CORNELL
INTERNATIONAL ACADEMY

Course Outline

School Name: Cornell International Academy

Department Name: Mathematics

Ministry of Education Course Title:

Advanced Functions Grade 12, University Preparation

Ministry Course Code: MHF4U

Grade Level: Grade 12

Developed from:*Mathematics- The Ontario Curriculum Grades 11 and 12, 2007 (Revised)*

Text: Advanced Functions
Nelson Education Limited, 2009 ISBN: 13:978-0-17-637443-3
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Prerequisite: Functions, Grade 11, University Preparation, or Mathematics for College Technology, Grade 12, College Preparation

Credit Value: 1

Length: 110 hrs

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Course Content

Unit	Length
Unit A: Characteristics of the Functions	**27.5 hours**
Unit B: Polynomial and Rational Functions	**27.5 hours**
Unit C: Exponential and Logarithmic Functions	**24.5 hours**
Unit D: Trigonometric Functions	**27.5 hours**
Final Exam	**3 hours**
Total	**110 hours**

Course Description:

This course extends students' experience with functions. Students will investigate the properties of polynomial, rational, logarithmic, and trigonometric functions; develop techniques for combining functions; broaden their understanding of rates of change; and develop facility in applying these concepts and skills. Students will also refine their use of the mathematical processes necessary for success in senior mathematics. This course is intended both for students taking the Calculus and Vectors course as a prerequisite for a university program and for those wishing to consolidate their understanding of mathematics before proceeding to any one of a variety of university programs.

Unit A: Characteristics of the Functions
Time: 27.5 hours
Overall expectations:

After completing this unit, student will be able to:

- demonstrate an understanding of average and instantaneous rate of change, and determine, numerically and graphically, and interpret the average rate of change of a function over a given interval and the instantaneous rate of change of a function at a given point;
- determine functions that result from the addition, subtraction, multiplication, and division of two functions and from the composition of two functions, describe some properties of the resulting functions, and solve related problems;
- compare the characteristics of functions, and solve problems by modeling and reasoning with functions, including problems with solutions that are not accessible by standard algebraic techniques

Unit B: Polynomial and Rational Functions
Time: 27.5 hours
Overall expectations:

After completing this unit, student will be able to:

- identify and describe some key features of polynomial functions, and make connections between the numeric, graphical, and algebraic representations of polynomial functions;
- identify and describe some key features of the graphs of rational functions, and represent rational functions graphically;
- solve problems involving polynomial and simple rational equations graphically and algebraically;
- demonstrate an understanding of solving polynomial and simple rational inequalities.

Unit C: Exponential and Logarithmic Functions
Time: 24.5 hours
Overall expectations:

After completing this unit, student will be able to:

- demonstrate an understanding of the relationship between exponential expressions and logarithmic expressions, evaluate logarithms, and apply the laws of logarithms to simplify numeric expressions;
- identify and describe some key features of the graphs of logarithmic functions, make connections among the numeric, graphical, and algebraic representations of logarithmic functions, and solve related problems graphically;
- solve exponential and simple logarithmic equations in one variable algebraically, including those in problems arising from real-world applications

Unit D: Trigonometric Functions
Time: 27.5 hours
Overall expectations:

After completing this unit, student will be able to:

- demonstrate an understanding of the meaning and application of radian measure;
- make connections between trigonometric ratios and the graphical and algebraic representations of the corresponding trigonometric functions and between trigonometric functions and their reciprocals, and use these connections to solve problems;
- solve problems involving trigonometric equations and prove trigonometric identities.

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Final Evaluation - 3 hrs

The final assessment task is a three hour proctored final exam worth 30% of the student's final mark in the course.

