Canadian International School of Egypt

COURSE TITLE: Advanced Functions
COURSE CODE: MHF4U
LEVEL OF DIFFICULTY: Grade 12, University Preparatory
CREDIT VALUE: 1.0
PERIOD LENGTH: 90 minutes
NUMBER OF PERIODS: 5 per week
HOURS OF INSTRUCTION: 110 hours
MINISTRY GUIDELINE: The Ontario Curriculum, Grades 11 and 12 Mathematics (Revised), 2007.
                                         http://www.edu.gov.on.ca/eng/curriculum/secondary/grades.html

PREREQUISITE: Functions and Relations, Grade 11, University Preparatory (MCR3U) or Mathematics for College Technology, Grade 12, College Preparatory

TEXT: Advanced Functions, Small, Kirkpatrick et al,
                                    Nelson, Toronto
                                    ISBN-13: 978-0-17-637443-3

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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 a variety of university programs.

Strands and Overall Expectations

A: EXPONENTIAL AND LOGARITHMIC FUNCTIONS. Students will:
1. Demonstrate an understanding of the relationship between exponential expressions and logarithmic expressions, evaluate logarithms, and apply the laws of logarithms to simplify numeric expressions.
1. 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.
2. Solve exponential and simple logarithmic equations in one variable algebraically, including those in problems arising from real-world applications.

B: TRIGONOMETRIC FUNCTIONS. Students will:
1. Demonstrate an understanding of the meaning and application of radian measure.
1. Make connections between trigonometric ratios and the graphical and algebraic representations of the corresponding trigonometric functions, make connections between trigonometric functions and their reciprocals and use these connections to solve problems.
2. Solve problems involving trigonometric equations and prove trigonometric identities.

C: POLYNOMIAL AND RATIONAL FUNCTIONS. Students will:
1. Identify and describe some key features of polynomial functions and make connections between the numeric, graphical, and algebraic representations of polynomial functions.
1. Identify and describe some key features of the graphs of rational functions, and represent rational functions graphically.
2. Solve problems involving polynomial and simple rational equations graphically and algebraically.
3. Demonstrate an understanding of solving polynomial and simple rational inequalities.

D: CHARACTERISTICS OF FUNCTIONS. Students will:
1. Demonstrate an understanding of average and instantaneous rate of change and determine these rates numerically and graphically.
1. 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.
2. 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.
3. 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.

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 will be used including:

- A balance of whole-class, small group, mixed-ability structured group, and individual instruction through student-centred and teacher-directed activities including board notes and overheads;
- The use of rich contextual problems which engage students and provide them with opportunities to demonstrate learning;
- The prompting, supporting, and challenging of individual students as well as the class as a whole;
- Approaches that will accommodate multiple learning styles (e.g., the provision of verbal and written instructions, the inclusion of hands-on activities, etc.);
- The use of technological tools and software in activities, demonstrations, and investigations to facilitate the exploration and understanding of mathematical concepts;
- Opportunities for students to practise and extend their skills and knowledge outside of the classroom;

References including textbooks and handouts will be provided.

Each student must take an active role in his/her own learning. To successfully complete the requirements of this course, students are expected, as a minimum, to:

- Develop an increased responsibility for their learning, including accountability for prerequisite skills, and regular homework completion and attendance;
- Participate as active learners, including asking questions and engaging in explorations using technology;
- Apply individual and group learning skills.
- Using the appropriate terminology and format, describe verbally, algebraically, and visually the mathematical patterns that emerge.

Time Allocation

Section	Topic	Hours
A	Exponential and Logarithmic Functions	30
B	Trigonometric Functions	30
C	Polynomial and Rational Functions	30
D	Characteristics of Functions	20

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Assessment and Evaluation

This table summarizes how students will be assessed and evaluated in this course. The weights are percentages of the student's final mark. Each evaluation and assessment tool may evaluate one or more of the four categories of knowledge and skills described below the table. Students are provided with opportunities to demonstrate their highest level of achievement in each of these four categories.

	Weight	What	Details
T E R M W O R K	20%	**Notes, Homework, Quizzes**	Any class may start with a short quiz that evaluates how well the student understands and practices recently presented curriculum content. A student who completes the homework assignments will be well prepared for the quiz. If a student misses a quiz for any reason, he/she will receive a mark of zero unless he/she arranges with the teacher to do the quiz *during the following lunch*. Students are expected to be on time for class and contribute in a positive manner to class discussions.
	10%	**Assignments & Investigations** (may be evaluated using rubrics)	In each unit, students will be given assignments to complete at home as well as in-class investigations. If a student is absent for an in-class investigation he/she must arrange a time to complete it outside of class time. Late assignments will be accepted until marked assignments are returned. Late assignments will have a deduction of 10% on the first day and an additional deduction of 2.5% each extra day.
	40%	**Tests**	There will usually be a review day in class the day before the test. In order to do well on the tests students should complete their homework daily and start studying several days in advance. Absent students will be given the opportunity to write the same or a similar test **on the day they return to school**.
F I N A L	30%	**Final Exam**	At the end of the semester there will be a final written exam covering all the topics included in this course. The questions on this exam will be similar to those on the tests and assignments so students are encouraged to save their marked tests and assignments after they are returned. Correct solutions to course work will be provided throughout the semester. Extra help is available throughout the semester. Students should not wait until the final exam before coming for extra help.

