



**TFS High School**  
5635 Yong St. Suite 206,  
Toronto, Ontario M2M 3S9  
**COURSE OUTLINE**  
**Functions 11**  
**MCR3U (University)**

<b>Department</b>	Mathematics
<b>Instructor</b>	Mr. Nima Ghaffari
<b>Course Development Date</b>	September 2010
<b>Ministry Course Code</b>	MCR3U
<b>Credit Value</b>	1.00
<b>Ministry Curriculum Document</b>	Mathematics, The Ontario Curriculum, Grades 11 and 12, 2007 (Revised) <a href="http://www.edu.gov.on.ca/eng/curriculum/secondary/math1112currb.pdf">http://www.edu.gov.on.ca/eng/curriculum/secondary/math1112currb.pdf</a> <a href="http://www.edu.gov.on.ca/eng/policyfunding/growsuccess.pdf">http://www.edu.gov.on.ca/eng/policyfunding/growsuccess.pdf</a>
<b>Prerequisites</b>	Grade 10 Principles of Mathematics, Academic MPM2D
<b>Course Revision Date</b>	September 2020

## Course Description:

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 Expectations - MCR3U

CHARACTERISTICS OF FUNCTIONS	
Overall Expectations	
1.1	demonstrate an understanding of functions, their representations, and their inverses, and make connections between the algebraic and graphical representations of functions using transformations;
1.2	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;
1.3	demonstrate an understanding of equivalence as it relates to simplifying polynomial, radical, and rational expressions.
EXPONENTIAL FUNCTIONS	
Overall Expectations	
2.1	evaluate powers with rational exponents, simplify expressions containing exponents, and describe properties of exponential functions represented in a variety of ways;
2.2	make connections between the numeric, graphical, and algebraic representations of exponential functions;
2.3	identify and represent exponential functions, and solve problems involving exponential functions, including problems arising from real-world applications.
DISCRETE FUNCTIONS	
Overall Expectations	
3.1	demonstrate an understanding of recursive sequences, represent recursive sequences in a variety of ways, and make connections to Pascal's triangle;
3.2	demonstrate an understanding of the relationships involved in arithmetic and geometric sequences and series, and solve related problems;
3.3	make connections between sequences, series, and financial applications, and solve problems involving compound interest and ordinary annuities.

# TRIGONOMETRIC FUNCTIONS

## Overall Expectations

4.1	determine the values of the trigonometric ratios for angles less than $360^\circ$ ; prove simple trigonometric identities; and solve problems using the primary trigonometric ratios, the sine law, and the cosine law;
4.2	demonstrate an understanding of periodic relationships and sinusoidal functions, and make connections between the numeric, graphical, and algebraic representations of sinusoidal functions;
4.3	identify and represent sinusoidal functions, and solve problems involving sinusoidal functions, including problems arising from real-world applications.

## Units of Study

Unit	Titles and Descriptions	Time and Sequence
Unit 1	<b>Characteristics of Functions</b> Students will explore functions in this unit, their representations, and their inverses, and how to make connections between the algebraic and graphical representations of functions using transformations. Students will learn how to 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. By the end of the unit students will be able to demonstrate an understanding of equivalence as it relates to simplifying polynomial, radical, and rational expressions.	25 hours
Unit 2	<b>Exponential Functions</b> This unit will explore several topics including evaluating powers with rational exponents, simplifying expressions containing exponents, and describing properties of exponential functions represented in a variety of ways. The emphasis will be on problem solving using these concepts.	24.5 hours
Unit 3	<b>Discrete Functions</b> The unit begins with an exploration of recursive sequences and how to represent them in a variety of ways. Making connections to Pascal's triangle, demonstrating understanding of the relationships involved in arithmetic and geometric sequences and series, and solving related problems involving compound interest and ordinary annuities will form the rest of the unit.	25 hours
Unit 4	<b>Trigonometric Functions</b> This unit concentrates students' attention on determining the values of the trigonometric ratios for angles less than $360^\circ$ ; proving simple trigonometric identities and solving problems using the primary trigonometric ratios. The sine law and the cosine law are developed. Students will learn to demonstrate an understanding of periodic relationships and sinusoidal functions, and make connections between the numeric, graphical, and algebraic representations of sinusoidal functions while solving problems involving sinusoidal functions, including problems arising from real-world applications.	15 hours
Unit 5	<b>Transforming Trigonometric Functions</b> Students will investigate the relationship between the graphs and the equations of sinusoidal functions sketching and describing the graphs and describing their periodic properties.	18 hours

	<b>Review and Final Evaluation</b> The final assessment task is a proctored 2.5 hour exam worth 30% of the student's final mark.	2.5 hours
	<b>Total</b>	<b>110 hours</b>