Assessment and Evaluation Strategies of Student Performance:

Assessment is a systematic process of collecting information or evidence about a student's progress towards meeting the learning expectations. Assessment is embedded in the instructional activities throughout a unit. The expectations for the assessment tasks are clearly articulated and the learning activity is planned to make that demonstration possible. This

process of beginning with the end in mind helps to keep focus on the expectations of the course. The purpose of assessment is to gather the data or evidence and to provide meaningful feedback to the student about how to improve or sustain the performance in the course. Scaled criteria designed as rubrics are often used to help the student to recognize their level of achievement and to provide guidance on how to achieve the next level. Although assessment information can be gathered from a number of sources (the student himself, the student's course mates, the teacher), evaluation is the responsibility of only the teacher. For evaluation is the process of making a judgment about the assessment information and determining the percentage grade or level.

The Final Grade:

The evaluation for this course is based on the student's achievement of curriculum expectations and the demonstrated skills required for effective learning. The percentage grade represents the quality of the student's overall achievement of the expectations for the course and reflects the corresponding level of achievement as described in the achievement chart for the discipline. A credit is granted and recorded for this course if the student's grade is 50% or higher. The final grade for this course will be determined as follows:

- 70% of the grade will be based upon evaluations conducted throughout the course. This portion of the grade will reflect the student's most consistent level of achievement throughout the course, although special consideration will be given to more recent evidence of achievement.
- 30% of the grade will be based on a final evaluation administered at the end of the course. This final evaluation will be based on an evaluation of achievement from all four categories of the Achievement Chart for the course and of expectations from all units of the course.

Term work: **70%** of your grade will be based on all of the evidence you have provided. It will reflect your most consistent level of achievement with special consideration given to more recent evidence.	**20% Knowledge & Understanding:** Knowledge of content and the understanding of mathematical concepts.
	20% Application: the application of knowledge and skills in familiar contexts; transfer of knowledge and skills to new contexts; making connections within and between various contexts.
	20% Thinking: use of planning and processing skills; use of critical and creative thinking processes.
	10% Communication: Expression and organization of ideas and mathematical thinking, communication for different audiences/purposes and use of conventions, vocabulary and terminology of the discipline … all using oral, visual and written forms.
	10% Performance Task: Consisting of a mathematical investigation or contextual, open-ended problematic situation suited to a variety of approaches including use of technology

	where appropriate
Final Evaluation: **30%** of your grade will be determined at the end of the course	**30% Exam**: Consisting of a variety of question types (e.g. short answer, multiple choice, extended tasks) sampling all strands and categories of 2.5 hours duration or less.
Your **final grade** will be calculated by combining your Term (70%) grade and Exam (30%).	

Teaching/Learning Strategies

In order to address the wide range of expectations in this course, a variety of teaching, learning, and assessment strategies and tools need to be used including;

• the use of rich contextual problems which engage students and provide them with opportunities to demonstrate learning, and appreciate the need for new skills;

• the prompting, supporting, and challenging of individual students

• the use of technological tools and software (e.g., graphing software, dynamic geometry software, the Internet, spreadsheets, and multimedia) in activities, demonstrations, and investigations to facilitate the exploration and understanding of mathematical concepts;

• the use of learning/performance tasks that are designed to link several expectations and give the students occasion to demonstrate their optimal levels of achievement through the demonstration of skill acquisition, the communication of results, the ability to pose extending questions following an inquiry, and the determination of a solution to unfamiliar problems;

• the use of accommodations, remediation, and/or extension activities, where necessary, to meet the needs of exceptional students;

• In addition to the contribution of the teacher, students themselves should play an active role in their own learning. In order to successfully complete the requirements of this course, students are expected to

• :develop an increased responsibility for their own learning;

• be accountable for prerequisite skills;

• participate as active learners; • engage in explorations using technology;

• apply individual and group learning skills;

• describe mathematical patterns that emerge verbally, algebraically, and visually in the course of learning

Assessment/Evaluation Strategies

Assessment as Learning	Assessment for Learning	Assessment of Learning
Conversation	**Conversation**	**Conversation**
Classroom discussion	Classroom discussion	Classroom discussion
Self-evaluation	Q&A during investigations	Q&A during investigations
	Teacher-student conference (informal)	Teacher Comment
	Interview	

Observation	**Observation**	**Observation**
Steps in problem solving	Group discussions	Investigations
	Investigations	Presentation
Student Products	**Student Products**	**Student Products**
Existing Card	Practice Exercises	Assignment
Checklist	Quizzes	Test
		Final Exam

