INSTITUTE OF CANADIAN EDUCATION

Course Title: Advanced Functions: (MHF4U) Grade 12, University Preparation

Course Name : Advanced Functions

Course Code: MHF4U

Grade :12

Course Type : University Preparation

Credit Value: 1.0

Prerequisite : MCR3U or MCT4C Functions, Grade 11, University Preparation, or Mathematics for College Technology, Grade 12, College Preparation.

Curriculum Policy Document : Mathematics , The Ontario Curriculum, Grade 12, 2007 (Revised); Growing Success 2012.

Course Developer: Institute of Canadian Education.

Department: Mathematics

Department Head: Meena Yohan

Development Date: 2025

Most Recent Revision Date: August 2026

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.

COURSE EXPECTATION

Unit	Title	Description	Time
1	**Introduction to Polynomial Functions**	Students explore key features and representations of polynomial functions and apply algebraic and graphical strategies to solve problems.	20 Hours
2	**Advanced Polynomial & Rational Functions**	Students explore rational functions, inequalities, their representations, and applications to real-world problems.	20 Hours
	MIDTERM EXAM	Assessment of Units 1–2.	2 Hours
3	**Exponential & Logarithmic Functions**	Students investigate exponential and logarithmic functions, their properties, applications, and related equations.	20 Hours
4	**Trigonometric Functions**	Students explore radians, trigonometric functions and graphs, identities, and equations.	20 Hours
5	**Characteristics of Functions**	Students examine rates of change, composition, characteristics, and mathematical modelling using data.	25 Hours
	FINAL EXAM	Comprehensive final evaluation covering course content.	**3 Hours**
	Total		**110 Hours**
Unit	**Title**	**Description**	**Time**

Overall Curriculum Expectations:

A. Introduction to Polynomial functions	
A1	Investigation of Characteristics of Polynomial Functions
A2	Identifying a Variety of Functions, Graphically
A3	Graphing Polynomial Functions from a Factored Form
A4	Factor and Remainder Theorem
A5	Finding the Roots of Polynomial Functions
A6	Applications of Polynomial Functions
A7	Introduction to Inequalities
A8	Solving Inequalities: Part 1
A9	Solving Inequalities: Part 2
A10	Unit Summative Evaluation
B. Advanced Polynomial and Rational Functions	
B1	Transformation of Polynomials
B2	Families of Polynomial Functions
B3	Characteristics of Odd and Even Functions
B4	Rational Functions: Part 1
B5	Rational Functions: Part 2
B6	Graphing Rational Functions: Part 1
B7	Graphing Rational Functions: Part 2
B8	Applications of Rational Functions
B9	Unit/Summative Evaluation
C. Exponential and Logarithmic Functions	
C1	Pre-Requisite Skills and Introduction to Logarithmic Functions

C2	Key Features of Logarithmic Functions
C3	Investigating Transformations and Sketching Graphs of Logarithmic Functions
C4	Properties and Laws of Logarithmic Functions
C5	Solving Logarithmic Equations
C6	Solving Exponential Equations
C7	Applications of Exponential and Logarithmic Functions
C8	Unit/Summative Evaluation
D. Trigonometric Functions	
D1	Review of Sine and Cosine Functions and Radian Measure
D2	Trig Ratios of any Angle (Including Special Angles)
D3	Graphing Trigonometric, Reciprocal, and Inverse Trigonometric Functions
D4	Comparison of Base/Inverse/Reciprocal Functions
D5	Properties and Transformations of Sinusoidal Functions
D6	Solving Problems
D7	Compound and Double Angle Formulae
D8	Trigonometric Identities
D9	Solving Trigonometric Equations
D10	Unit / Summative Evaluation
E. Characteristics of Functions	
E1	Average Rates of Change
E2	Comparing Average and Instantaneous Rates of Change
E3	Solving Problems with Rates of Change
E4	Characteristics of Functions
E5	Investigating Compound Functions
E6	Composition of Functions

E7	Modeling Functions from Data
F. Course Culminating Activities	
F1	Course Review
F2	Culminating Activity
F3	Final Examination

Assessment

Students will be provided with numerous and varied opportunities to demonstrate the full extent of their achievement of the curriculum expectations, across all four categories of the Achievement Chart. Progress will be monitored on an on-going basis using a variety of assessment tools, including written work, formal testing, quizzes, teacher-student communication, discussion boards and chat rooms.

