



TFS High School
 5635 Yong St. Suite 206,
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Advanced Functions 12

(University)

Course Outlines

Department	Mathematics
Instructor	Mrs. Shiva Shirkhani
Course Development Date	September 2014
Ministry Course Code	MHF4U
Credit Value	1.00
Ministry Curriculum Document	Mathematics, The Ontario Curriculum, Grades 11 and 12, 2007 (Revised) http://www.edu.gov.on.ca/eng/curriculum/secondary/math1112currb.pdf http://www.edu.gov.on.ca/eng/policyfunding/growsuccess.pdf
Prerequisites	Grade 11 Functions, MCR3U; or Mathematics for College Technology, MCT4C
Course Revision Date	August 2023

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.

Outline of Course Content:MHF4U

Unit Titles and Descriptions	Time and Sequence
Review of Essential Skills	12 hours
By the end of this unit, students will demonstrate an understanding of function notation.	
Polynomial Functions	15 hours
In this unit students learn to identify and describe some key features of polynomial functions and to make connections between the numeric, graphical, and algebraic representations of polynomial functions. These concepts allow students to manipulate functions in a number of ways and apply their skills to solve real-world problems. Strategies will be employed to aid in the connection to an understanding of rates of change.	
Rational Functions and Inequalities	15 hours
Students begin this unit by identifying and describing some of the key features of rational functions. Students then learn to represent and manipulate these functions to solve real-life problems, graphically and algebraically. This unit also introduces the idea of inequalities and how they produce different solutions than equations.	
Exponential and Logarithmic Functions	24 hours
This unit begins with a review of exponential functions, their properties, and applications. This leads into discussions about a related function, the logarithmic function. From here students learn about logarithmic properties and then apply their knowledge of exponential and logarithmic functions to solve real-world problems.	

Trigonometry	12 hours
This unit examines the meaning and application of radian measure. This allows students to solve more complex situations in exact values. Students will make connections between trigonometric ratios and the graphical and algebraic representations of the corresponding trigonometric functions and use these connections to solve problems involving trigonometric equations and to prove trigonometric identities.	
Trigonometry Functions and Graphs	12 hours
This unit develops students understanding of trigonometry by expanding on the functions behind the trigonometric ratios. Students look at trigonometric functions and their reciprocals, examine their key properties and behaviours, and learn how they can be transformed to model a wide range of data.	
Operations and Characteristics of Functions	17 hours
Having studied various types of functions and transformations of functions and understood the significance of differential rates of change in functions, this final unit focuses on the theory and practice of performing arithmetic operations on entire functions, including but not limited to the algebraic, graphical and practical implications of performing those operations.	
Final Exam Assessments	
Final Exam	3 hours
Total	110 hours

Overall Curriculum Expectations

A. 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.
B. 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.
C. 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.
D. 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 modelling and reasoning with functions, including problems with solutions that are not accessible by standard algebraic techniques.

Teaching & Learning Strategies:

Students will follow a similar pattern of instructions in all units. To begin students will be involved in the exploration of an investigation of a concept. Then they will apply what they have learned in several real-life scenarios or applications of the concept. Students will see solutions to applications after they try to solve them for themselves. Then students will complete assignments where no solutions are provided. There will be quiz and Unit test for each unit. Finally, the course ends with a test. Since the over-riding aim of this course is to help students use the language of mathematics skilfully, confidently, and flexibly, a wide variety of instructional strategies are used to provide learning opportunities to accommodate a variety of learning styles, interests and ability levels. Seven mathematical processes will form the heart of the teaching and learning strategies used:

- *Communicating*: To improve student success there will be several opportunities for students to share their understanding both in oral as well as written form.
- *Problem solving*: Scaffolding of knowledge, detecting patterns, making and justifying conjectures, guiding students as they apply their chosen strategy, directing students to use multiple strategies to solve the same problem, when appropriate, recognizing, encouraging, and applauding perseverance, discussing the relative merits of different strategies for specific types of problems.
- *Reasoning and proving*: Asking questions that get students to hypothesize, providing students with one or more numerical examples that parallel these with the generalization and describing their thinking in more detail.
- *Reflecting*: Modelling the reflective process, asking students how they know.
- *Selecting Tools and Computational Strategies*: Modelling the use of tools and having students use technology to help solve problems.
- *Connecting*: Activating prior knowledge when introducing a new concept in order to make a smooth connection between previous learning and new concepts and introducing skills in context to make connections between particular manipulations and problems that require them.
- *Representing*: Modelling various ways to demonstrate understanding, posing questions that require students to use different representations as they are working at each level of conceptual development - concrete, visual or symbolic, allowing individual students the time they need to solidify their understanding at each conceptual stage.

