

Course Outline

School Name: KEEWAYTINOOK INTERNET HIGH SCHOOL
Department Name: Mathematics

Ministry of Education Course Title: Mathematics for College Technology

Grade Level: 12

Ministry Course Code: MCT4C

Teacher's Name: Ian Vaithilingam

Developed by: Erik Tu Date: July 2015

Revision Date: September 2021

Developed from:

Ontario Ministry of Education. (2007). *The Ontario curriculum, grades 11 and 12: Mathematics*. Queen's Printer for Ontario.

Text: None

Prerequisite: MCF3M

Credits: One

Length: 110 hours

Principal's Name: Angela Batsford-Mermans

Principal's Approval:



Approval Date: September 8, 2021

Course Description/Rationale

This course enables students to extend their knowledge of functions. Students will investigate and apply properties of polynomial, exponential, and trigonometric functions; continue to represent functions numerically, graphically, and algebraically; develop facility in simplifying expressions and solving equations; and solve problems that address applications of algebra, trigonometry, vectors, and geometry. Students will reason mathematically and communicate their thinking as they solve multi-step problems. This course prepares students for a variety of college technology programs.

Overall Curriculum Expectations

Exponential Functions

- Solve problems involving exponential equations graphically, including problems arising from real-world applications;
- Solve problems involving exponential equations algebraically using common bases and logarithms, including problems arising from real-world applications.

Polynomial Functions

- Recognize and evaluate polynomial functions, describe key features of their graphs, and solve problems using graphs of polynomial functions;
- Make connections between the numeric, graphical, and algebraic representations of polynomial functions;
- Solve polynomial equations by factoring, make connections between functions and formulas, and solve problems involving polynomial expressions arising from a variety of applications.

Trigonometric Functions

- Determine the values of the trigonometric ratios for angles less than 360° , and solve problems using the primary trigonometric ratios, the sine law, and the cosine law;
- Make connections between the numeric, graphical, and algebraic representations of sinusoidal functions;
- Demonstrate an understanding that sinusoidal functions can be used to model some periodic phenomena, and solve related problems, including those arising from real-world applications.

Applications of Geometry

- Represent vectors, add and subtract vectors, and solve problems using vector models, including those arising from real-world applications;
- Solve problems involving two-dimensional shapes and three-dimensional figures and arising from real-world applications;
- Determine circle properties and solve related problems, including those arising from real-world applications.

Course Content

Unit	Length
1. Graphing Exponential Functions	16 hours
2. Exponential and Logarithmic Functions	16 hours
3. Key Features of Polynomial Functions	16 hours
4. Exploring Polynomial Functions	16 hours
5. Graphing Trigonometric Functions	16 hours
6 Exploring Trigonometric Functions	15 hours
7. Applications of Geometry	15 hours
Total	110 hours

Unit Descriptions

Unit 1 – Graphing Exponential Functions

Through models, students are introduced to the definition of an exponential function and the notations associated with it. Students use graphing technology and paper and pencil tasks to investigate the properties of exponential functions. Students explore the domain and range of functions.

Unit 2 – Exponential and Logarithmic Functions

Students investigate properties of exponential functions and logarithmic functions. The relationship between exponential function and logarithmic function is explored both algebraically and graphically. Students use laws of logarithms to simplify and evaluate logarithmic expressions, and to solve problems. A variety of models are examined.

Unit 3 – Key features of Polynomial Functions

Students are introduced to the main concepts of graphing polynomial functions in order to explore them later in the course. Students examine the type and numbers of intercepts, the effect of changing coefficients, symmetry and the degree in relation to the shape of the functions. Using skills from previous years, students explore curve sketching from a factored form.

Unit 4 – Key features of Polynomial Functions

Students will explore polynomial equations. Real and complex roots of both factorable and non-factorable polynomials are determined through graphical investigation and algebraic manipulation. Finally, students will solve problems that involve functions arising from real-world applications.

Unit 5 – Graphing Trigonometric Functions

Students investigate the periodic nature and graphical properties of the primary trigonometric functions. Students use the primary trigonometric ratios, the sine law, and the cosine law to model and solve triangles. Students 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.

Unit 6 – Exploring Trigonometric Functions

Students consolidate and extend concepts first introduced. Using technology, students explore the effects of simple transformations on their graphs and equations. Students apply these concepts to model authentic and real-world problems. Students develop the skills to manipulate and solve trigonometric equations.

Unit 7 – Application of Geometry

Students will investigate, and then solve real-world problems. They will demonstrate an understanding of vectors, two-dimensional, three-dimensional in a variety of ways, including circle and related problems.

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:

- the use of rich contextual problems which engage students and provide them with opportunities to demonstrate learning, and appreciate the need for new skills;
- the prompting, supporting, and challenging of individual students;

- the use of technological tools and software (e.g., graphing software, dynamic geometry software, the Internet, spreadsheets, and multimedia) in activities, demonstrations, and investigations to facilitate the exploration and understanding of mathematical concepts;
- the use of learning/performance tasks that are designed to link several expectations and give the students occasion to demonstrate their optimal levels of achievement through the demonstration of skill acquisition, the communication of results, the ability to pose extending questions following an inquiry, and the determination of a solution to unfamiliar problems;

In addition to the contribution of the teacher, students themselves should play an active role in their own learning. In order to successfully complete the requirements of this course, students are expected to

- develop an increased responsibility for their own learning;
- be accountable for prerequisite skills;
- participate as active learners;
- engage in explorations using technology;
- apply individual and group learning skills;
- describe mathematical patterns that emerge verbally, algebraically, and visually in the course of learning.

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. 41).

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	Identify properties of functions using technology Use key properties of functions	13
	Thinking	Solve equations Model exponential growth and decay Model polynomial and trigonometric functions	19
	Communication	Sketching functions and their inverse Describe the nature of function change Determine connections between functions and their inverse	19
	Application	Solve exponential/polynomial equations arising from real-world applications Apply logarithmic laws	19

		Applying sine law and cosine law		
Final Evaluation (30%)	Culminating Activity (15%)	Plot functions using technology	K/U	3
		Perform transformations to plotted functions	T	4
		Solve equations representing real world scenarios	C	4
		Calculate triangle side lengths and angles using sine and cosine laws	A	4
	Exam (15%)	Simplify and solve equations	K/U	3
		Analyse and determine key points such as vertex, intercepts, min/max value	T	4
		Solve problems using graphical Representations of data	C	4
		Solve problems arising from real-world applications	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.

An effective assessment program in mathematics must include a balance of diagnostic, formative and summative assessment instruments that incorporate the categories of learning as defined in The Achievement Chart for Mathematics. One approach is shown below:

	Knowledge/ Understanding	Thinking	Communication	Application
final examinations				
observations				
performance tasks				
quizzes				
reports/assignments				
student/teacher conferences				
unit tests				

Assessment tools such as observational checklists, performance criteria, the Achievement Chart for Mathematics, marking schemes, and rating scales can and should be used to assist in developing objective and consistent evaluations of student achievement.

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

Erdman, W. (2009). *Mathematics 12*. McGraw-Hill Rerson.

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. (2013). *The Ontario curriculum, grades 9 to 12: Social sciences and humanities*. <http://www.edu.gov.on.ca/eng/curriculum/secondary/ssciences.html>

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.