TEACHING AND LEARNING STRATEGIES

Students will experience a variety of teaching and learning activities throughout the course, including:

- **Presentations and Multimedia:** Teacher presentations, instructional videos, examples, practice questions, online quizzes, and interactive resources are used to introduce and reinforce mathematical concepts and skills.
- **Instructor Demonstrations:** Teachers model mathematical procedures, problem-solving strategies, use of technology, and other skills through demonstrations, videos, and guided instruction.
- **Discussion Forums:** Students share mathematical ideas, strategies, and solutions with peers and respond to others, supporting communication and deeper understanding.
- **Reflection:** Students reflect on their learning, identify areas of strength and improvement, and connect mathematical concepts to practical applications.
- **Practice Problems and Applications:** Students complete guided and independent practice problems that apply mathematical concepts and skills to real-world and problem-solving situations.
- **Individual Activities and Assignments:** Students complete assignments independently and at an appropriate pace to consolidate learning. Teachers provide ongoing written and oral feedback and adjust instruction or assessment, where appropriate, to address individual learning needs and IEP accommodations.
- **Interactive and Virtual Learning:** Online tools, simulations, graphing technology, and interactive activities allow students to explore relationships, test ideas, visualize concepts, and develop mathematical reasoning.

- **Visual Representations:** Diagrams, graphs, charts, tables, and other visual representations help students organize information, identify patterns, interpret data, and make connections between mathematical concepts.
- **Problem Solving and Critical Thinking:** Students analyze problems, select appropriate strategies, communicate their reasoning, evaluate solutions, and apply mathematical knowledge to unfamiliar and real-world situations.
- **Extension and Application:** Learning activities encourage students to connect mathematical concepts to everyday situations and practical applications, developing independence, critical thinking, and confidence in using mathematics.

Final Grade

The final grade will be determined as follows (in accordance with Ministry of Education standards):

Term Work Based on evaluations conducted throughout the course.	65%
Final Evaluation A final evaluation in the form of a written exam.	25%
Attendance and Participation	10%

Final Examination Breakdown

- 25% written exam

ASSESSMENT ACTIVITIES

Assessment activities may include:

- Homework and practice assignments
- Individual teacher-student conferences
- Discussion forums and mathematical discussions
- Diagnostic assessments and problem-solving tasks
- Completed templates, organizers, and mathematical representations
- Reflections and learning self-assessments
- Oral presentations and mathematical communication
- Quizzes, tests, and examinations
- Unit and course evaluations

ATTENDANCE POLICY

Regular attendance and active engagement are important for student success. Attendance and participation are monitored through the school's Learning Management System (LMS).
All online credit courses at ICE are designed to meet or exceed the **minimum 110 hours of instructional time** required for a credit course.

Online instructional time and engagement are monitored through:

- **LMS Engagement:** Students are expected to log in regularly and actively participate in online learning activities. LMS activity records are used to monitor engagement.
- **Biweekly Check-Ins:** Students complete a brief check-in every two weeks to review their progress and engagement. Additional support may be provided when concerns are identified.
- **Post-Unit Quizzes:** Short formative quizzes are completed at the end of each unit to monitor student progress and pacing.
- **Discussion Forums:** Students participate in required unit discussions and peer activities. Participation is monitored based on completion and engagement.

Students are responsible for maintaining regular participation and completing required learning activities within the course schedule.

EVALUATION MODEL – 10% TOTAL ATTENDANCE AND ENGAGEMENT WEIGHT

Component	Weight	Quantifiable Metric	Criteria
Biweekly Check-In	3%	Completed every two weeks	Students completes the required check-in within the scheduled time frame.
Post-Unit Formative Quiz	4%	Completed after each unit	Student completes the formative quiz by the assigned deadline.
Discussion Forum Participation	3%	Required posts and responses	Student submits the required original response and completes assigned peer responses.

CONSIDERATIONS FOR PROGRAM PLANNING

PLANNING PROGRAMS FOR STUDENTS WITH SPECIAL EDUCATION NEEDS

Teachers support the success of all students through Universal Design for Learning, differentiated instruction, and evidence-based practices, consistent with *Learning for All* (2013). Where a student has an IEP, identified instructional, environmental, and assessment accommodations are implemented. The online learning environment provides flexibility through extended time, breaks, assistive technology, and opportunities to review course materials.

PROGRAM CONSIDERATIONS FOR ENGLISH LANGUAGE LEARNERS

Teachers consider the strengths and needs of English language learners in accordance with Ontario's ESL/ELD policies. Supports may include clear and accessible instructional language, visual and multimedia resources, opportunities to replay lessons, additional time where appropriate, bilingual dictionaries, and feedback that supports academic language development.