### Assessment and Evaluation Strategies of Student Performance based on Growing Success

Strategy	Purpose	Who	Assessment Tool
Self Assessment Quizzes	Diagnostic	Self/Teacher	Marking scheme
Problem Solving	Diagnostic	Self/Peer/Teacher	Marking scheme
Graphing Application	Diagnostic	Self	Anecdotal records
Problem Solving	Assessment	Peer/teacher	Marking scheme
Research	Assessment	Peer/teacher	Anecdotal records
Problem Solving	Evaluation	Teacher	Marking scheme
Graphing	Evaluation	Teacher	Checklist
Investigations	Evaluation	Teacher	Checklist
Unit Tests	Evaluation	Teacher	Marking scheme
Final Exam	Evaluation	Teacher	Checklist

### Teaching / Learning Strategies:

Since the over-riding aim of this course is to help students use language 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. These include:

Guided Exploration	Problem Solving	Graphing
Visuals	Direct Instruction	Independent Reading
Independent Study	Ideal Problem Solving	Multimedia Productions
Logical Mathematical Intelligence	Graphing Applications	Problem Posing
Model Analysis		Self-Assessments

**Assessment** is a systematic process of collecting information or evidence about student learning. **Evaluation** is the judgment we make about the assessments of student learning based on established criteria. The purpose of assessment is to improve student learning. This means that judgments of student performance must be criterion-referenced so that feedback can be given that includes clearly expressed next steps for improvement. Tools of varying complexity are used by the teacher to facilitate this. For the more complex evaluations, the criteria are incorporated into a rubric where levels of performance for each criterion are stated in language that can be understood by students.

Percentage of Final Mark	Weight	Evaluation Categories	Assessment will be ongoing to inform the students of their performance and the opportunity for success. Four achievement categories are illustrated in the chart.  <b>K:</b> Knowledge and Understanding 35% <b>I:</b> Inquiry/Thinking 20% <b>C:</b> Communication 15% <b>A:</b> Application/ Making Connections 30%
70%	60%	Tests and Quizzes	
	10%	Projects and Assignments	
30%	30%	Final Written Examination	

### Potential Resources:

- MCR3U online course of study
- *McGraw-Hill Ryerson Mathematics: Functions*

Categories	50-59% (Level 1)	60-69% (Level 2)	70-79% (Level 3)	80-100% (Level 4)
<b>Knowledge and Understanding</b> - Subject-specific content acquired in each course (knowledge), and the comprehension of its meaning and significance (understanding)				
	The student:			
<b>Knowledge of content</b> (e.g., facts, terms, procedural skills, use of tools)	demonstrates limited knowledge of content	demonstrates some knowledge of content	demonstrates considerable knowledge of content	demonstrates thorough knowledge of content
<b>Understanding of mathematical concepts</b>	demonstrates limited understanding of content	demonstrates some understanding of content	demonstrates considerable understanding of content	demonstrates thorough and insightful understanding of content
<b>Thinking</b> - The use of critical and creative thinking skills and/or processes				
	The student:			
<b>Use of planning skills</b> -understanding the problem (e.g., formulating and interpreting the problem, making conjectures) -making a plan for problem solving	uses planning skills with limited effectiveness	uses planning skills with moderate effectiveness	uses planning skills with considerable effectiveness	uses planning skills with a high degree of effectiveness
<b>Use of processing skills</b> -carrying out a plan (e.g., collecting data, questioning, testing, revising, modelling, solving, inferring, forming conclusions) -looking back at the solution (e.g., evaluating reasonableness, making convincing arguments,	uses processing skills with limited effectiveness	uses processing skills with some effectiveness	uses processing skills with considerable effectiveness	uses processing skills with a high degree of effectiveness