In addition, teachers and students have at their disposal several tools that are unique to electronic learning environments.

- **Electronic simulation activities**
- **Video presentations**
- **Discussion boards and email**
- **Assessments with real-time feedback**
- **Interactive activities that engage both the student and teacher in the subject**
- **Peer review and assessment**
- **Internet instructional videos**

Strategies for Assessment & Evaluation of Student Performance based on Growing Success

Assessment is the process of gathering information that accurately reflects on how well a student is achieving the curriculum expectations in a subject or course. As part of assessment for learning, teachers provide students with descriptive feedback and coaching for improvement. Teachers engage in assessment as learning by helping all students develop their capacity to be independent, autonomous learners who are able to set individual goals, monitor

their own progress, determine next steps, and reflect on their thinking and learning. Assessment of learning is the process of collecting and interpreting evidence for the purpose of summarizing learning at a given point in time, to make judgments about the quality of student learning on the basis of established criteria, and to assign a value to represent the quality. The information gathered may be used to communicate the student's achievement to parents, other teachers, students themselves, and others. It occurs at or near the end of a learning cycle.

Assessment for Learning

Assignment (Student Product)
Quizzes (Student Product)
Debate (Observation)
Oral test (Observation)
Small Group Discussion (Conversation)
Oral Quizzes (Conversation)
Homework check (Student Product)

Assessment as Learning

Whole Class Discussion (Observation)
Small Group Discussion (Conversation)
Oral pre-test (Observation)
Exit Card (Student Product)
Exit Slip (Student Product)
Learner Self Assessment (Student Product)
Quizzes (Student Product)

Assessment of Learning

Assignment (Student Product)
Final Exam (Student Product)
Unit Tests (Student Product)

	Unit	Time	Expectatio	AFL	AAL	AOL	K 30 %	A 25 %	C 25%	T 20 %
70% Term Work	A	18 Hours	A1-A3	Assignmen t Quizzes Debate Oral test Small Group Discussion Oral Quizzes Homework check	Whole Class Discussion Small Group Discussion Oral pre-test Exit Card Exit Slip Learner Self Assessment Quizzes	Assignme nt Unit Test	*	*	*	*
	B	38 Hours	B1- B3	Assignmen t Quizzes Debate Oral test Small Group Discussion Oral Quizzes Homework check	Whole Class Discussion Small Group Discussion Oral pre-test Exit Card Exit Slip Learner Self Assessment Quizzes	Assignme nt Unit Test	*	*	*	*

	Unit	Time	Expectatio	AFL	AAL	AOL	K 30 %	A 25 %	C 25%	T 20 %
	C	39 Hours	C1-C4	Assignment Quizzes Debate Oral test Small Group Discussion Oral Quizzes Homework check	Whole Class Discussion Small Group Discussion Oral pre-test Exit Card Exit Slip Learner Self Assessment Quizzes	Assignme nt Unit Test	*	*	*	*
	D	12 Hours	D1-D3	Assignment Quizzes Debate Oral test Small Group Discussion Oral Quizzes Homework check	Whole Class Discussion Small Group Discussion Oral pre-test Exit Card Exit Slip Learner Self Assessment Quizzes	Assignme nt Unit Test	*	*	*	*
30% Sum mati ve		3 Hours	A1-D3			Final Exam	*	*	*	*

Learning Skills:

Learning Skills are skills and habits are essential to success in school and in the workplace. Teachers report achievement on the six Learning Skills in the table below using letter codes:

E = Excellent
Improvement.

