



Insight Academy of Canada

Course Outline

Course Title	Functions, Grade 11, University Preparation (MCR3U)
Grade	11
Course Type	University
Course Code	MCR3U
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)	Principles of Mathematics, Grade 10, Academic (MPM2D)

Course Description

This course introduces the mathematical concept of the function by extending students' experiences with linear and quadratic relations. Students will investigate properties of discrete and continuous functions, including trigonometric and exponential functions; represent functions numerically, algebraically, and graphically; solve problems involving applications of functions; investigate inverse functions; and develop facility in determining equivalent algebraic expressions. Students will reason mathematically and communicate their thinking as they solve multi-step problems.

Overall Curriculum Expectations

A. Characteristics of Functions By the end of this course, students will:	
A1	Demonstrate an understanding of functions, their representations, and their inverses, and make connections between the algebraic and graphical representations of functions using transformations;
A2	Determine the zeroes and the maximum or minimum of a quadratic function, and solve problems involving quadratic functions, including problems arising from real-world applications;
A3	Demonstrate an understanding of equivalence as it relates to simplifying polynomial, radical, and rational expressions.
B. Exponential Functions By the end of this course, students will:	
B1	Evaluate powers with rational exponents, simplify expressions containing exponents, and describe properties of exponential functions represented in a variety of ways;
B2	Make connections between the numeric, graphical, and algebraic representations of exponential functions;
B3	Identify and represent exponential functions, and solve problems involving exponential functions, including problems arising from real-world applications.
C. Discrete Functions By the end of this course, students will:	
C1	Demonstrate an understanding of recursive sequences, represent recursive sequences in a variety of ways, and make connections to Pascal's triangle;
C2	Demonstrate an understanding of the relationships involved in arithmetic and geometric sequences and series, and solve related problems;
C3	Make connections between sequences, series, and financial applications, and solve problems involving compound interest and ordinary annuities.
D. Trigonometric Functions By the end of this course, students will:	

D1	Determine the values of the trigonometric ratios for angles less than 360° ; prove simple trigonometric identities; and solve problems using the primary trigonometric ratios, the sine law, and the cosine law;
D2	Demonstrate an understanding of periodic relationships and sinusoidal functions, and make connections between the numeric, graphical, and algebraic representations of sinusoidal functions;
D3	Identify and represent sinusoidal functions, and solve problems involving sinusoidal functions, including problems arising from real-world applications.

Outline of Course Content

Unit No.	Unit Title	Instructional Time	Overall Expectations
1	Functions	15 hours	A1, A2, A3
2	Transformations of Functions	16 hours	A1, A3
3	Exponential Functions	16 hours	B1, B2, B3
4	Trigonometry	16 hours	D1
5	Trigonometric Functions	16 hours	D2, D3
6	Discrete Functions	16 hours	C1, C2, C3
7	Financial Applications	15 hours	C3
Total Instructional Time		110 HOURS	
8	Final Exam	2.5 hours	All

Unit Descriptions

The entire course is delivered online

Unit 1: Functions

In this unit, students will investigate quadratic functions and related concepts from algebraic and geometric perspectives, in order to deepen their understanding and prepare them for further explorations of functions and relations. Skills involving operations with polynomials and rational expressions are consolidated, and then extended to the complex number system, which is introduced in this unit. Students apply the method of completing the square in order to solve maximum/minimum problems involving quadratic functions. Algebraic and graphical methods are used to determine the roots of quadratic equations. The exponent laws are applied to expressions which have powers containing integer and rational exponents. Students discover the nature of exponential functions and solve exponential equations.

Specific Expectations: A1.1, A1.2, A1.3, A1.7, A2.1, A2.2, A2.3, A2.4, A2.5, A3.2

Unit 2: Transformations of Functions

In this unit, students will investigate the relationship between the graphs and the equations of sinusoidal functions sketching and describing the graphs and describing their periodic properties.

Specific Expectations: A1.4, A1.5, A1.6, A1.8, A1.9, A3.1, A3.3, A3.4

Unit 3: Exponential Functions

This unit will explore several topics including evaluating powers with rational exponents, simplifying expressions containing exponents, and describing properties of exponential functions represented in a variety of ways. The emphasis will be on problem solving using these concepts.

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

Unit 4: Trigonometry

Students will consolidate and extend concepts first introduced in Grade 10. Students use the primary trigonometric ratios, the sine law, and the cosine law to model and solve two- and three-dimensional problems involving acute, right, and oblique triangles.

They will investigate the relationship between degree and radian measure, and explore the use of the unit circle and special triangles to determine selected values of the primary trigonometric ratios.

Methods of proof are introduced and applied to verify trigonometric identities. Students will develop the skills to manipulate and solve trigonometric equations.

Specific Expectations: D1.1, D1.2, D1.3, D1.4, D1.5, D1.6, D1.7

Unit 5: Trigonometric Functions

In this unit, students will investigate the periodic nature and graphical properties of the primary trigonometric functions. Using technology, students explore the effects of simple transformations on their graphs and equations. Students apply these concepts to model authentic problems.

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

Unit 6: Discrete Functions

The unit begins with an exploration of recursive sequences and how to represent them in a variety of ways. Making connections to Pascal's triangle, demonstrating understanding of the relationships involved in arithmetic and geometric sequences and series, and solving related problems involving compound interest and ordinary annuities will form the rest of the unit.

Specific Expectations: C1.1, C1.2, C1.3, C1.4, C1.5, C1.6, C2.1, C2.2, C2.3, C2.4

Unit 7: Financial Applications

In this unit, students investigate arithmetic and geometric sequences and series as the basis for applications to personal finance.

Students develop the formula for compound interest and solve problems related to compound

interest and annuities. As skills are developed, they will use spreadsheets to investigate the cost of borrowing when interest rates, compound periods, lending terms, etc., are varied.

Students apply skills with linear and exponential functions

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

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 Unit Review Assignment, a 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.

<p>Direct Instruction Strategies</p> <ul style="list-style-type: none"> • Online lecture • Video/Animation • Examples of full solutions • Scaffolding • Administering probes and/or prompts • Providing descriptive feedback • 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 	<p>Independent Learning Strategies</p> <ul style="list-style-type: none"> • Homework Q&A • Handout, Work and Task Sheet • Class Investigations • Independent Study (teacher direction) • Self-Assessment • Self-regulation • Self-reflection • Exit Card • Survey • Learning Log • ePortfolio • Computer-Assisted Instruction • Interactive Online Activity • Student Exploration Tasks • Simulation • Graphing Software
<p>Cooperative Strategies</p> <ul style="list-style-type: none"> • Discussion Boards • Group/Peer Discussion (Think-Pair-Share) • Emails • Peer Conferencing • Peer Assessment • Peer Feedback 	<p>Thinking-Skills Strategies</p> <ul style="list-style-type: none"> • 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 follows:

- 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.