Insight Academy of Canada

Course Outline

Course Title	Advanced Functions, Grade 12, University Preparation (MHF4U)
Grade	12
Course Type	University
Course Code	MHF4U
Credit Value	1.0
Curriculum Policy Documents	The Ontario Curriculum, Grades 11 and 12: Mathematics, 2007 (revised) Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools, 2010
Prerequisite(s)	Functions, Grade 11, University Preparation (MCR3U), or Mathematics for College Technology, Grade 12, College Preparation (MCT4C)

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

A. Exponential and Logarithmic Functions By the end of this course, students will:	
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 By the end of this course, students will:	
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 By the end of this course, students will:	
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 By the end of this course, students will:	

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.

Outline of Course Content

Unit No.	Unit Title	Instructional Time	Overall Expectations
1	Basic Skills Review	9 hours	C1
2	Polynomial Functions and Inequalities	27 hours	C1, C3, C4, D1
3	Rational Functions	16 hours	C2, C3, C4
4	Trigonometry	27 hours	B1, B2, B3
5	Exponential and Logarithmic Equations	19 hours	A1, A2, A3
6	Composite Functions	12 hours	D2, D3
Total Instructional Time		110 HOURS	
7	Final Exam	3 hours	All

Unit Descriptions
The entire course is delivered online

Unit 1: Basic Skills Review
Review of foundational concepts that have been covered in prerequisite math courses. Students revisit the definition of a function, function notation, and the key properties of functions. Students also review transformations of functions and inverse functions. The unit assessment evaluates students' ability to carry out proper communication, formatting, and technical skills in their work, all of which will be important aspects of their assignments in the remainder of the course. Specific Expectations: C1.1, C1.2, C1.3, C1.4, C1.5, C1.6, C1.7, C1.8, C1.9
Unit 2: Polynomial Functions and Inequalities
In this unit, students will: identify and describe some key features of polynomial functions and make connections between the numeric, graphical and algebraic representations of polynomial functions; solve problems involving polynomial equations graphically and algebraically;

demonstrate an understanding of solving polynomial inequalities

Specific Expectations: C1.1, C1.2, C1.3, C1.4, C1.5, C1.6, C1.7, C1.8, C1.9, C3.1, C3.2, C3.3, C3.4, C3.5, C3.6, C3.7,C4.1, C4.2, C4.3, D1.1, D1.2, D1.3, D1.4, D1.5, D1.6, D1.7, D1.88, D1.9

Unit 3: Rational Functions

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.

Specific Expectations: C2.1, C2.2, C2.3, C3.1, C3.2, C3.3, C3.4, C3.5, C3.6, C3.7, C4.1, C4.2, C4.3

Unit 4: Trigonometry

In this unit, students will: 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. Students will: solve problems involving trigonometric equations and prove trigonometric identities.

Specific Expectations: B1.1. B1.2, B1.3, B1.4, B2.1, B2.2, B2.3, B2.4, B2.5, B2.6, B2.7, B3.1, B3.2, B3.3, B3.4

Unit 5: Exponential and Logarithmic Equations

In this unit, students will: 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.

Specific Expectations: A1.1, A1.2, A1.3, 1.4, A2.1, A2.3, A2.4, A3.1, A3.2, A3.3, A3.4

Unit 6: Composite Functions

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.

Specific Expectations: D2.1, D2.2, D2.3, D2.4, D2.5, D2.6, D2.7, D2.8, D3.1, D3.3, D3.4

Teaching and Learning Strategies

Effective instruction is key to student success and students learn best when they are engaged in a variety of ways of learning. Teachers at Insight Academy of Canada (IAC) provide numerous opportunities and use a variety of instructional, assessment, and evaluation strategies to help

students develop skills of inquiry, problem solving, and communication as they investigate and learn fundamental concepts. The activities offered enable students not only to make connections among these concepts throughout the course but also to relate and apply them to relevant societal, environmental, and economic contexts. Opportunities to relate knowledge and skills to these wider contexts will motivate students to learn and to become lifelong learners.

The following seven mathematical process expectations describe a set of skills that support lifelong learning in mathematics and that students need to develop on an ongoing basis, as they work to achieve the expectations outlined within the course.

- Problem Solving: develop, select, apply, compare, and adapt a variety of problem-solving strategies as they pose and solve problems and conduct investigations, to help deepen their mathematical understanding;
- Reasoning and Proving: develop and apply reasoning skills to make mathematical conjectures, assess conjectures, and justify conclusions, and plan and construct organized mathematical arguments;
- Reflecting: demonstrate that they are reflecting on and monitoring their thinking to help clarify their understanding as they complete an investigation or solve a problem;
- Selecting Tools and Computational Strategies: select and use a variety of concrete, visual, and electronic learning tools and appropriate computational strategies to investigate mathematical ideas and to solve problems;
- Connecting: make connections among mathematical concepts and procedures, and relate mathematical ideas to situations or phenomena drawn from other contexts;
- Representing: create a variety of representations of mathematical ideas, connect and compare them, and select and apply the appropriate representations to solve problems;
- Communicating: communicate mathematical thinking orally, visually, and in writing, using precise mathematical vocabulary and a variety of appropriate representations, and observing mathematical conventions.

