Ontario eSecondary School
Course Outline
2022-2023

Ministry of Education Course Title: Functions and Applications, University Preparation	
Ministry Course Code: MCR3U	
Course Type: University Preparation	
Grade: 11	
Credit Value: 1.0	
Prerequisite(s): Principles of Mathematics, Grade 10 (MPM2D)	
Department: Mathematics	
Course developed by: **Asif Sami Haque**	**Date: July 1st, 2017**
Length: **One Semester**	**Hours:** **110**
This course has been developed based on the following Ministry documents: 1. *The Ontario Curriculum, Grades 11 and 12 Mathematics, Revised 2007*	

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

Unit 1

By the end of this course, students will:

1. Demonstrate an understanding of functions, their representations, and their inverses, reciprocals and make connections between the algebraic and graphical representations of functions using transformations;
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
3. Demonstrate an understanding of equivalence as it relates to simplifying polynomial, radical, and rational expressions.

Unit 2

By the end of this course, students will:

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

Unit 3

By the end of this course, students will:

1. 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;
2. Demonstrate an understanding of periodic relationships and sinusoidal functions, and make connections between the numeric, graphical, and algebraic representations of sinusoidal functions;
3. Identify and represent sinusoidal functions, and solve problems involving sinusoidal functions,

Unit 4

By the end of this course, students will:

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

COURSE CONTENT

Unit	*Length*
Unit 1: Characteristics of Functions	33 hours
Unit 2: Exponential Functions	28 hours
Unit 3: Trigonometric Functions	25.5 hours
Unit 4: Discrete Functions and Financial Applications	21 hours
Final Exam	3 hours
Total	**110 Hours**

UNIT DESCRIPTIONS

UNIT 1: CHARACTERISTICS OF FUNCTIONS

Students will explore what the difference between a function and a relation is. They will learn how to express the details of a function such as domain and range. They will learn to apply these terms on different functions such as linear, quadratic, and radical. They will also learn how to determine the numeric or graphical representation of the inverse of a linear or quadratic function, given the numeric, graphical, or algebraic representation of the function.

UNIT 2: EXPONENTIAL FUNCTIONS

Students will learn how to express an exponential function. They will investigate it using a variety of tools (e.g., calculator, paper and pencil, graphing technology) and strategies that they used to express functions that they learned in the past. Students will be expected to be able to compare exponential functions with the functions they learned in the past. They will explore different types of exponential functions and make connection through graphing and transformation, also identify exponential functions. An emphasis will be made to expose students to real world applications of growth and decay.

UNIT 3: TRIGONOMETRIC FUNCTIONS

Students will extend their knowledge about trigonometric functions through describing key properties (e.g., cycle, amplitude, period) of periodic functions arising from real-world applications, given a numeric or graphical representation and making connections between the sine and cosine function and the unit circle with or without technology. They will pose problems involving right triangles and oblique triangles in two-dimensional settings/three-dimensional settings, and solve these and other such problems using the primary trigonometric ratios, the cosine law, and the sine law.

UNIT 4: DISCRETE FUNCTIONS AND FINANCIAL APPLICATIONS

Students will expand what they learned in patterning and acquire new skills on how to express sequences and patterns. There is an emphasis made on financial applications in this section based on simple investments and investments in a compound period.

TEACHING AND LEARNING STRATEGIES

The students will experience a variety of activities:

Whole-Class Activities

Whole class activities are designed to introduce concepts and skills that are directly applicable to the workplace and to build on the content being studied during small group and individual activities. These activities include the following:

Class discussions that are facilitated through video conferencing and telephone conversations with their subject teacher or discussions with other students concerning the concepts and skills being studied. This is done with the use of Socratic circles for discussions.

Teacher demonstrations (research skills, etc.) through video conferencing, email, or telephone conversations with subject teacher, or videos provided of a teacher or student demonstrating the concepts and skills being studied. This helps the student and teacher create an atmosphere of trust and respect to aid in the online learning environment.

Video presentations and technological aids (research) with videos embedded to enrich the course content and clarify concepts and skills being studied. Also the use of online pre-approved quizzes and games to help a student become more familiar with the concepts and skills being studied.