	Knowledge/ Understanding	Thinking/Inquiry/ Problem Solving	Communication	Application
Final examinations	√	√	√	√
Classroom discussion		√	√	√
Performance tasks	√	√	√	√
Quizzes	√			
Assignments	√	√	√	√
Student-teacher conferences	√		√	
Tests	√	√	√	√
Self –evaluation	√			
Q&A during investigations	√	√	√	√
Teacher Comment		√	√	
Existing Card	√		√	
Checklist	√		√	

Assessment tools such as observational checklists, performance criteria, the Achievement Chart for Mathematics, marking schemes, and rating scales can and should be used to assist in developing objective and consistent evaluations of student achievement.

Program Planning Considerations for Mathematics:

Teachers who are planning a program in Mathematics must take into account considerations in a number of important areas. Essential information that pertains to all disciplines is provided in the companion piece to this document, *The Ontario Curriculum, Grades 11 to 12: Program Planning and Assessment, 2007 (Revised)*. The areas of concern to all teachers that are outlined there include the following:

Education for Exceptional Students

In planning this course, teachers should begin by examining both the curriculum expectations for the course and take into account the needs of exceptional students as set out in the students' individual education plan. The most appropriated methods and materials will be used to help students to achieve the expectations as outline in their individual education plan.

Program Considerations for English Language Learners

Young people whose first language is not English enter Ontario secondary schools with diverse linguistic and cultural backgrounds. Some English language learners may have experience of highly sophisticated educational systems, while others may have come from regions where access to formal schooling was limited. All of these students bring a rich array of background knowledge and experience to the classroom, and all teachers must share in the responsibility for their English-language development. Teachers of mathematics must incorporate appropriate adaptations and strategies for instruction and assessment to facilitate the success of the English language learners in their classrooms. These adaptations and strategies include:

- modification of some or all of the course expectations so that they are challenging but attainable for the learner at his or her present level of English proficiency, given the necessary support from the teacher;
- use of a variety of instructional strategies (e.g., extensive use of visual cues, scaffolding, manipulatives, pictures, diagrams, graphic organizers; attention to clarity of instructions);
- modelling of preferred ways of working in mathematics; previewing of textbooks; pre-teaching of key vocabulary; peer tutoring; strategic use of students' first languages);
- use of a variety of learning resources (e.g., visual material, simplified text, bilingual dictionaries, materials that reflect cultural diversity);
- use of assessment accommodations (e.g., granting of extra time; simplification of language used in problems and instructions; use of oral interviews, learning logs, portfolios, demonstrations, visual representations, and tasks requiring completion of graphic organizers or cloze sentences instead of tasks that depend heavily on proficiency in English).

When learning expectations in any course are modified for English language learners (whether or not the students are enrolled in an ESL or ELD course), this must be clearly indicated on the student's report card.

Antidiscrimination Education in Mathematics

Learning activities and resources used to implement the curriculum should be inclusive in nature, reflecting the range of experiences of students with varying backgrounds, abilities, interests, and learning styles. They should enable students to become more sensitive to the diverse cultures and perceptions of others, including Aboriginal peoples. By discussing aspects of the history of mathematics, teachers can help make students aware of the various

cultural groups that have contributed to the evolution of mathematics over the centuries. Finally, students need to recognize that ordinary people use mathematics in a variety of everyday contexts, both at work and in their daily lives. Connecting mathematical ideas to real-world situations through learning activities can enhance students' appreciation of the role of mathematics in human affairs, in areas including health, science, and the environment. Students can be made aware of the use of mathematics in contexts such as sampling and surveying and the use of statistics to analyse trends. Recognizing the importance of mathematics in such areas helps motivate students to learn and also provides a foundation for informed, responsible citizenship

