



TORONTO WORLD SCHOOL

COURSE OUTLINE

Department: MATHEMATICS

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Course Reviser/ Revision Date: Simon Gallo, June 2024

Course Title/ Grade/ Type: Functions, Grade 11, University / College Preparation

Course Code: MCR3U

Credit Value: 1.0

Total Hours: 110 hours

Policy Document: The Ontario Curriculum Grades 11 and 12 Mathematics, Ministry of Education 2007

Prerequisite: Principles of Mathematics, Grade 10, Academic

Course Description

This course introduces the mathematical concept of the function by extending student' 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

Characteristics of Functions

- A.1** – Demonstrate an understanding of functions, their representations, and their inverses, and make connections between the algebraic and graphical representations of functions using transformations
- A.2** – Determine the zeros and maximum and minimum of quadratic function, and solve problems involving quadratic functions, including problems arising from real-world applications
- A.3** – Demonstrate an understanding of equivalence as it relates to simplifying polynomial, radical, and rational expressions

Exponential Functions

- B.1** – Evaluate powers with rational exponents, simplify expressions containing exponents, and describe properties of exponential functions represented in a variety of ways
- B.2** – Make connections between the numeric, graphical, and algebraic representations of exponential functions
- B.3** – Identify and represent exponential functions, and solve problems involving exponential functions, including problems arising from real-world applications

Discrete Functions

- C.1** – Demonstrate an understanding of recursive sequences, represent recursive sequences in a variety of ways, and make connections to Pascal's triangle
- C.2** – Demonstrate an understanding of the relationship involved in arithmetic and geometric sequences and series, and solve related problems
- C.3** – Make connections between sequences, series, and financial applications, and solve problems involving compound interest and ordinary annuities

Trigonometric Functions

- D.1** – 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

D.2 – Demonstrate an understanding of periodic relationships and sinusoidal functions, and make connections between the numeric, graphical, and algebraic representations of sinusoidal functions

D.3 – Identify and represent sinusoidal functions, and solve problems involving sinusoidal functions, including problems arising from real-world applications

Outline of Course Content

Unit	Titles and Descriptions	Time and Sequence
Unit 1	<p>Introduction to Functions:</p> <p>By the end of this section, you will be able to, identify a function as a special type of relation. They will recognize functions in various representations and use function notation. You will Explore the properties of some basic functions and apply transformations to those functions, and investigate the inverse of a linear function and its properties.</p>	15 hours
Unit 2	<p>Equivalent Algebraic Expressions:</p> <p>By the end of this unit, you will be able to determine whether algebraic expressions are equivalent. Add, subtract, multiply, and factor polynomials. You will simplify rational expressions; and add, subtract, multiply, and divide rational expressions.</p>	13 hours
Unit 3	<p>Quadratic Functions:</p> <p>.By the end of this section, you will be able to, graph and analyze the properties of a quadratic function. You will determine the zeros of quadratic functions. You will calculate the maximum or minimum values of quadratic function, and solve problems involving quadratic functions.</p>	13 hours
Unit 4	<p>Exponential Functions:</p> <p>By the end of the section, you will be able to describe the characteristics of exponential functions and their graphs. You will compare exponential functions with linear and quadratic functions, and evaluate powers with integer and rational exponents and simplify expressions involving them. Lastly, you will use exponential functions to solve problems involving</p>	13.5 hours

	exponential growth and decay.	
Unit 5	<p>Trigonometric Ratios:</p> <p>By the end of the section, you will be able to, relate the six trigonometric ratios to the unit circle, and solve real-life problems by using trigonometric ratios, properties of triangles, and the sine and cosine laws. Finally, you will prove simple trigonometric identities.</p>	15 hours
Unit 6	<p>Sinusoidal Functions:</p> <p>By the end of the section, you will be able to, identify situations that can be modeled using sinusoidal and other periodic functions, and interpret the graphs of sinusoidal and other periodic phenomena. You will understand the effect of applying transformations to the functions: $f(x)=\sin x$ and $f(x)=\cos x$, where x is measured in degrees, and determine the equations of sinusoidal functions in real- world situations and use those equations to solve problems.</p>	13.5 hours
Unit 7	<p>Sequences and Series:</p> <p>By the end of the section, you will be able to identify and classify sequences and create functions for describing sequences and use the sequences to make predictions. You will investigate efficient ways to add the terms of a sequence and model real-life problems using sequences.</p>	12 hours
Unit 8	<p>Discrete Functions: Financial Applications</p> <p>By the end of the section, you will be able to determine how interest is earned and charged and use the difference between future value and present value to solve problems. You will solve problems about money invested at regular intervals over a period of time and calculate payments that must be made when a purchase is financed over a period of time.</p>	12 hours
	<p style="text-align: center;">Review and Final Evaluation</p> <p>The final assessment task is a broken down into a conversation portion worth 10% and a written exam worth 20% of the student's final mark.</p>	3 hours
	Total	110 hours

