Course Outline

Department: MATHEMATICS

Course Developer: Simon Gallo

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Course Reviser/ Revision Date : Nidhi Vyas

Course Title/ Grade/ Type: Advanced Functions, Grade 12, University Preparation

Course Code: MHF4U

Credit Value: 1.0

Total Hours: 110 hours

Policy Document: The Ontario Curriculum Grades 11 and 12 Mathematics, Ministry of Education 2007 (revised)

Prerequisite: Functions, Grade 11, University Preparation, or Mathematics for College Technology, Grade 12, College Preparation

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.

Overall Curriculum Expectations

Exponential and Logarithmic Functions

A1 - Demonstrate an understanding of the relationship between exponential expressions and logarithmic expressions, evaluate logarithms, and apply the laws of logarithms to simplify numeric expressions;

A2 - 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;

A3 - Solve exponential and simple logarithmic equations in one variable algebraically, including those in problems arising from real-world applications.

Trigonometric Functions

B1 - Demonstrate an understanding of the meaning and application of radian measure;

B2 - 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;

B3 - Solve problems involving trigonometric equations and prove trigonometric identities.

Polynomial and Rational Functions

C1 - Identify and describe some key features of polynomial functions, and make connections between the numeric, graphical, and algebraic representations of polynomial functions;

C2 - Identify and describe some key features of the graphs of rational functions, and represent rational functions graphically;

C3 - Solve problems involving polynomial and simple rational equations graphically and algebraically;

C4 - Demonstrate an understanding of solving polynomial and simple rational inequalities.

Characteristics of Functions

D1 - 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;

D2 - 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;

D3 - 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.

Outline of Course Content

Unit Title	Description	Hours
Polynomial Equations and Inequalities	In this unit, students determine properties of the graph of polynomial functions and sketch the graph them. They then describe the nature of change in polynomial functions and determine the nature of change in polynomial functions. Finally, they will understand the Remainder and Factor Theorems. Students will factor polynomial expressions, determine the roots of polynomial equations and determine the real roots of non-factorable polynomial equations. They will compare the nature of change of polynomial functions with that of linear and quadratic functions and solve problems involving the abstract extensions of algorithms as well as solve factorable and non-factorable polynomial inequalities. Finally, they will write the equation of a family of polynomial functions and describe intervals and distances.	27
Trigonometric Functions	In this unit, students will sketch the graphs of sine and cosine functions for the angle expressed in radians, and determine and describe some key properties. They will also graph the tangent and reciprocal trigonometric functions, and relate those graphs to the graphs of sine and cosine. Students will learn how to graph transformations of trigonometric functions and will learn to determine the period, amplitude and phase shift of the transformed functions. Students will also solve a variety of problems including solving equations and real-world applications. Students will study the connections between exponentials and logarithms, simplify and evaluate numerical expressions, determine the key features of the graph of a logarithmic function and its transformations, and pose and solve problems involving exponential and logarithmic functions and equations. Average and instantaneous rates of change will also be analyzed.	24
Exponential and Logarithmic Equations	In this unit, students will verify the product and quotient laws of logarithms and use them to simplify and evaluate numerical expressions. They will simplify and solve exponential and logarithmic equations, as well as solve applications problems by the use of exponential and logarithmic equations.	30
Combining Functions	In this unit, students will develop an understanding of the combining of functions, especially the composition of functions. They will also use function models to solve a variety of problems.	24
Final culminating +Final Exam	Final evaluation should be designed to provide the opportunity for students to demonstrate comprehensive learning in each of the four Achievement Chart categories. Due to the emphasis of cumulative tests and examinations in university programs, a final evaluation should play a prominent role in the final assessment of the student.	6

		Total Hours	110

Teaching and Learning Strategies

The strategies used are varied to meet the needs and the range of learning styles encountered and they include the following:

Demonstrations   Homework   Discussions
Problem Solving   Work and Task Sheets   Information Analysis
Decision Making   Teacher Led Review   Problem-based Learning
Direct Instruction   Co-operative Learning

Strategies for Assessment and Evaluation of Student Performance

Diagnostic assessment is used at the beginning of a unit to assist in determining a starting point for instruction. Assessment for Learning (AFL) provides information to students as they are learning and refining their skills. Assessment as Learning (AAL) acts as a stepping-stone for students to begin applying their understanding using critical thinking; it bridges the gap between AFL and AOL. Assessment of Learning (AOL), at the end of units and course, provides students with the opportunity to synthesize/apply/demonstrate their learning and the achievement of the expectations. The following is a list of specific assessment/evaluation strategies that the teacher may use but is not limited to.