G = Good

S = Satisfactory

N = Needs

Learning Skills	Sample Behaviors
Responsibility	The student fulfills responsibilities and commitments within the learning environment; completes and submits class work, homework, and assignments according to agreed-upon timelines; takes responsibility for and manages own behavior.
Organization	The student devises and follows a plan and process for completing work and tasks; establishes priorities and manages time to complete tasks and achieve goals; identifies, gathers, evaluates, and uses information, technology, and resources to complete tasks.
Independent Work	The student independently monitors, assesses, and revises plans to complete tasks and meet goals; uses class time appropriately to complete tasks; follows instructions with minimal supervision.
Collaboration	The student accepts various roles and an equitable share of work in a group; responds positively to the ideas, opinions, values, and traditions of others; builds healthy peer-to-peer relationships through personal and media-assisted interactions; works with others to resolve conflicts and build consensus to achieve group goals; shares information, resources, and expertise and promotes critical thinking to solve problems and make decisions.
Initiative	The student looks for and acts on new ideas and opportunities for learning; demonstrates the capacity for innovation and a willingness to take risks; demonstrates curiosity and interest in learning; approaches new tasks with a positive attitude; recognizes and advocates appropriately for the rights of self and others.
Self-Regulation	The student sets own individual goals and monitors progress towards achieving them; seeks clarification or assistance when needed; assesses and reflects critically on own strengths, needs, and interests; identifies learning opportunities, choices, and strategies to meet personal needs and achieve goals; perseveres and makes an effort when responding to challenges.

Mark Breakdown:

The overall course is broken into Term Work and the Final Exam:

Section

Term work	70 %
Final Summative Evaluation	30 %

Both the Term work and the Final Exam are broken into the following skill categories:

Categories of Mark Breakdown	
Knowledge / Understanding	30 %
Thinking / Inquiry	20 %
Communication	25 %
Application	25 %

Late and Missed Assignments Policy:

Students are responsible for handling in their assignments on time. Special care will be taken to divide up very large projects into smaller parts. Also the overall workload of the student will be considered in setting deadlines. However, if a student were to miss a due date, they will be asked to clarify the reason for not completing the assignment. It will be required of the student to provide an official Doctor's note in case of sickness. It will be the aim of the teacher to explain to the student the importance of time-management and its direct correlation with success and Achi consequences for cheating, plagiarizing, not completing work, and submitting work late.

Cheating and Plagiarism:

TFS work with its students to ensure that they fully understand that plagiarism and cheating is unacceptable behaviour. Before every evaluation is assigned, teachers remind students, both verbally and in writing, that all student products must be original work. If a student submits plagiarised work, or cheats, it is dealt with on a case-by case basis.

If it was done accidentally or purposefully; it is a first-time offence; the grade level and maturity of the student; the reason for plagiarising/cheating, etc. Each case is different, but a student may be allowed a second chance, may receive a zero, or a repeat offender may be asked to leave TFS.

As a teacher I do as follows:

- Give a visual consideration like as drawing a graph or examples such as geometrical examples of preparation.
 - Give a mathematical definition for topic or subject and interpret it in simple words.
 - Give examples for solving or finding or evaluating.
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- Asking the students randomly to come to the board and solve the related questions.
 - Ask the students to have a debate on the issues and try to explain some issues for each other.
 - Using graphing calculator or online websites (such as www.desmos.com or installing its App) for complex or further examples.
 - Asking one of the students to explain what he/she learned in their own words.
 - Introducing internet and different resources for better understanding such as www.khanacademy.org .
 - Homework check.
 - Review the last session subject by solving some problems from homework before starting the new subject and ask one of the students to come to the board and explain it for others .
 - Have students share problem-solving strategies.
 - Write a question on Exit Card to assess that if the students understand the subject of the day

Resources:

- Nelson Advanced Function 12
- Internet: www.Khanacademy.or

Program Planning Consideration:

Program Planning Considerations for English: Teachers who are planning a program in English 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 9 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
- The Role of Technology in the Curriculum ✓
- English as a Second Language (ESL) ✓

- English as a Second Language (ESL) and English Literacy Development (ELD)
- Antidiscrimination Education in the English Program ✓
- Literacy, Numeracy, and Inquiry/Research Skills ✓
- Career Education ✓
- Cooperative Education •
- Health and Safety