Teaching and Learning Strategies

The strategies used are varied to meet the needs and the range of learning styles encountered and they include the following:

Strategies marked with “x” are used in the course.			
Game	X	Conferencing	X
Oral Presentation	X	Demonstration	X
Stimulation	X	Prompt	X
Survey	X	Review	X
Role Playing	X	Textbook	X
Collaborative	X	Workbook/Worksheets	X
Discussion	X	Homework	X
Interview	X	Independent Study	X
Peer Practice	X	Memorization	X
Peer Teaching	X	Note Taking	X
Reflection	X	Questioning Process	X
Inquiry Process	X	Research Process	X
Communication Applications	X	Classifying	X
Email Applications	X	Expressing Another Point of View	X
Media Presentation	X	Graphing	X
Media Production	X	Metacognitive	X
Multimedia Applications	X	Oral Explanation	X
Brainstorming	X		

Strategies for Assessment and Evaluation of Student Performance

Diagnostic assessment is used at the beginning of a unit to assist in determining a starting point for instruction. Assessment for Learning (AFL) provides information to students as they are learning and refining their skills. Assessment as Learning (AAL) acts as a stepping-stone for students to begin applying their understanding using critical thinking; it bridges the gap between AFL and AOL. Assessment of Learning (AOL), at the end of units and course, provides students with the opportunity to synthesize/apply/demonstrate their learning and the achievement of the expectations. The following is a list of specific assessment/evaluation strategies that the teacher may use but is not limited to.

Assessment and Evaluation

Evaluation in this course will be continuous throughout the year and will include a variety of evaluation methods. The tools highlighted in yellow will be used for the three different types of assessments:

Assessment as Learning	Assessment for Learning	Assessment of Learning
<p>Student Product</p> <ul style="list-style-type: none"> <input type="checkbox"/> Journals/Letters/Emails (checklist) <input type="checkbox"/> Learning Logs (anecdotal) <input type="checkbox"/> Learning Goals (Checklist) <input type="checkbox"/> Entrance tickets <input type="checkbox"/> Exit tickets 	<p>Student Product</p> <ul style="list-style-type: none"> <input type="checkbox"/> Assignment <input type="checkbox"/> Journals/Letters/Emails (checklist) <input type="checkbox"/> Pre-tests (scale/rubric) <input type="checkbox"/> Peer feedback (anecdotal/checklist) <input type="checkbox"/> Entrance ticket <input type="checkbox"/> Vocabulary notebooks (anecdotal) 	<p>Student Product</p> <ul style="list-style-type: none"> <input type="checkbox"/> Assignment <input type="checkbox"/> Journals/Letters/Emails (checklist) <input type="checkbox"/> Tests (scale/rubric) <input type="checkbox"/> Exam <input type="checkbox"/> Reports (rubric) <input type="checkbox"/> Essays (rubric)
<p>Observation</p> <ul style="list-style-type: none"> <input type="checkbox"/> Whole class discussions (anecdotal) <input type="checkbox"/> Self-proofreading (checklist) 	<p>Observation</p> <ul style="list-style-type: none"> <input type="checkbox"/> Class discussions (anecdotal) <input type="checkbox"/> Debate (rubric) <input type="checkbox"/> Performance tasks (anecdotal/scale) 	<p>Observation</p> <ul style="list-style-type: none"> <input type="checkbox"/> PowerPoint presentations (rubric) <input type="checkbox"/> Performance tasks (anecdotal/scale)
<p>Conversation</p> <ul style="list-style-type: none"> <input type="checkbox"/> Student teacher conferences (checklist) <input type="checkbox"/> Small Group Discussions (checklist) <input type="checkbox"/> Pair work (checklist) 	<p>Conversation</p> <ul style="list-style-type: none"> <input type="checkbox"/> Student teacher conferences (checklist) <input type="checkbox"/> Small group discussions (checklist) <input type="checkbox"/> Pair work (anecdotal) <input type="checkbox"/> Peer-feedback (anecdotal) <input type="checkbox"/> Peer-editing (anecdotal) <input type="checkbox"/> Oral pre-tests (scale/rubric) 	<p>Conversation</p> <ul style="list-style-type: none"> <input type="checkbox"/> Student teacher conferences (checklist) <input type="checkbox"/> Question and Answer Session (checklist) <input type="checkbox"/> Oral tests (scale/rubric)