Assessment and Evaluation

Evaluation in this course will be continuous throughout the year and will include a variety of evaluation methods. The tools highlighted in yellow will be used for the three different types of assessments:

Assessment as Learning	Assessment for Learning	Assessment of Learning
Student Product	Student Product	Student Product
€ Journals/Letters/Emails (checklist)	€ Assignment	€ Assignment
€ Learning Logs (anecdotal)	€ Journals/Letters/Emails (checklist)	€ Journals/Letters/Emails (checklist)
€ Learning Goals (Checklist)	€ Pre-tests (scale/rubric)	€ Tests (scale/rubric)
€ Entrance tickets	€ Peer feedback (anecdotal/checklist)	€ Exam
€ Exit tickets	€ Entrance ticket	€ Reports (rubric)
	€ Vocabulary notebooks (anecdotal)	€ Essays (rubric)

Observation € **Whole class discussions (anecdotal)** € Self-proofreading (checklist)	**Observation** € **Class discussions (anecdotal)** € Debate (rubric) € Performance tasks (anecdotal/scale)	**Observation** € **PowerPoint presentations (rubric)** € Performance tasks (anecdotal/scale)
Conversation € Student teacher conferences (checklist) € **Small Group Discussions (checklist)** € **Pair work (checklist)**	**Conversation** € Student teacher conferences (checklist) € Small group discussions (checklist) € Pair work (anecdotal) € Peer-feedback (anecdotal) € Peer-editing (anecdotal) € **Oral pre-tests (scale/rubric)**	**Conversation** € **Student teacher conferences (checklist)** € **Question and Answer Session (checklist)** € Oral tests (scale/rubric)

The Final Grade:

The percentage grade represents the quality of the students' overall achievement of the expectations for the course and reflects the corresponding achievement as described in the achievement chart for Mathematics. The distribution of marks into a grade is based on the departmental assessment and evaluation guide for the course and will reflect the student's most consistent level of achievement where appropriate. Comments on the development of learning skills and contributions to the course will be provided on reports. Term work will be 70% of the overall grade for the course; the final evaluation will be 30% of the overall grade, incorporating a final written examination and student/teacher conference at the end of the semester.

Assessment and Percentage of Final Mark		Weightage in Final Gradebook
	Assignment 1: Polynomials and Rational Function Assignment [Student Product]	5%

(Term) **70%**	Test 1: polynomial and rational function Test [Student Product]	9%	
	Polynomial Function Student teacher's Conference [Observation/Conversation]	7%	
	Assignment 2: Trigonometric Functions Assignment [Student Product]	5%	
	Test 2: Trigonometric Functions [Student Product]	9%	
	Assignment 3: Logarithmic and exponential Functions Assignment [Student Product]	5%	
	Test 3: Logarithmic and exponential Functions [Student Product]	9%	
	Applying trigonometric, log and exponential function concepts Student teacher's Conference [Observation/Conversation]	7%	
	Assignment 4 : Combining Function Assignment [Student Product]	5%	
	Test 4: Combining Functions [Student Product]	9%	
30%	Final Evaluation	written exam (**20%**) [Student Product] + Final culminating assignment (**10%**) [Observation/Conversation]	

● **Each Assessment of Learning (AoL) will be broken into the following categories and given the following weights: Knowledge/Understanding (25%), Inquiry/Thinking (25%), Communication (25%), and Application/Making Connections (25%).**

A Summary Description of Achievement in Each Percentage Grade Range and Corresponding Level of Achievement		
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%	Level R	Insufficient achievement of curriculum expectations. A credit will not be granted.

Program Planning Considerations:

English language learners: As our school can have multilingual student population, special accommodation will be made to bring a rich diversity of background knowledge and experience to the classroom.

TWS courses can provide a wide range of options to address the needs of ESL/ELD students. Assessment and evaluation exercises will help ESL students in mastering the English language. In addition, since all occupations require employees with a wide range of English skills and abilities, many students will learn how the operation of their own physical world can contribute to their success in their social world. The student whose first language is not English enters Ontario Secondary schools with diverse linguistic and cultural backgrounds. 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 must incorporate appropriate strategies for instructions and assessment to facilitate the success of the English language learners in their classrooms. These 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 English; 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).

Literacy education: Communication skills are fundamental to the development of literacy. Fostering students' communication skills is an important part of the teacher's role in the curriculum. When students read they need to understand vocabulary and terminology. Students are encouraged to use language with care and precision in order to communicate effectively. Students are encouraged to ask questions to their peers/teachers and to also be proactive with solving their own questions.

The role of information and communications technology: Information and communication technologies (ICT) provide a range of tools that can significantly extend and enrich teachers' instructional strategies and support students' learning. 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 tasks, allowing students to devote more of their efforts to thinking and concept development.

Information technology is considered a learning tool that must be accessed by students when the situation is appropriate. As a result, students will develop transferable skills through their experience with word processing, internet research, and presentation software, as would be expected in any environment.

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.