ENVIRONMENTAL EDUCATION
Environmental education is integrated where appropriate through mathematical applications involving real-world data, such as climate trends, population growth, resource use, and sustainability. Students develop skills in interpreting data and using mathematics to understand environmental issues.

EQUITY AND INCLUSIVE EDUCATION
The course promotes an inclusive and respectful learning environment in which all students are supported and valued. Learning resources and examples reflect diverse perspectives and experiences, while teaching and assessment practices are designed to be fair, accessible, and free from unnecessary bias.

FINANCIAL LITERACY EDUCATION
Students apply mathematical concepts to financial contexts such as budgeting, saving, interest, taxes, credit, and comparing costs. These applications support informed financial decision-making and practical problem-solving.

FIRST NATIONS, MÉTIS, AND INUIT EDUCATION
Where appropriate to the curriculum, teachers incorporate accurate and respectful First Nations, Métis, and Inuit perspectives, contributions, and contemporary contexts using relevant Ministry-recommended resources.

THE ROLE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY
ICT is integrated throughout the course through the learning management system, multimedia resources, graphing tools, digital assessments, video conferencing, and other mathematical technologies. Students develop responsible digital citizenship, including appropriate technology use, academic integrity, privacy awareness, and critical evaluation of online information.

CAREER EDUCATION
Students connect mathematical reasoning, problem-solving, quantitative skills, and data analysis to postsecondary education and career pathways. Applications may include STEM, finance, business, technology, skilled trades, data analysis, and other fields that use mathematics.

COOPERATIVE EDUCATION AND OTHER FORMS OF EXPERIENTIAL LEARNING
Where appropriate, students are encouraged to connect mathematical learning to workplace and community contexts through experiential learning, job-shadowing, work experience, and cooperative education opportunities.

HEALTH AND SAFETY

Health and safety are addressed in the online learning environment through appropriate ergonomics, regular breaks, balanced screen time, responsible technology use, and strategies that support student well-being. Students are provided with clear procedures for reporting concerns and accessing support.

Course Materials – MHF4U

Texts & Resources

- Grade 12 Advanced Functions (MHF4U) textbook (Ontario approved)
- Teacher-provided worksheets, problem sets, and inquiry packages
- Supplementary materials: reference guides for functions, probability, and statistics; sample datasets for practice and analysis

Digital Resources

- Google Drive or equivalent cloud storage for file sharing and assignment submission
- Microsoft Office / Google Workspace (Word, Excel, Google Sheets) for organizing calculations, tables, and graphing data
- Online mathematics and graphing tools: Desmos, GeoGebra, Khan Academy, StatCrunch, or similar interactive platforms
- Online simulations for probability experiments, function transformations, and data visualization

Teacher Considerations

- Assistive technology: speech-to-text or text-to-speech software for students requiring accommodations
- Flexible submission formats: digital submissions, scanned handwritten work, or typed solutions depending on student needs
- Optional tools: approved calculators (graphing or scientific) for assignments and exams

Tips for Success – MHF4U

Welcome to MHF4U: Grade 12 Advanced Functions – University Preparation

Welcome! This course will help you develop a strong understanding of advanced mathematical concepts, including polynomial, rational, exponential, logarithmic, and trigonometric functions, as well as rates of change and function modeling. You will strengthen your analytical, problem-solving, and reasoning skills, essential for university-level programs in STEM, economics, and other math-intensive disciplines.

Stay Organized

- Review the course calendar regularly and complete all assignments, quizzes, projects, and problem sets on time.
- Carefully read instructions and rubrics; use checklists to ensure all steps, calculations, graphs, and reasoning are complete and accurate.

Ask for Help

- For technical issues, contact the Help Desk.
- For course-related questions, email your teacher; expect a response within 24 hours. Mark emails as “URGENT” if needed.

Key Elements to Success

- **Time Commitment:** Plan for 1–2 hours of focused study each day, plus additional time for practice problems, graphing, transformations, and modeling exercises.
- **Communication:** Maintain regular contact with your teacher for guidance, clarification, and feedback.
- **Engagement:** Stay curious, persistent, and attentive. Active participation in discussions, problem-solving exercises, and projects, along with consistent practice in solving advanced function problems, is essential for mastering MHF4U concepts.

Remember:

This course is designed to help you analyze, model, and interpret functions, apply mathematical reasoning, and solve real-world problems. Approach all activities thoughtfully, accurately, and with confidence in your ability to learn, reason, and succeed.