

Course Outline

School Name:	Keewaytinook Internet High School
Department Name:	Mathematics
Ministry of Education Course Title:	Functions
Grade Level:	11
Ministry Course Code:	MCR3U

Teacher's Name: Zafer Erol

Developed by: Lorne Goring Date: February 2010

Revision Date: September 2018

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

Text: None

Prerequisite: Principles of Mathematics, Grade 10, Academic

Credits: 1

Length: 110 hours

Principal's Name: Kevin Dempsey

Principal's Approval (signature)



Approval Date: September 17, 2018

Course Description/Rationale

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

- demonstrate an understanding of functions, their representations, and their inverses, and make connections between the algebraic and graphical representations of functions using transformations;
- determine the zeros and the maximum or minimum of a quadratic function, and solve problems involving quadratic functions, including problems arising from real-world applications;
- demonstrate an understanding of equivalence as it relates to simplifying polynomial, radical, and rational expressions.
- evaluate powers with rational exponents, simplify expressions containing exponents, and describe properties of exponential functions represented in a variety of ways;
- 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 recursive sequences, represent recursive sequences in a variety of ways, and make connections to Pascal's triangle;
- demonstrate an understanding of the relationships involved in arithmetic and geometric sequences and series, and solve related problems;
- make connections between sequences, series, and financial applications, and solve problems involving compound interest and ordinary annuities.
- 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;
- demonstrate an understanding of periodic relationships and sinusoidal functions, and make connections between the numeric, graphical, and algebraic representations of sinusoidal functions;
- identify and represent sinusoidal functions, and solve problems involving sinusoidal functions, including problems arising from real-world applications.

Course Content

<i>Unit</i>	<i>Length</i>
Algebra	12 hours
Representing Functions	14 hours
Quadratic Functions	14 hours
Determining and Applying Trigonometric Ratios	15 hours
Graphing Trigonometric Functions	14 hours
Exponential Functions	15 hours
Sequences and Series	14 hours
Financial Mathematics	12 hours
Total	110 hours

Unit Descriptions

Unit 1 - Algebra

In this unit students will simplify polynomial expressions through addition, subtraction and multiplication. Rational expressions will be simplified by adding, subtracting, multiplying, and dividing, stating restrictions on variable values. Finally, students will determine through substitution and simplification if two given algebraic expressions are equivalent.

Unit 2 - Representing Functions

Through authentic models, students are introduced to the definition of a function and the notations associated with it. Students use graphing technology and paper-and-pencil tasks to investigate the properties of functions and their inverses, and the transformations of functions. The investigations are used to introduce and extend the use of function notation to inverses and transformations. Students explore the domain and range of functions, inverses, and transformations.

Unit 3 - Quadratic Functions

Students will solve problems that involve quadratic functions arising from real-world applications. They will determine the maximum or minimum value of a quadratic function and the number of zeroes (i.e., x-intercepts). Students will simplify radicals and radical expressions obtained by adding, subtracting, and multiplying.

Unit 4 - Determining and Applying Trigonometric Ratios

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

Unit 5 - Graphing Trigonometric Functions

Students 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.

Unit 6 - Exponential Functions

Students will use prior knowledge of linear and quadratic functions to compare with exponential functions (comparing rates of change using finite differences in tables of values; identifying a constant ratio in a table of values, inspecting graphs, comparing equations). Students will graph various exponential functions and make comparisons between the graphs.

Unit 7 - Sequences and Series

Students will investigate arithmetic and geometric series and sequences, and then solve related problems. They will demonstrate an understanding of recursive sequences and represent them in a variety of ways, including connections to Pascal's triangle.

Unit 8 - Financial Mathematics

Students develop the formula for compound interest and solve problems related to compound interest and annuities. As skills are developed, students use spreadsheets to investigate the cost of borrowing when interest rates, compound periods, lending terms, etc., are varied. The activities are designed to reflect the type of decisions that students are likely to face in the future. Students apply skills with linear and exponential functions.

Teaching/Learning Strategies

In order to address the wide range of expectations in this course, a variety of teaching, learning, and assessment strategies and tools need to be used including the following:

- 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;
- the use of accommodations, remediation, and/or extension activities, where necessary, to meet the needs of exceptional students.

Evaluation

The final grade will be determined as follows:

- 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 per cent 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).

Growing Success: Assessment, Evaluation and Reporting in Ontario Schools. Ontario Ministry of Education Publication, 2010, p. 41.

Type of Assessment	Category	Details	Weighting %	
Term Work (70%)	Knowledge/ Understanding	- Explore exponential relations and perform algebraic operations	13%	
	Thinking	- Investigate properties of inverse functions	19%	
	Communication	- Verify, through investigation facilitated by dynamic geometry software, geometric properties and relationships involving functions	19%	
	Application	- Solve exponential equations - Apply exponential laws - Find inverse functions by applying algebraic approaches	19%	
Final Assessment (30%)	Culminating Activity	- Graph quadratic functions by hand and using technology = Perform transformations on plotted functions -Solve quadratic equations of real world examples -Calculate using Sine and cosine laws	K/U	3%
			T	4%
			C	4%
			A	4%
	Final Exam	-Analyze various aspects on the graph of a quadratic function -Compare investment options and make an educated decision -Use the sine/cosine law to calculate distances -Solve problems using graphical representations of data	K/U	3%
			T	4%
			C	4%
			A	4%
TOTAL			100%	

Assessment/Evaluation Strategies

Assessment strategies and tools must address the variety of teaching and learning styles as well as the variety of expectations. High quality assessment can measure individual and group performance, and individual performance within a group. A balanced assessment program will include the following assessment methods:

- Understanding of Conceptual and Procedural Knowledge/Understanding: tests, quizzes, and observation of performance tasks.
- Thinking/ Problem Solving, and Application in unfamiliar settings: performance assessment, observation, and conferencing.

- Communication: journals, portfolios, performance assessments, observations and presentations.
- Application in familiar settings: tests, quizzes, performance assessments
- Learning Skills and to set goals: journals, portfolios, observations and conferencing.

Where possible, assessment tasks are designed in “real world” contexts so that students see the learning in Principles of Mathematics as meaningful and relevant and are motivated to apply their learning in an assessment situation.

The four major categories of assessment/evaluation will be incorporated into the design of the various assessment strategies used in the course, as illustrated in the following table.

K/U	Thinking	Communications	Applications
Quizzes Paper and Pencil Tests Matching Columns Short Answer Written Examinations (open-ended questioning)	Tests Examinations (open-ended questioning) Research Creation of Communication Products and Displays Self-Evaluation	Open-Ended Questions Tests Exams Graphic Organizers Creation of Communication Products and Displays Online forums	Open-Ended Questions Allowing for Knowledge to be Applied to a New Situation/Problem Creation of Communication Products and Displays

Resources

Course Profile: Course Profile - Functions and Relations, Grade 11

McGraw-Hill Ryerson. (2007). *Foundations for College Mathematics 11*

Ontario Ministry of Education. (2010). *Growing Success: Assessment, Evaluation and Reporting in Ontario Schools*. Retrieved from <http://www.edu.gov.on.ca/eng/policyfunding/growSuccess.pdf>

Ontario Ministry of Education. (2018). *Indigenous education strategy*. Retrieved from <http://www.edu.gov.on.ca/eng/aboriginal/>

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

MS Excel, Geometer's Sketchpad.

Program Planning

This course is offered to indigenous students living in 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.