Equity and Inclusive Education: The TWS equity and inclusive education strategy focuses on respecting diversity, promoting inclusive education, and identifying and eliminating discriminatory biases, systemic barriers, and power dynamics that limit the ability of students to learn, grow, and contribute to society. In an environment based on the principles of inclusive education, all students, parents, caregivers, and other members of the school community - regardless of ancestry, culture, ethnicity, sex, physical or intellectual ability, race, religion, gender identity, sexual orientation, socio-economic status, or other similar factors - are welcomed, included, treated fairly, and respected. Diversity is valued, and all members of the TWS community feel safe, comfortable, and accepted. Every student is supported and inspired to succeed in a culture of high expectations for learning. In an inclusive education system, all students see themselves reflected in the curriculum, their physical surroundings, and the broader environment, so that they can feel engaged in and empowered by their learning experiences. In addition, TWS differentiates the instruction and assessment strategies to take into account the background and experiences, as well as the interests, aptitudes, and learning needs, of all students.

Plagiarism/Cheating:

Any incident of plagiarism or cheating will result in a resubmission/rewrite of that particular assignment/test at the end of the course on the student's own time and at his/her own expense to pay for the creation and marking of a new assessment. The incident will be documented in the office.

A second incident of plagiarism or cheating in any course will result in a mark of zero for that assignment. For example, if you cheat on a math test and then plagiarize an English essay, you will receive a zero on the essay.

Missed and Late Assignment Policy:

Teachers will make it Clear to the students and parents/guardian early in the school year that they are responsible not only for their behaviour in the classroom/school but also for providing evidence of their achievement of the overall expectations within the time frame specified by the teacher and in a form approved by the teacher. Students must understand that there will be consequences for not completing assignments for evaluation or for submitting those assignments late. Where in the teacher's professional judgment it is appropriate to do so, a number of strategies will be used to encourage the student to modify his/her behaviour. Some of these may include:

- Asking the student to clarify the reason for not completing the assignment taking into consideration legitimate reasons for missed deadlines
- Maintaining ongoing communication with students and/or parents about due dates and late assignments, and scheduling conferences with parents if the problem persists
- Setting up a student contract
- Providing alternative assignments or tests/exams where, in the teacher's professional judgment, it is reasonable and appropriate to do so
- Deducting marks for late assignments, up to and including the full value of the assignment

Students and parent/guardians will be informed in a timely fashion via phone call, face to face conference, e-mail and if need be a formal letter about the importance of submitting assignments for evaluation when they are due and about the consequences for students who submit assignments late or fail to submit assignments. **If the above measures have been put into place and the behaviour of the student has no provided sufficient evidence, then 0 will be inserted as the mark for the missed assignment.**

Resources:

McGraw-Hill Ryerson Advanced Functions 12

Growing Success: Assessment Evaluation and Reporting in Ontario Schools, First Edition Covering Grades 1-12

Attendance Policy:

Consistent log-in is crucial to a student's success in Toronto World School's online program. The guidelines of the Ministry of Education require that students receive at least 110 hours of scheduled instruction time for each credit course. Attendance patterns will be monitored to ensure a student is actively logging into their course.
Students who have not completed the course within 12 months of enrolment will be automatically removed from the course. Only under extenuating circumstances, with proper documentation and the permission of the Principal, can a student be reinstated.

Acceptable Online Use Policy

Toronto World School uses the ConnectED Integrated Learning Platform and is intended for educational purposes only. The use of this program or any tools within TWS systems, other than for educational purposes, is strictly prohibited. The inappropriate uses include, but are not limited to, criminal, obscene, commercial, cyber-bullying or illegal purposes.
The administration has the right to review all student work in order to determine the appropriateness of computer use. If TWS online programs are deemed to be used inappropriately, the Administration will levy consequences which may include suspensions and/or removal from the program. In some cases, further action may be taken including contacting day schools, legal representation or the police.
Students need to be very vigilant in order to prevent them getting into a situation where they may be suspected for inappropriate use.

Therefore, students are reminded to
- Always protect their passwords and not share them with anyone
- Always inform their teachers of suspicious messages or other incidents that they encounter
- Always only access content that is intended for educational use.

Hardware/software requirements:

Hardware:
- PC running Windows 8 or higher
- Mac running Apple OS X or higher
- Chromebook running Chrome OS

High speed internet is recommended with access to a computer with the following:

- A processor of 2GHz or faster
- 4 GB RAM or greater
- A high speed internet connection of 1.5 MB/s or faster
- Keyboard and mouse
- Headphone/Speakers/Microphone/Camera

Recommended Software:

- Adobe Reader, Shockwave, Flash Player, Java, Office suite

Browser:
- Mozilla Firefox4 or higher, Internet Explorer 7 or higher, Safari 5 or higher, Google Chrome 11 or higher