

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 2021

Developed from:

Ontario Ministry of Education. (2013). *The Ontario curriculum, grades 11 and 12: Mathematics*. Toronto ON: Queen's Printer for Ontario.

Text: None

Prerequisite: MPM2D: Principles of Mathematics, Grade 10, Academic OR
MFM2P: Foundations of Mathematics, Grade 10, Applied

Credits: One

Length: 110 hours

Principal's Name: Angela Batsford-Mermans

Principal's Approval:



Approval Date: September 13, 2021

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

Quadratic Functions

- Expand and simplify quadratic expressions, solve quadratic equations, and relate the roots of a quadratic equation to the corresponding graph;
- Demonstrate an understanding of functions, and make connections between the numeric, graphical, and algebraic representations of quadratic functions;
- Solve problems involving quadratic functions, including problems arising from real-world applications.

Exponential Functions

- Simplify and evaluate numerical expressions involving exponents and make connections between the numeric, graphical, and algebraic representations of exponential functions;
- Identify and represent exponential functions, and solve problems involving exponential functions, including problems arising from real-world applications;
- Demonstrate an understanding of compound interest and annuities, and solve related problems.

Trigonometric Functions

- Solve problems involving trigonometry in acute triangles using the sine law and the cosine law, including problems arising from real-world applications;
- Demonstrates an understanding of periodic relations and the sine function, and make connections between the numeric, graphical, and algebraic representations of sine functions;
- Identify and represent sine functions, and solve problems involving sine functions, including problems arising from real-world applications.

Course Content

Unit	Length
1. Quadratic Functions	30 hours
2. Exponential Functions	17 hours
3. Financial Application	17 hours
4. Trigonometric Functions	30 hours
5. 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. This unit provides opportunities to analyse theoretical experiments of quadratic functions in local First Nation communities.

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. This provides an opportunity to analyse the exponential behaviour of Treaty annuity payments to status Indigenous peoples.

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. This unit provides an opportunity to analyse the sinusoidal behaviour of the weather's temperature in Northwestern Ontario. Indigenous students will also connect trigonometric laws to land-based applications.

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. Students also use technology to assist themselves and other students in their exploration of potential solutions.

Teaching/Learning Strategies

This course is organized into an eight-week series of lessons and activities that is presented to students in remote northern communities via the internet. The eighth week is used for course consolidation, review, and the final examination. Teacher and students communicate over the internet through timely activity feedback, emails, messages, video and audio calls. Classroom mentors assume the role of liaison between the teacher and student while also supporting a holistic approach to motivate, engage and support each individual student.

A variety of strategies will be used in the online delivery of this course. Some instructional strategies include:

- 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 overriding 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.

Learning goals will be discussed at the beginning of each assignment and success criteria will be provided to students. The success criteria are used to develop the assessment tools in this course, including rubrics and checklists.

Evaluation

The final grade will be determined as follows (Ontario Ministry of Education, 2010):

- Seventy per cent of the grade will be based on evaluation conducted throughout the course. This portion of the grade should reflect the student's most consistent level of achievement throughout the course, although special consideration should be given to more recent evidence of achievement.
- Thirty percent of the grade will be based on a final evaluation administered at or towards the end of the course. This evaluation will be based on evidence from one or a combination of the following: an examination, a performance, an essay, and/or another method of evaluation suitable to the course content. The final evaluation allows the student an opportunity to demonstrate comprehensive achievement of the overall expectations for the course (p. 47).

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
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			g (%)	
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 Evaluation (30%)	Culminating Activity (15%)	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
	Exam (15%)	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

A variety of assessment and evaluation methods, strategies and tools are required as appropriate to the expectation being assessed. These include diagnostic, formative, and summative within the course and within each unit.

Assessment *for* learning and assessment *as* learning is obtained through a variety of means, including the following:

- Ongoing descriptive feedback;
- Self-assessment;
- Mentor observations (e.g. of specific course expectations during Land based and cultural activities as well as during course specific activities);
- Conversations with student on a regular basis to verbalize observations, ask questions, and clarify understanding.

Evidence of student achievement (assessment *of* learning) is collected from various sources, including the following:

- Ongoing observations of most consistent work, with consideration given to most recent work;
- Conversations with students;
- Summative unit activities;
- Culminating activity;
- Exam.

The Ministry of Education's 2010 document, *Growing Success*, outlines the seven fundamental principles that guide best practice in the assessment and evaluation of students. KiHS teachers use practices 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 course and at other 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 (p.6).

Resources

Ontario Ministry of Education. (n.d.). *Indigenous education strategy*.
<http://www.edu.gov.on.ca/eng/aboriginal/>

Ontario Ministry of Education. (2007). *The Ontario curriculum, grades 11 and 12: Mathematics*.
<http://www.edu.gov.on.ca/eng/curriculum/secondary/math1112currb.pdf>

Ontario Ministry of Education. (2010). *Growing success: Assessment, evaluation and reporting in Ontario schools*. <http://www.edu.gov.on.ca/eng/policyfunding/growSuccess.pdf>

Ontario Ministry of Education. (2016). *Ontario schools, kindergarten to grade 12: Policy and program requirements*. <http://edu.gov.on.ca/eng/document/policy/os/index.html>

Toulouse, P.R. (2016). What matters in Indigenous education: Implementing a vision committed to holism, diversity and engagement. <https://peopleforeducation.ca/wp-content/uploads/2017/07/MWM-What-Matters-in-Indigenous-Education.pdf>

Program Planning

This course is offered to Indigenous students living in isolated, northern Ontario communities. It is offered by qualified teachers in a blended classroom with a balance of academic, wellness, land-based learning, local language and culture to support the success of the whole student. 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 support as required.

Indigenous and local content is used throughout the course to meet students' learning needs. Opportunities for outdoor activities and land-based learning are also incorporated and students are encouraged to use local knowledge in their products. Considerations are made to the learning preferences of the student population and lessons can be adjusted for individual students as required. Opportunities have been provided for students to apply ideas and concepts encountered in this course to their lives as an individual and as a member of a First Nations community.

Teachers consult the Ontario Ministry of Education policies, guidelines and important initiatives when planning a comprehensive program in this area.