NIAGARA ACADEMY
FUNCTIONS, GRADE 11, UNIVERSITY PREPARATION
COURSE OUTLINE

COURSE CODE: MCR3U

DEVELOPED BY: R. Cooper, September, 2007

REVISED BY: R. Cooper (2009), M. Wilson (2013), S. Davis (2014, 2015, 2016),
                    J. Pauls (2017, 2018), M. Ramsey (2019)

DEVELOPED   The Ontario Curriculum Grades 11 and 12, Mathematics, 2007,
FROM: http://www.edu.gov.on.ca/eng/curriculum/secondary/math1112currb.pdf

PREREQUISITE: Grade 10 Principles of Mathematics, Academic

COURSE
DURATION: 110 hours

COURSE VALUE: 1.0 credits

COURSE DESCRIPTION AND 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 multistep problems.

OVERALL CURRICULUM EXPECTATIONS

Characteristics of Functions:

By the end of this course, students will:

- 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.

Exponential Functions:

By the end of this course, students will:

- 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.

Discrete Functions:

By end of this course, students will:

- 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.

Trigonometric Functions:

By the end of this course, students will:

- determine the values of the trigonometric ratios for angles less than 360º; 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 AND EVALUATION

Unit	Description	Evaluation	Hours
Unit 1	*Polynomials Review:* 1. Adding, subtracting, multiplying polynomial expressions 2. Operations with radicals 3. Factoring (all types) 4. Simplifying rational expressions	10%	16 hrs
Unit 2	*Introduction to Functions* 1. Function notation and properties 2. Four basic graphs and their transformations 3. Inverse of a function	10%	16 hrs
Unit 3	*Quadratic Functions:* 1. Properties of quadratic functions 2. Transformations 3. Solving quadratic equations	10%	16 hrs
Unit 4	*Exponential Functions*: 1. Integer and rational exponents 2. Graphing exponential functions 3. Transformations 4. Exponential growth and decay	10%	16 hrs
Unit 5	*Trigonometric Ratios* 1. Right angle trigonometry 2. Angles in standard position 3. Sine Law and Cosine Law	10%	16 hrs
Unit 6	*Trigonometric Rules* 1. Periodic functions 2. Graphs of sinusoidal functions 3. Transformations	10%	16 hrs
Unit 7	*Sequences and Series* 1. Arithmetic and geometric sequences 2. Arithmetic and geometric series 3. Financial applications	10%	16 hrs
	Total Term Work	**70%**	**110 hrs**
Final Evaluation	**Culminating Activity** **Exam**	**10%** **20%**	
	Final Mark	**100%**	

Knowledge/ Understanding	Thinking/ Inquiry	Communication	Application/Making Connections
(30%)	(30%)	(20%)	(20%)
- Quizzes - Worksheets - Assignments - Note making	- Tests - Assignments - Gizmos	- Assignments - Gizmos	- Investigations - Using technology

ASSESSMENT AND EVALUATION

Evaluation and Reporting of Student Achievement
Student achievement is communicated formally to students and parents twice per semester by means of the Provincial Report Card, Grades 9–12. The report card provides a record of the student's achievement of the curriculum expectations in every course, at particular points in the school year or semester, 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 which are described in the achievement chart on pages 28-29 of The Ontario Curriculum Grades 11 and 12, Mathematics, 2007, http://www.edu.gov.on.ca/eng/curriculum/secondary/math1112currb.pdf.

Learning Skills will also be assessed and reported on the Provincial Report Card, Grades 9-12. The quality of the learning skills demonstrated by a student are recorded in six categories – Responsibility, Organization, Independent Work, Collaboration, Initiative, Self-Regulation – and are assessed throughout the semester using a four-point scale (E-Excellent, G-Good, S-Satisfactory, N-Needs Improvement), and using the document Growing Success: Assessment, Evaluation and Reporting in Ontario Schools, 2010 (page 11), as a guide (http://www.edu.gov.on.ca/eng/ policyfunding/growSuccess.pdf).

Assessment for Learning will be used as a process for seeking and interpreting evidence for use by learners and their teachers to decide where the learners are in their learning, where they need to go, and how best to get there. Teachers will use diagnostic assessment before instruction and formative assessment will occur frequently and in an ongoing manner to monitor students' progress. Observation and conversation will be used to determine the needs of individual student learning.

Assessment as Learning will focus on the explicit fostering of student's capacity over time to be their own best assessors, but teachers need to start by presenting and modeling external, structured opportunities for students to assess themselves. Formative assessment be used by students to monitor their own and their peers' progress.

Assessment of Learning will be used as the assessment that becomes public and results in statements or symbols about how well students are learning. Summative assessment will be used by the teacher to summarize learning at a given point in time. (Ref: page 31 of Growing Success, or page 8 of this document)

A final grade is recorded for every course, and a credit is granted and recorded for every course in which the student's grade is 50% or higher. The final grade for each course in Grades 9–12 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 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. Please see the following page for an explanation of how course work marks will be obtained.

• Thirty per cent of the grade will be based on a final evaluation in the form of an examination, performance task and/or other method of evaluation suitable to the course content and administered towards the end of the course. This final evaluation will include a Culminating Activity 10% and a Final Exam 20%.

A student's achievement of the overall curriculum expectations will be evaluated in accordance with the achievement charts in the provincial curriculum and will be reported using percentage marks. It is expected that both mathematical calculations and professional judgement will inform the determination of percentage marks.

TEACHING AND LEARNING STRATEGIES

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. Seven 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 both in oral as well as written form.
- *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.

CONSIDERATIONS FOR PROGRAM PLANNING

The planning and administering of this course is based on the premise that all students can be successful language learners. The teacher will provide quality instruction that respects students' strengths and address their learning needs, using assessment information to plan instruction. Accommodation for IEP students is not applicable at Niagara Academy, but the teacher will make appropriate adaptions for English Language Learners, such as the following:

- modification of some or all of the course expectations, based on the student's level of English proficiency;
- use of a variety of instructional strategies (e.g. extensive use of visual cues, manipulatives, pictures, diagrams, graphic organizers; attention to clarity of instructions; modelling of preferred ways of working in mathematics; previewing of textbooks; pre-teaching of key specialized vocabulary; encouragement of peer tutoring and class discussion; strategic use of students' first languages);
- use of a variety of learning resources (e.g., visual material, simplified text, bilingual dictionaries, culturally diverse materials);
- use of assessment accommodations (e.g., granting of extra time; use of alternative forms of assessment, such as oral interviews, learning logs, or portfolios; simplification of language used in problems and instructions).

Information and communications technology will be used throughout the course where it is appropriate. The program will also include opportunities for students to apply their skills to work-related situations, to explore educational and career options, and to become self-directed learners.

Teachers will model safe practices at all time and communicate safety requirements to students in accordance with the school, the Ministry of Education policies and Ministry of Labour regulations. This is particularly important in the case of off-site excursions. Teachers will also adhere to the policies of the First Nation, Métis and Inuit Education policy framework should the class include students from these communities.

RESOURCES

Functions 11, Nelson, 2008, ISBN 0-17-633203-0

Functions and Relations 11, Addison-Wesley, 2002, ISBN 0-201-72657-2 MCR3U-C (ILC) The Ontario Educational Communications Authority, 2012

Kuta Software (Worksheets) https://www.kutasoftware.com/

Desmos Graphing Software https://www.desmos.com/calculator