy Mathematics, to give them confidence to use their Mathematics and to achieve their full potential.
For further advice please see:

Mathematics Department Staff:
Mrs. D. Spackman (Head of Faculty)
Mr. S. Ahras (Second in charge of Faculty)
Mr. S. Clark
Mrs. A. Goldsmith
Mrs. C. Higgs
Mr A Hill
Mr D Gillhespey
Mr J McKenna

MYP Mathematics Assessment Criteria

General

The assessment criteria listed in the table below apply to both levels of MYP mathematics. Final assessment at the end of the MYP must be based on these assessment criteria.

Criterion A	Knowledge and Understanding	Maximum 10
Criterion B	Application and Reasoning	Maximum 10
Criterion C	Communication	Maximum 6
Criterion D	Reflection and Evaluation	Maximum 8

- For each assessment criterion, a number of band descriptors are defined. These describe a range of achievement levels with the lowest level represented as 0.
- The criteria are not equally weighted.
- The descriptors concentrate on positive achievement, although failure to achieve may be included in the description for the lower levels.
- The assessment criteria and levels of achievement appear on the following pages.

Criterion A: Knowledge and Understanding

Maximum 10

Students are expected to have a knowledge and understanding of the concepts and skills of MYP mathematics as shown in the prescribed framework.

This criterion includes:

- *using knowledge and understanding to make deductions*
- *using numeric, algebraic, geometric, graphical and other forms of representation*
- *moving between different forms of representation using appropriate technology.*

Level of Achievement	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1–2	The student demonstrates **minimal mathematical knowledge** and **attempts** to use different forms to represent mathematical ideas.
3–4	The student demonstrates **partial** knowledge and understanding of the subject material. The student uses a **limited range** of forms to represent mathematical ideas.
5–6	The student demonstrates **sufficient** knowledge and understanding of the subject material to **make deductions**. The student uses a **variety** of forms to represent mathematical ideas.
7–8	The student demonstrates a broad knowledge and a **good** understanding of the subject material, and makes deductions **with some insight**. The student moves between different forms of representation in **most situations**.
9–10	The student demonstrates a **thorough** knowledge and a **comprehensive** understanding of the subject material and is able to make deductions with insight **even in unfamiliar situations**. The student moves **confidently** between different forms of representation.

Notes

1. Assessment tasks should allow students to demonstrate knowledge and understanding of the concepts and skills within the appropriate level of MYP mathematics.
2. Assessment tasks for this criterion are likely to be class tests and/or examinations. Teachers are encouraged to use other tasks also, such as open-ended investigations.
3. Assessment tasks should provide students with problems set in a variety of contexts.

Criterion B: Application and Reasoning
Maximum 10
Students are expected to apply concepts and skills and, through reasoning, develop problem-solving strategies.
This criterion includes:

- *selecting and using appropriate mathematical knowledge and skills*
- *recognizing patterns and structures and describing them as relationships or general rules*
- *drawing conclusions consistent with findings*
- *justifying mathematical relationships*

developing flexible strategies, including the use of appropriate technology.

Level of Achievement	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1–2	The student uses **limited** mathematical knowledge and recognizes **simple** patterns or structures when investigating problems. The student applies **basic problem-solving techniques** to routine tasks.
3–4	When investigating problems the student recognizes patterns and **suggests relationships** or **general rules**. The student applies skills and problem-solving techniques **with some success**.
5–6	When investigating problems the student recognizes patterns and structures, describes them as relationships or general rules and **draws conclusions**. The student applies appropriate skills and problem-solving techniques and uses **appropriate technology** to a limited extent.
7–8	When investigating problems of **some complexity** the student recognizes patterns and structures, describes them as relationships or general rules and **draws conclusions consistent with findings**. The student successfully **selects** and applies skills and problem-solving techniques. The student makes **reasoned choices** for the use of technology, where appropriate.
9–10	When investigating **challenging** problems, the student recognizes patterns and structures, describes them as relationships or general rules, draws conclusions and **provides justifications or proofs**. The student selects and applies **advanced** problem-solving techniques including the use of technology where appropriate.

Notes

1. Assessment tasks should allow students to demonstrate their ability to apply and reason using concepts and skills of the appropriate level of MYP mathematics.
2. Assessment tasks for this criterion are likely to be reasoned pieces of work, including open-ended investigations set in a variety of contexts.
3. Little credit should be given for knowledge and understanding which is assessed using criterion A.

Criterion C: Communication
Maximum 6

Students are expected to communicate facts, ideas, methods, results and conclusions using appropriate symbols and the language of mathematics.

This criterion includes:

- *encoding and decoding*
- *describing in words (verbalizing) a line of reasoning*
- *explaining solutions*
- *presenting mathematical information clearly and logically using appropriate technology for effective communication.*

Level of Achievement	**Descriptor**
0	The student does not reach a standard described by any of the descriptors given below.
1–2	The student recognizes and uses **basic** mathematical symbols and language. An **attempt** is made to verbalize when investigating problems set in familiar contexts. The student presents **some** mathematical information clearly.
3–4	The student recognizes and uses **a range of** mathematical symbols and language. The lines of reasoning are **verbalized** and the solutions to problems are **explained**. Mathematical information is presented **clearly and logically**.
5–6	The student recognizes and uses a **wide range** of mathematical symbols and language. The student verbalizes **effectively** and explains solutions to problems **clearly**. The student chooses and uses the **most appropriate technology** to present mathematical information clearly and logically.

Notes
1. Assessment tasks should allow students to communicate effectively when using concepts and skills of the appropriate level of MYP mathematics.
2. Assessment tasks for criteria A, B and D can also be used for this criterion.

Criterion D: Reflection and Evaluation
Maximum 8

Students are expected to reflect upon methods and processes and to evaluate the significance and reliability of their findings and the findings of others. It is expected that students will consider alternative approaches to solving problems where relevant.

This criterion includes:

- *reflecting upon and evaluating methods and processes used during investigations which could be open-ended*
- *considering the use of technology where appropriate.*

Level of Achievement	Descriptor
0	The student does not reach a standard described by any of the descriptors given below.
1–2	The student **attempts** to justify the method used and to **evaluate** the reliability of findings.
3–4	The student **justifies** the method and the majority of processes used. The student **evaluates** the reliability of findings with some success.
5–6	The student presents a **reasoned** justification for the method and processes, and provides an evaluation of the **significance** and reliability of findings. The student suggests **other approaches** to solving the problem, where relevant.
7–8	The student presents a **concise**, reasoned justification for the method and processes and, where relevant, **considers fully** the range of approaches which could have been used, including the use of technology. The student makes a **thorough evaluation** of the significance and reliability of findings.

Notes

1. Assessment tasks are likely to be reports on investigations undertaken using concepts and skills of the appropriate level of MYP mathematics.
2. Assessment tasks should give students clear instructions to reflect and evaluate.
3. Assessment tasks should focus on the individual's ability to reflect and evaluate.