Online Activities (within LMS)	Offline Activities
Watching video lectures Watching additional resource videos Completing interactive activities Communicating with teachers Participating in virtual conferences Completing online quizzes Reviewing peer submissions Submitting all AAL, AFL, & AOL Assessment and Evaluations	Reading materials for the course Reviewing materials for the course Completing assignments Completing practice activities Preparing presentations Reviewing for exams and unit tests Researching topics on the internet Recording and producing presentations Practicing processes and skills Completing proctored unit tests and exams

The Final Grade:

The percentage grade represents the quality of the students' overall achievement of the expectations for the course and reflects the corresponding achievement as described in the achievement chart for English. The distribution of marks into a grade is based on the departmental assessment and evaluation guide for the course and will reflect the student's most consistent level of achievement where appropriate. Comments on the development of learning skills and contributions to the course will be provided on reports. Term work will be 70% of the overall grade for the course; the final evaluation will be 30% of the overall grade, incorporating conversation activities and a final written examination at the end of the semester.

Assessment and Percentage of Final Mark	
(Term) 70%	Unit 1 Test (5%) [Student Product]
	Unit 2 Test (5%) [Student Product]
	Unit 2 Presentation (10%) [Observation]
	Unit 3 Test (5%) [Student Product]
	Unit 4 Test (5%) [Student Product]
	Unit 5 Test (5%) [Student Product]
	Unit 6 Test (5%) [Student Product]

	Unit 7 Conference (10%) [Conversation] Unit 7 Test (5%) [Student Product]
	Unit 8 Presentation (10%) [Observation] Unit 8 Test (5%) [Student Product]
30%	Final Evaluation (10%) – Conference [Conversation]
	Final Evaluation (20%) - Written[Student Product]

- Each Assessment of Learning (AoL) will be broken into the following categories and given the following weights: Knowledge/Understanding (25%), Inquiry/Thinking (25%), Communication (25%), and Application/Making Connections (25%).

A Summary Description of Achievement in Each Percentage Grade Range and Corresponding Level of Achievement		
Percentage Grade Range	Achievement Level	Summary Description
80-100%	Level 4	A very high to outstanding level of achievement. Achievement is <i>above</i> the provincial standard.
70-79%	Level 3	A high level of achievement. Achievement is <i>at</i> the provincial standard.
60-69%	Level 2	A moderate level of achievement. Achievement is <i>below, but approaching</i> , the provincial standard.
50-59%	Level 1	A passable level of achievement. Achievement is <i>below</i> the provincial standard.
below 50%	Level R	Insufficient achievement of curriculum expectations. A credit will not be granted.

Assessment of Learning Skills & Work Habits:

The following learning skills and work habits will be fostered throughout this course and assessed on the report card: responsibility, organization, independent work, collaboration, initiative, self-regulation. These skills will not be included as part of the final mark unless they are identified in the provincial curriculum expectations for the course. However, it is important to remember that the development of these skills is critical to daily academic success and individual growth.

The following chart indicates the skills and look-fors for each student.

Learning Skills and Work Habits		E – Excellent G – Good S – Satisfactory N – Needs Improvement			
Responsibility				Organization	
<ul style="list-style-type: none"> ▪ Fulfils 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 behaviour. 			<ul style="list-style-type: none"> ▪ 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			Collaboration		
<ul style="list-style-type: none"> ▪ Independently monitors, assesses, and revises plans to complete tasks and meet goals. ▪ Uses class time appropriately to complete tasks. ▪ Follows instructions with minimal supervision. 			<ul style="list-style-type: none"> ▪ 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			Self-Regulation		
<ul style="list-style-type: none"> ▪ 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. 			<ul style="list-style-type: none"> ▪ 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. 		