Achievement Categories of Knowledge and Skills

Each of the assessment and evaluation tools listed above may be used to evaluate the following categories of knowledge and skills defined by the Ontario Ministry of Education:

30% Knowledge and Understanding: Subject specific knowledge acquired in the course, and the comprehension of its meaning and significance.

30% Application: The use of knowledge and skills to make connections within and between various contexts.

20% Communication: Conveying meaning through various forms.

20% Thinking: The use of critical and creative thinking skills and/or processes.

Assessment and Evaluation Policy

The Achievement Chart below is the basis for assessment and evaluation in this course. It is copied from *The Ontario Curriculum, Grades 11 and 12, Mathematics,* p.28-29.

The chart identifies four major categories of knowledge and skills as follows: Knowledge and Understanding, Thinking, Communication, and Application. These categories encompass the curriculum expectations in all courses in Mathematics. The descriptions at Level 3 represent the Ontario provincial standard for student achievement.

In the Ontario provincial philosophy, the purpose of assessment is to improve the quality of student learning. Knowledge and skills are assessed to evaluate student performance within the curriculum taught. Assessment outcomes are used to inform students, parents and other stakeholders of student performance while allowing the teacher to judge progress and to review teaching strategies as necessary.

Course Files:

Course files (Outlines, assignment instructions, rubrics, and review exercises can be found on the course Dropbox folder. Parents and students can choose to have access to it by providing an email address which they allow to be added to the permissions list.

Achievement Chart, Grades 11-12, Mathematics

Category	LEVEL 1 (50-59%)	LEVEL 2 (60-69%)	LEVEL 3 (70-79%)	LEVEL 4 (80-100%)
Knowledge/ Understanding	The student:			
understanding concepts,	demonstrates limited understanding of concepts	demonstrates some understanding of concepts	demonstrates considerable understanding of concepts	demonstrates thorough understanding of concepts
performing algorithms	performs only simple algorithms accurately by hand and by using technology	performs algorithms with inconsistent accuracy by hand, mentally, and by using technology	performs algorithms accurately by hand, mentally, and by using technology	selects the most efficient algorithm and performs it accurately by hand, mentally, and by using technology
Thinking/ Inquiry/ Problem Solving	The student:			
reasoning	follows simple mathematical arguments	follows arguments of moderate complexity and makes simple arguments	follows arguments of considerable complexity, judges the validity of arguments, and makes arguments of some complexity	follows complex arguments, judges the validity of arguments, and makes complex arguments
applying the steps of an inquiry/ problem-solving process	applies the steps of an inquiry/ problem-solving process with limited effectiveness	applies the steps of an inquiry/ problem-solving process with moderate effectiveness	applies the steps of an inquiry/ problem-solving process with considerable effectiveness	applies the steps of an inquiry/problem-solving process with a high degree of effectiveness and poses extending questions

Canadian International School of Egypt

Communicating	The student:			
communicating reasoning orally, in writing, and graphically	communicates with limited clarity and limited justification of reasoning	communicates with some clarity and some justification of reasoning	communicates with considerable clarity and considerable justification of reasoning	communicates concisely with a high degree of clarity and full justification of reasoning
using mathematical language, symbols, visuals, and conventions	infrequently uses mathematical language, symbols, visuals, and conventions correctly	uses mathematical language, symbols, visuals, and conventions correctly some of the time	uses mathematical language, symbols, visuals, and conventions correctly most of the time	routinely uses mathematical language, symbols, visuals, and conventions correctly and efficiently
Application	**The student:**			
applying concepts and procedures relating to familiar and unfamiliar ettings	applies concepts and procedures to solve simple problems relating to familiar settings	applies concepts and procedures to solve problems of some complexity relating to familiar settings	applies concepts and procedures to solve complex problems relating to familiar settings; recognizes major mathematical concepts and procedures relating to applications in unfamiliar settings	applies concepts and procedures to solve complex problems relating to familiar and unfamiliar settings

Percentage Grade Range	Achievement Level	Summary Description
80 – 100%	Level 4	A very high to outstanding level of achievement. Achievement is above the provincial standard.
70 – 79%	Level 3	A high level of achievement. Achievement is at the provincial standard.
60 – 69%	Level 2	A moderate level of achievement. Achievement is below but approaching the provincial standard.
50 – 59%	Level 1	A passable level of achievement. Achievement is below the provincial standard.
Below 50%	Insufficient achievement of curriculum expectations. A credit will not be granted.	