reasoning, justifying, proving, reflecting)				
<b>Use of critical/creative thinking processes</b> (e.g., problem solving, inquiry)	uses critical / creative thinking processes with limited effectiveness	uses critical / creative thinking processes with some effectiveness	uses critical / creative thinking processes with considerable effectiveness	uses critical / creative thinking processes with a high degree of effectiveness
<b>Communication</b> - The conveying of meaning through various forms				
	The student:			
<b>Expression and organization of ideas and mathematical thinking</b> (e.g., clarity of expression, logical organization), <b>using oral, visual, and written forms</b> (e.g., pictorial, graphic, dynamic, numeric, algebraic forms; concrete materials)	expresses and organizes mathematical thinking with limited effectiveness	expresses and organizes mathematical thinking with some effectiveness	expresses and organizes mathematical thinking with considerable effectiveness	expresses and organizes mathematical thinking with a high degree of effectiveness
<b>Communication for different audiences and purposes</b> (e.g., peers and teachers) <b>and purposes</b> (e.g., to present data, justify a solution, express a mathematical argument) <b>in oral, visual, and written forms</b>	communicates for different audiences and purposes with limited effectiveness	communicates for different audiences and purposes with some effectiveness	communicates for different audiences and purposes with considerable effectiveness	communicates for different audiences and purposes with a high degree of effectiveness
<b>Use of conventions, vocabulary, and terminology of the discipline</b> (e.g., terms, symbols) <b>in oral, visual, and written forms</b>	uses conventions, vocabulary, and terminology of the discipline with limited effectiveness	uses conventions, vocabulary, and terminology of the discipline with some effectiveness	uses conventions, vocabulary, and terminology of the discipline with considerable effectiveness	uses conventions, vocabulary, and terminology of the discipline with a high degree of effectiveness
<b>Application</b> - The use of knowledge and skills to make connections within and between various contexts				
	The student:			
<b>Application of knowledge and skills in familiar contexts</b>	applies knowledge and skills in familiar contexts with limited effectiveness	applies knowledge and skills in familiar contexts with some effectiveness	applies knowledge and skills in familiar contexts with considerable effectiveness	applies knowledge and skills in familiar contexts with a high degree of effectiveness
<b>Transfer of knowledge and skills to new contexts</b>	transfers knowledge and skills to new contexts with limited effectiveness	transfers knowledge and skills to new contexts with some effectiveness	transfers knowledge and skills to new contexts with considerable effectiveness	transfers knowledge and skills to new contexts with a high degree of effectiveness
<b>Making connections within and between various contexts</b> (e.g., connections between concepts, representations, and forms within mathematics;	makes connections within and between various contexts with limited effectiveness	makes connections within and between various contexts with some effectiveness	makes connections within and between various contexts with considerable effectiveness	makes connections within and between various contexts with a high degree of effectiveness

connections involving use of prior knowledge and experience; connections between mathematics, other disciplines, and the real world))				
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### Learning Skills:

*Learning Skills* are skills and habits are essential to success in school and in the workplace. Teachers report achievement on the six Learning Skills in the table below using letter codes:

E = Excellent                  G = Good                  S = Satisfactory                  N = Needs Improvement.

Learning Skills	Sample Behaviors
Responsibility	The student fulfills responsibilities and commitments within the learning environment; completes and submits class work, homework, and assignments according to agreed-upon timelines; takes responsibility for and manages own behavior.
Organization	The student devises and follows a plan and process for completing work and tasks; establishes priorities and manages time to complete tasks and achieve goals; identifies, gathers, evaluates, and uses information, technology, and resources to complete tasks.
Independent Work	The student independently monitors, assesses, and revises plans to complete tasks and meet goals; uses class time appropriately to complete tasks; follows instructions with minimal supervision.
Collaboration	The student accepts various roles and an equitable share of work in a group; responds positively to the ideas, opinions, values, and traditions of others; builds healthy peer-to-peer relationships through personal and media-assisted interactions; works with others to resolve conflicts and build consensus to achieve group goals; shares information, resources, and expertise and promotes critical thinking to solve problems and make decisions.
Initiative	The student looks for and acts on new ideas and opportunities for learning; demonstrates the capacity for innovation and a willingness to take risks; demonstrates curiosity and interest in learning; approaches new tasks with a positive attitude; recognizes and advocates appropriately for the rights of self and others.
Self-Regulation	The student sets own individual goals and monitors progress towards achieving them; seeks clarification or assistance when needed; assesses and reflects critically on own strengths, needs, and interests; identifies learning opportunities, choices, and strategies to meet personal needs and achieve goals; perseveres and makes an effort when responding to challenges.

### Academic Honesty: Cheating and Plagiarism:

Plagiarism is a serious offense. It is defined as taking words, phrasing, sentence structure, or any other element of the expression of another person's **ideas**, and using them as if they were your own. Plagiarism is a violation of another person's rights, whether the material taken is excessive or small. Students will be assisted in developing strategies and techniques to avoid plagiarism. They need to be aware that plagiarized term work will be penalized and could result in a mark of zero.

## **Program Planning Considerations:**

Program Planning Considerations for English: Teachers who are planning a program in English must take into account considerations in a number of important areas. Essential information that pertains to all disciplines is provided in the companion piece to this document, *The Ontario Curriculum, Grades 9 to 12: Program Planning and Assessment, 2007 (Revised)*.

The areas of concern to all teachers that are outlined there include the following:

- Education for Exceptional Students
- The Role of Technology in the Curriculum √
- English as a Second Language (ESL) and English Literacy Development (ELD)
- Antidiscrimination Education in the English Program √
- Literacy, Numeracy, and Inquiry/Research Skills √
- Career Education √
- Cooperative Education •
- Health and Safety