The report card will therefore focus on two distinct but related aspects of student achievement; the achievement of curriculum expectations and the development of learning skills. The report card will contain separate sections for the reporting of these two aspects.

Program Planning Considerations:

English language learners: As our school can have multilingual student population, special accommodation will be made to bring a rich diversity of background knowledge and experience to the classroom.

TWS courses can provide a wide range of options to address the needs of ESL/ELD students. Assessment and evaluation exercises will help ESL students in mastering the English language. In addition, since all occupations require employees with a wide range of English skills and abilities, many students will learn how the operation of their own physical world can contribute to their success in their social world. The student whose first language is not English enters Ontario Secondary schools with diverse linguistic and cultural backgrounds. All of these students bring a rich array of background knowledge and experience to the classroom, and all teachers must share in the responsibility for their English-language development. Teachers must incorporate appropriate strategies for instructions and assessment to facilitate the success of the English language learners in their classrooms. These strategies include:

- modification of some or all of the course expectations so that they are challenging but attainable for the learner at his or her present level of English proficiency, given the necessary support from the teacher;

- use of a variety of instructional strategies (e.g., extensive use of visual cues, scaffolding, manipulatives, pictures, diagrams, graphic organizers; attention to clarity of instructions);
- modelling of preferred ways of working in English; previewing of textbooks; pre-teaching of key vocabulary; peer tutoring; strategic use of students' first languages);
- use of a variety of learning resources (e.g., visual material, simplified text, bilingual dictionaries, materials that reflect cultural diversity);
- use of assessment accommodations (e.g., granting of extra time; simplification of language used in problems and instructions; use of oral interviews, learning logs, portfolios, demonstrations, visual representations, and tasks requiring completion of graphic organizers or cloze sentences instead of tasks that depend heavily on proficiency in English).

Literacy education: Communication skills are fundamental to the development of literacy. Fostering students' communication skills is an important part of the teacher's role in the curriculum. When students read they need to understand vocabulary and terminology. Students are encouraged to use language with care and precision in order to communicate effectively. Students are encouraged to ask questions to their peers/teachers and to also be proactive with solving their own questions.

The role of information and communications technology: Information and communication technologies (ICT) provide a range of tools that can significantly extend and enrich teachers' instructional strategies and support students' learning. Teachers can use ICT tools and resources both for whole-class instruction and to design programs that meet diverse student needs. Technology can help to reduce the time spent on routine tasks, allowing students to devote more of their efforts to thinking and concept development.

Information technology is considered a learning tool that must be accessed by students when the situation is appropriate. As a result, students will develop transferable skills through their experience with word processing, internet research, and presentation software, as would be expected in any environment.

Technology also makes possible simulations of complex systems that can be useful for problem-solving purposes or when field studies on a particular topic are not feasible. Information and communications technologies can be used in the classroom to connect students to other schools, at home and abroad, and to bring the global community into the local classroom. Although the Internet is a powerful electronic learning tool, there are potential risks attached to its use. All students must be made aware of issues of Internet privacy, safety, and responsible use, as well as of the ways in which this technology is being abused – for example, when it is used to promote hatred.

Teachers, too, will find the various ICT tools useful in their teaching practice, both for whole class instruction and for the design of curriculum units that contain varied approaches to learning to meet diverse student needs.

Equity and Inclusive Education: The TWS equity and inclusive education strategy focuses on respecting diversity, promoting inclusive education, and identifying and eliminating discriminatory biases, systemic barriers, and power dynamics that limit the ability of students to learn, grow, and contribute to society. In an environment based on the principles of inclusive education, all students, parents, caregivers, and other members of the school community - regardless of ancestry, culture, ethnicity, sex, physical or intellectual ability, race, religion, gender identity, sexual orientation, socio-economic status, or other similar factors - are welcomed,

included, treated fairly, and respected. Diversity is valued, and all members of the TWS community feel safe, comfortable, and accepted. Every student is supported and inspired to succeed in a culture of high expectations for learning. In an inclusive education system, all students see themselves reflected in the curriculum, their physical surroundings, and the broader environment, so that they can feel engaged in and empowered by their learning experiences. In addition, TWS differentiates the instruction and assessment strategies to take into account the background and experiences, as well as the interests, aptitudes, and learning needs, of all students.