Literacy and Inquiry/Research Skills

Literacy skills can play an important role in student success in mathematics courses. Many of the activities and tasks students undertake in mathematics courses involve the use of written, oral, and visual communication skills. For example, students use language to record their observations, to explain their reasoning when solving problems, to describe their inquiries in both informal and formal contexts, and to justify their results in small group conversations, oral presentations, and written reports. The language of mathematics includes special terminology. The study of mathematics consequently encourages students to use language with greater

In all courses in mathematics, students will develop their ability to ask questions and to plan investigations to answer those questions and to solve related problems. Students need to learn a variety of research methods and inquiry approaches in order to carry out these investigations and to solve problems, and they need to be able to select the methods that are most appropriate for a particular inquiry. Students learn how to locate relevant information from a variety of sources, such as statistical databases, newspapers, and reports. As they advance through the grades, students will be expected to use such sources with increasing sophistication. They will also be expected to distinguish between primary and secondary sources, to determine their validity and relevance, and to use them in appropriate ways.

The Role of Information and Communication Technology in Mathematics

Information and communication technologies (ICT) provide a range of tools that can significantly extend and enrich teachers' instructional strategies and support students' learning in mathematics. Teachers can use ICT tools and resources both for whole-class instruction and to design programs that meet diverse student needs. Technology can help to reduce the time spent on routine mathematical tasks, allowing students to devote more of their efforts to thinking and concept development. Useful ICT tools include simulations, multimedia resources, databases, sites that give access to large amounts of statistical data, and computer-assisted learning modules.

Applications such as databases, spreadsheets, dynamic geometry software, dynamic statistical software, graphing software, computer algebra systems (CAS), word-processing software, and presentation software can be used to support various methods of inquiry in

mathematics. Technology also makes possible simulations of complex systems that can be useful for problem-solving purposes or when field studies on a particular topic are not feasible.

Information and communications technologies can be used in the classroom to connect students to other schools, at home and abroad, and to bring the global community into the local classroom.

Although the Internet is a powerful electronic learning tool, there are potential risks attached to its use. All students must be made aware of issues of Internet privacy, safety, and responsible use, as well as of the ways in which this technology is being abused – for example, when it is used to promote hatred. Teachers, too, will find the various ICT tools useful in their teaching practice, both for whole class instruction and for the design of curriculum units that contain varied approaches to learning to meet diverse student needs.

Career Education in Mathematics

Teachers can promote students' awareness of careers involving mathematics by exploring applications of concepts and providing opportunities for career-related project work. Such activities allow students the opportunity to investigate mathematics-related careers compatible with their interests, aspirations, and abilities. Students should be made aware that mathematical literacy and problem solving are valuable assets in an ever-widening range of jobs and careers in today's society. The knowledge and skills students acquire in mathematics courses are useful in fields such as science, business, engineering, and computer studies; in the hospitality, recreation, and tourism industries; and in the technical trades.

Cooperative Education

By applying the skills they have developed, students will readily connect their classroom learning to real-life activities in the world in which they live.

Health and Safety in class

Although health and safety issues are not normally associated with mathematics, they may be important when learning involves fieldwork or investigations based on experimentation. Out-of-school fieldwork can provide an exciting and authentic dimension to students' learning experiences. It also takes the teacher and students out of the predictable classroom environment and into unfamiliar settings. Teachers must preview and plan activities and expeditions carefully to protect students' health and safety

Assignment Policy:

Should students not submit an assignment by the due date, the following will apply:

- The assignment may be submitted the next class, but must be accompanied by reason for the assignment being late and there will be no penalty.

- If the submission does not apply the above policy is the professional judgment of the teacher that will decide if other requirements will apply or penalties, including a mark of zero, will be given.

Missed Tests:

- If students miss attest with legitimate reasons, they are responsible to write that evaluation on the day on which they return at the time set by teacher. For prolonged absences, the teacher will use his/her professional judgment to set new test dates for that particular student.
- If student is not willing to take the test a mark zero will be given.

Attendance:

Attendance is crucial for all classes as is written in the school policies. After 3 days of missing, student will be asked to see the school principal and provide explanations about the reasons. For more than 3 days the process will follow the school policy about missing classes. With 30% absences in the course the credit will not be given.