Achievement Chart: Mathematics, Grades 9-12

Categories	50-59% (Level 1)	60-69% (Level 2)	70-79% (Level 3)	80-100% (Level 4)
Knowledge and Understanding - Subject-specific content acquired in each course (knowledge), and the comprehension of its meaning and significance (understanding)				
	The student:			
Knowledge of content (e.g., facts, terms, definitions)	demonstrates limited knowledge of content	demonstrates some knowledge of content	demonstrates considerable knowledge of content	demonstrates thorough knowledge of content
Understanding of content (e.g., concepts, ideas, theories, procedures, processes, methodologies, and/or technologies)	demonstrates limited understanding of content	demonstrates some understanding of content	demonstrates considerable understanding of content	demonstrates thorough and insightful understanding of content
Thinking - The use of critical and creative thinking skills and/or processes				
	The student:			
Use of planning skills (e.g., focusing research, gathering information, organizing an inquiry, asking questions, setting goals)	uses planning skills with limited effectiveness	uses planning skills with moderate effectiveness	uses planning skills with considerable effectiveness	uses planning skills with a high degree of effectiveness
Use of processing skills (e.g., inquiry process, problem-solving process, decision-making process, research process)	uses processing skills with limited effectiveness	uses processing skills with some effectiveness	uses processing skills with considerable effectiveness	uses processing skills with a high degree of effectiveness
Use of critical/creative thinking processes (e.g., oral discourse, research, critical	uses critical / creative thinking processes with	uses critical / creative thinking processes with	uses critical / creative thinking processes with	uses critical / creative thinking processes with

analysis, critical literacy, metacognition, creative process)	limited effectiveness	some effectiveness	considerable effectiveness	a high degree of effectiveness
Communication - The conveying of meaning through various forms				
	The student:			
Expression and organization of ideas and information (e.g., clear expression, logical organization) in oral, graphic, and written forms, including media forms	expresses and organizes ideas and information with limited effectiveness	expresses and organizes ideas and information with some effectiveness	expresses and organizes ideas and information with considerable effectiveness	expresses and organizes ideas and information with a high degree of effectiveness
Communication for different audiences (e.g., peers, adults) and purposes (e.g., to inform, to persuade) in oral, written, and visual forms	communicates for different audiences and purposes with limited effectiveness	communicates for different audiences and purposes with some effectiveness	communicates for different audiences and purposes with considerable effectiveness	communicates for different audiences and purposes with a high degree of effectiveness
Use of conventions (e.g., conventions of form, map conventions), vocabulary, and terminology of the discipline in oral, written, and visual forms	uses conventions, vocabulary, and terminology of the discipline with limited effectiveness	uses conventions, vocabulary, and terminology of the discipline with some effectiveness	uses conventions, vocabulary, and terminology of the discipline with considerable effectiveness	uses conventions, vocabulary, and terminology of the discipline with a high degree of effectiveness
Application - The use of knowledge and skills to make connections within and between various contexts				
	The student:			
Application of knowledge and skills (e.g., concepts, procedures, processes, and/or technologies) in familiar contexts	applies knowledge and skills in familiar contexts with limited effectiveness	applies knowledge and skills in familiar contexts with some effectiveness	applies knowledge and skills in familiar contexts with considerable effectiveness	applies knowledge and skills in familiar contexts with a high degree of effectiveness
Transfer of knowledge and skills (e.g., concepts, procedures, methodologies, technologies) to new contexts	transfers knowledge and skills to new contexts with limited effectiveness	transfers knowledge and skills to new contexts with some effectiveness	transfers knowledge and skills to new contexts with considerable effectiveness	transfers knowledge and skills to new contexts with a high degree of effectiveness

Making connections within and between various contexts (e.g., past, present, and future; environmental; social; cultural; spatial; personal; multidisciplinary)	makes connections within and between various contexts with limited effectiveness	makes connections within and between various contexts with some effectiveness	makes connections within and between various contexts with considerable effectiveness	makes connections within and between various contexts with a high degree of effectiveness
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