Each unit of the course contains a Unit Overview, a number of lessons, a Mid-Unit Quiz, a Unit Test, and a Unit Exit Card. Lessons are delivered through the following format.

- Mind on. Students are introduced to the content through a variety of exploratory and instructional strategies including watching online videos.
- Actions. Students practice and apply their new learning through worked examples, investigation, and exploration. Students are actively engaged in their assessment process as they monitor their own learning to determine their next steps and set individual learning goals.
- Consolidation. Students are provided opportunities to demonstrate what they have learned through independent practice, reflection assignments, and discussion posts (Exit Slip).
- Extension Activities. Students study extra lesson resources, complete homework assignment, and response to teacher's follow-up questions to expand their learning and prepare for unit test.

A variety of teaching and learning strategies will be used in this course.

Direct Instruction Strategies	Independent Learning Strategies
- Online lecture - Video/Animation - Examples of full solutions - Scaffolding - Administering probes and/or prompts - Providing descriptive feedback	- Homework Q&A - Handout, Work and Task Sheet - Class Investigations - Independent Study (teacher direction) - Self-Assessment - Self-regulation

• Providing pictorial or diagram presentation • Allowing independent practice and individually paced instruction • Teacher modelling • Providing individual instruction • Class activity, practice • Class and 1:1 Discussion/Chat • Student-Teacher Conferences • Q&A • Review, Seminar • Virtual Office Hours	• Self-reflection • Exit Card • Survey • Learning Log • ePortfolio • Computer-Assisted Instruction • Interactive Online Activity • Student Exploration Tasks • Simulation • Graphing Software
Cooperative Strategies • Discussion Boards • Group/Peer Discussion (Think-Pair-Share) • Emails • Peer Conferencing • Peer Assessment • Peer Feedback	**Thinking-Skills Strategies** • Opinion Sharing/Commentary Offering • Oral Explanation • Presentation • Problem-Based Learning • Problem Solving • Reasoning and Proving • Reflective Thinking • Research Process • Case Study

Strategies for Assessment & Evaluation of Student Performance

Insight Academy of Canada's (IAC) Assessment and Evaluation policy is aligned with the Ministry of Education's Growing Success policy document which outlines the assessment, evaluation, and reporting policies and practices in Ontario schools.

Basic Considerations

The primary purpose of assessment and evaluation is to improve student learning. Assessment is the process of gathering information from a variety of sources that accurately reflects how well a student is achieving the curriculum expectations in a course. Evaluation refers to the process of judging the quality of student learning on the basis of established performance standards, and assigning a value to represent that quality.

In order to ensure that assessment and evaluation are valid and reliable, and that they lead to the improvement of student learning, IAC teachers will use assessment and evaluation strategies that:
• are fair, transparent, and equitable for all students;
• support all students, including those with special education needs, those who are learning the language of instruction (English or French), and those who are First Nation, Métis, or Inuit;
• are carefully planned to relate to the curriculum expectations and learning goals and, as much as possible, to the interests, learning styles and preferences, needs, and experiences of all students;
• are communicated clearly to students and parents at the beginning of the school year or course and at other appropriate points throughout the school year or course;

- are ongoing, varied in nature, and administered over a period of time to provide multiple opportunities for students to demonstrate the full range of their learning;
- provide ongoing descriptive feedback that is clear, specific, meaningful, and timely to support improved learning and achievement;
- develop students' self-assessment skills to enable them to assess their own learning, set specific goals, and plan next steps for their learning

Evaluation and Reporting of Student Achievement

Insight Academy of Canada's (IAC) will use the Provincial Report Card, Grades 9–12, for formal written reports to students and parents two times a term. The report card provides a record of the student's achievement of the curriculum expectations in the course, at particular points in the school year or term, in the form of a percentage grade. 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 final grade is recorded for the course, and a credit is granted and recorded for the course in which the student's grade is 50% or higher. The final grade for the course will be determined as followings:
- Seventy per cent of the grade will be based on 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.
- Thirty per cent of the grade will be based on a final evaluation in the form of an examination and administered at the end of the course.

Assessment and Evaluation Categories and Weights			
Achievement Categories	Percent	Evaluation for Final Grade	Percent
Knowledge/Understanding	25%	Term Work	70%
Inquiry/Thinking	25%		
Communication	25%	Final Evaluation	30%
Application	25%		

Reporting on Demonstrated Learning Skills & Work Habits

The report card provides a record of the learning skills demonstrated by the student in every course, in the following six categories: Responsibility, Organization, Independent Work, Collaboration, Initiative & Self-regulation. These learning skills and work habits are evaluated using a four-point scale (E-Excellent, G-Good, S-Satisfactory, N-Needs Improvement). The separate evaluation and reporting of the learning skills and work habits in these six areas reflect their critical role in students' achievement of the curriculum expectations. To the extent possible, the evaluation of learning skills and work habits, apart from any that may be included as part of a curriculum expectation in a course, should not be considered in the determination of percentage grades.

In order to ensure that assessment and evaluation are valid and reliable, and that they lead to the improvement of student learning, I.A.C teachers use a variety of strategies throughout the course.