

Course Outline

School Name: Keewaytinook Internet High School

Department Name: Mathematics

Ministry of Education Course Title: Functions and Applications

Grade Level: 11

Ministry Course Code: MCF3M

Teacher's Name: Mary Anne F. Barrett

Developed by: Erik Tu Date: August 2017

Revision Date: September 2019

Developed from: The Ontario Curriculum, Grades 11 and 12,
Mathematics, 2007

Text: None

Prerequisite: Principles of Mathematics, Grade 10, Academic, or
Foundations of Mathematics, Grade 10, Applied

Credits: 1

Length: 110 hours

Principal's Name: Angela Batsford-Mermans

Principal's Approval: 

Approval Date: September 5, 2019

Course Description/Rationale

This course introduces basic features of the function by extending students' experiences with quadratic relations. It focuses on quadratic, trigonometric, and exponential functions and their use in modeling real world situations. Students will represent functions numerically, graphically, and algebraically; simplify expressions; solve equations; and solve problems relating to applications. Students will reason mathematically and communicate their thinking as they solve multi-step problems.

Overall Curriculum Expectations

A1) expand and simplify quadratic expressions, solve quadratic equations, and relate the roots of a quadratic equation to the corresponding graph;

A2) demonstrate an understanding of functions, and make connections between the numeric, graphical, and algebraic representations of quadratic functions;

A3) solve problems involving quadratic functions, including problems arising from real-world applications.

B1) simplify and evaluate numerical expressions involving exponents and make connections between the numeric, graphical, and algebraic representations of exponential functions;

B2) identify and represent exponential functions, and solve problems involving exponential functions, including problems arising from real-world applications;

B3) demonstrate an understanding of compound interest and annuities, and solve related problems.

C1) solve problems involving trigonometry in acute triangles using the sine law and the cosine law, including problems arising from real-world applications;

C2) demonstrates an understanding of periodic relations and the sine function, and make connections between the numeric, graphical, and algebraic representations of sine functions;

C3) identify and represent sine functions, and solve problems involving sine functions, including problems arising from real-world applications.

Course Content

<i>Unit</i>	<i>Length</i>
Quadratic Functions	30 hours
Exponential Functions	17 hours
Financial Application	17 hours
Trigonometric Functions	30 hours
Mathematical Modeling	16 hours
Total	110 hours

Unit Descriptions

Unit 1 - Quadratic Functions

Students will study one particular family of functions, quadratics, in detail. They will explore the various forms of the quadratic equation, and use strategies to convert equations to graphs and vice versa. They will explore the significance of the characteristics of quadratic functions. They will make connections between the numeric, graphical and algebraic representations of quadratic functions, and relate the roots of quadratic equations to the corresponding graph. They will investigate the utility of quadratic functions as models for a variety of real-world applications.

Unit 2 - Exponential Functions

Students will start by studying a special family of functions - the exponential functions - in depth. Before diving into money matters, they will use exponential functions to model a number of real-world phenomena. As with quadratics, they will relate the numeric, graphical and algebraic representations of exponential functions.

Unit 3 - Financial Applications

One of the most obvious applications for mathematics in day-to-day Canadian society is the understanding and manipulation of money. This unit focus heavily on this application, with particular attention to the mathematics of interest, annuities, investments and loans. They will intensively investigate simple interest, compound interest, annuities, and solve realistic problems related to these tools of finance.

Unit 4 - Trigonometric Functions

Trigonometry was explored briefly in Grade 10, but in this unit it will be investigated with depth. Trigonometry, and trigonometric functions, are used extensively in sea and land navigation, survival situations, planning building projects, plotting and predicting cyclic phenomena, and exploring space. By the end of this unit, students will understand how

to do all of these things at a basic level, and relate these applications to the numeric, graphical and algebraic representations of sine functions.

Unit 5 - Mathematical Modeling

Students will use their acquired knowledge and skills to solve problems involving all of the mathematics learned in this course. Students use previous knowledge of key properties that differentiate quadratic function, exponential function and trigonometric function. They also use of technology assist students in their exploration of potential solutions.