First Nation, Métis and Inuit Education Policy Framework

The new First Nation, Métis and Inuit Education Policy Framework is a key part of the strategy. The framework includes approaches for schools and school boards that will boost Aboriginal student achievement, help close the gap in achievement between Aboriginal and non-Aboriginal students, and improving students' literacy and numeracy skills, training teachers in teaching methods that are appropriate for Aboriginal students, and encouraging more parents to get involved in their children's education or school. The framework also sets out strategies to integrate First Nations, Métis and Inuit cultures, histories and perspectives throughout the Ontario curriculum. This will increase knowledge and awareness among all students.

Plagiarism/Cheating:

Any incident of plagiarism or cheating will result in a resubmission/rewrite of that particular assignment/test at the end of the course on the student's own time and at his/her own expense to pay for the creation and marking of a new assessment. The incident will be documented in the office. A second incident of plagiarism or cheating in any course will result in a mark of zero for that assignment. For example, if you cheat on a math test and then plagiarize an English essay, you will receive a zero on the essay.

Missed and Late Assignment Policy:

Teachers will make it clear to the students and parents/guardian early in the school year that they are responsible not only for their behaviour in the classroom/school but also for providing evidence of their achievement of the overall expectations within the time frame specified by the teacher and in a form approved by the teacher. Students must understand that there will be consequences for not completing assignments for evaluation or for submitting those assignments late. Where in the teacher's professional judgment it is appropriate to do so, a number of strategies will be used to encourage the student to modify his/her behaviour. Some of these may include:

- Asking the student to clarify the reason for not completing the assignment taking into consideration legitimate reasons for missed deadlines
- Maintaining ongoing communication with students and/or parents about due dates and late assignments, and scheduling conferences with parents if the problem persists

- Setting up a student contract
- Providing alternative assignments or tests/exams where, in the teacher's professional judgment, it is reasonable and appropriate to do so
- Deducting marks for late assignments, up to and including the full value of the assignment

Students and parent/guardians will be informed in a timely fashion via phone call, face to face conference, e-mail and if need be a formal letter about the importance of submitting assignments for evaluation when they are due and about the consequences for students who submit assignments late or fail to submit assignments. **If the above measures have been put into place and the behaviour of the student has no provided sufficient evidence, then 0 will be inserted as the mark for the missed assignment.**

Resources:

Mathematic 11, McGraw-Hill Ryerson, 2010

Growing Success: Assessment Evaluation and Reporting in Ontario Schools, First Edition
Covering Grades 1-12

Attendance Policy:

Consistent log-in is crucial to a student's success in Toronto World School's online program. The guidelines of the Ministry of Education require that students receive at least 110 hours of scheduled instruction time for each credit course. Attendance patterns will be monitored to ensure a student is actively logging into their course. Students who have not completed the course within 12 months of enrolment will be automatically removed from the course. Only under extenuating circumstances, with proper documentation and the permission of the Principal, can a student be reinstated.

Acceptable Online Use Policy

Toronto World School uses the ConnectED Integrated Learning Platform and is intended for educational purposes only. The use of this program or any tools within TWS systems, other than for educational purposes, is strictly prohibited. The inappropriate uses include, but are not limited to, criminal, obscene, commercial, cyber-bullying or illegal purposes.

The administration has the right to review all student work in order to determine the appropriateness of computer use. If TWS online programs are deemed to be used inappropriately, the Administration will levy consequences which may include suspensions and/or removal from the program. In some cases, further action may be taken including contacting day schools, legal representation or the police.

Students need to be very vigilant in order to prevent them getting into a situation where they may be suspected for inappropriate use.

Therefore, students are reminded to

- Always protect their passwords and not share them with anyone

- Always inform their teachers of suspicious messages or other incidents that they encounter
- Always only access content that is intended for educational use.

Hardware/software requirements:

Hardware:

- PC running Windows 8 or higher
- Mac running Apple OS X or higher
- Chromebook running Chrome OS

High speed internet is recommended with access to a computer with the following:

- A processor of 2GHz or faster
- 4 GB RAM or greater
- A high speed internet connection of 1.5 MB/s or faster
- Keyboard and mouse
- Headphone/Speakers/Microphone/Camera

Recommended Software:

- Adobe Reader, Shockwave, Flash Player, Java, Office suite

Browser:

- Mozilla Firefox 4 or higher, Internet Explorer 7 or higher, Safari 5 or higher, Google Chrome 11 or higher