Teaching/Learning Strategies

As in a conventional classroom, instructors employ a range of strategies for teaching a course:

- Clear writing that connects mathematics to relevant situational problems
- Examples of full solutions in various contexts and opportunities to practice
- Direct instruction and coaching on student work by the mentor

In addition, teachers and students have at their disposal a number of tools that are unique to electronic learning environments:

- Electronic simulation activities
- Discussion boards and email
- Assessments with real-time feedback
- Interactive activities that engage both the student and teacher in subject

Since the over-riding aim of this course is to help students use the language of mathematics skillfully, 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. 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.
- *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*: Modeling the reflective process, asking students how they know.
- *Selecting Tools and Computational Strategies*: Modeling 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*: Modeling 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.

Evaluation

The evaluation for this course is based on the student's achievement of curriculum expectations and the demonstrated skills required for effective learning. The final 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 credit is granted and recorded for this course if the student's grade is 50% or higher. The final grade will be determined as follows:

- 70% of the grade will be based upon 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.
- 30% of the grade will be based on final evaluations administered at the end of the course. The final assessment is a combination of both an exam and culminating activities.

Our theory of assessment and evaluation follows the Ministry of Education's *Growing Success* document, and it is our firm belief that doing so is in the best interests of students. We seek to design assessment in such a way as to make it possible to gather and show evidence of learning in a variety of ways to gradually release responsibility to the students, and to give multiple and varied opportunities to reflect on learning and receive detailed feedback.

Ontario Ministry of Education. (2010). *Growing success: Assessment, evaluation and reporting in Ontario schools*. Toronto ON: Queen's Printer for Ontario.

Type of Assessment	Category	Details	Weighting %	
Term Work (70%)	Knowledge/ Understanding	- expand and simplify quadratic expressions, solve quadratic equations, and relate the roots of a quadratic equation to the corresponding graph; - simplify and evaluate numerical expressions involving exponents.	13%	
	Thinking	- make connections between the numeric, graphical, and algebraic representations of quadratic functions; - demonstrate an understanding of compound interest and annuities, and solve related problems	19%	
	Communication	- make connections between the numeric, graphical, and algebraic representations of exponential functions. - make connections between the numeric, graphical, and algebraic representations of sine functions.	19%	
	Application	- solve problems arising from real-world applications; - solve problems involving sine functions, including problems arising from real-world applications.	19%	
Final Assessment (30%)	Culminating Activity	- design and carry out a culminating investigation* that requires the integration and application of the knowledge and skills related to the expectations of this course; communicate the findings of a culminating investigation.	K/U	3%
			T	4%
			C	4%
			A	4%
	Final Exam	- Written examination designed to cover all of the overall expectations of the course	K/U	3%
			T	4%
			C	4%
			A	4%
TOTAL			100%	

Assessment/Evaluation Strategies

Our assessment and evaluation follows the Ministry of Education's *Growing Success* document. We seek to design assessment in such a way as to make it possible to gather and show evidence of learning in a variety of ways to gradually release responsibility to the students, and to give multiple and varied opportunities to reflect on learning and receive detailed feedback. Below are fundamental principles of assessment and evaluation by KIHS teachers.

- are fair and transparent for all students;
- support all students, including those with special education needs.
- are carefully planned to relate to the curriculum expectations and learning goals and, as much as possible;
- are ongoing, 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.

For a full explanation, please refer to [Growing Success](#).

Resources

Note: This course is entirely online and does not require or rely on any textbook.

- Access to a spreadsheet, *Excel* or similar
- A scanner, smart phone camera, or similar device to upload handwritten or hand-drawn work

Program Planning

This course is offered to Indigenous students living in isolated northern Ontario communities which do not have access to regular high school facilities, equipment or teachers associated with secondary education. This course uses the internet for instruction, demonstration and research. It utilizes a student-centered semi-virtual classroom which capitalizes on the strengths of internet program delivery to minimize the disadvantages of geographic remoteness.

Students are presented with 1320 minutes of instruction/activity via the internet over the period of one week. All lessons, assignments, questions and course material is presented in this manner, with approved print materials available as a student resource in each classroom. The student and instructor communicate via the internet, while a classroom mentor (a fully qualified teacher) assists students in completing tasks in a timely manner and provides tutoring as required. Students may also receive support from various programs at KiHS, including the First Nation Student Success Program and the Special Education Program.

Indigenous and local content is used throughout the course to meet students' learning needs. Considerations are made to the learning preferences of the student population and lessons can be adjusted for individual students as required.