Diagnostic and review activities (audio and video taping) can be student-lead or teacher lead to work as a review for students through audio and video made to share among each other to help reinforce the concepts and skills being studied.

Brainstorming, charts and graphs are a great way for students to demonstrate their knowledge of subject matter through graphic organizers, pictures, and texts. This is communicated through assignments in Moodle.

Small Group Activities

The teacher sets up small group activities to provide opportunities for active and oral learning as well as to bolster practical communication and teamwork skills. The teacher plays a critical role during group activities by monitoring group progress as well as answering questions that arise and using questions to assist students in their understanding. In this way, the teacher also facilitates student understanding of effective learning, communication, and team building during group activities.

The small group activities include the following:

Comparison and evaluation of written work is very important in this course. This course focuses on giving many examples of correct work, and helping students build the skills needed to peer-correct and self-correct. Students are given a variety of texts to read through embedded links, to make comparisons with different texts, real life situations, and their own writing.

Practical extension and application of knowledge is used as an effective learning strategy in this course because it allows the students to read and listen to the texts and stories and reflect back with connections to themselves, other texts and the world. Students are encouraged to share their understandings through work submitted each day, phone conversations about course work, or videoconferencing.

Oral presentations in an online environment we have the equipment to have student either live video conference oral presentations, or make videos and submit them for their oral presentations. These oral presentations can be viewed by fellow students (when appropriate) and the teacher. Students can learn from one another, and from their teacher. Such activities include dramatic readings and performances.

Charts and graphs are used to present effective learning opportunities of concepts and skills to students who would benefit from visual objects to learn. Every student learns differently, and it is used to help students discover another way to present their information such as graphic organizers, lists, and pictures.

Individual Activities

> The teacher should provide a variety of individual assignments to expand and consolidate the learning that takes place in the whole-class and small group activities. Individual activities allow the teacher to accommodate interests and needs and to access the progress of individual students. The teacher plays an important role in supporting these activities through the provision of ongoing feedback to the students, both orally and in writing. Teachers are encouraged to include individual activities such as the following in the course:

Research is completed in an online environment by teaching the students first about plagiarism rules and giving examples of good sources to use. The students are not only limited to the online search for information, but have resources available by links on the Moodle page of information that has been scanned and uploaded.

Individual assignments are worked on at a student's own pace. The teacher can support the student in these activities with ongoing feedback.

Oral presentations are facilitated through the use of video conferencing and video recording.

Practical extension and application of knowledge helps students develop their own voice, and gives them the ability to make personal connections, and connections to the world throughout their course. Students are given a variety or reading and viewing texts to give them many chances to apply their new concepts, skills, and knowledge.

Ongoing project work is something that is valued in the earning of an English credit. The ongoing project can be submitted to the teacher for ongoing feedback in both written and oral work.

Reading students are able to read a variety of texts online. The students may print out the reading material to use it to highlight, take notes, and have with them when a computer is not available.

Written assignments are used to allow students to develop their skills in writing, comprehension, and communication. With the online format students submit their work, and have a chance to get feedback from the teacher, and submit their best work. This can be demonstrated with reading responses, personal writing, report writing, essay writing, script writing, business and technical writing, and individual research assignments.

ASSESSMENT, EVALUATION, AND REPORTING

Assessment: The process of gathering information that accurately reflects how well a student is achieving the identified curriculum expectations. Teachers provide students with descriptive feedback that guides their efforts towards improved performance.

Evaluation: Assessment of Learning focuses on Evaluation which is the process of making a judgement about the quality of student work on the basis of established criteria over a limited, reasonable period of time.

Reporting: Involves communicating student achievement of the curriculum expectations and Learning Skills and Work Habits in the form of marks and comments as determined by the teacher's use of professional judgement.

STRATEGIES FOR ASSESSMENT

Assessment practices can nurture students' sense of progress and competency and information instruction. Many diagnostic tools, e.g. checklists and inventories, are used at regular intervals throughout the units to encourage students' understanding of their current status as learners and to provide frequent and timely reviews of their progress. Assessment of student acquisition of listening and talking, reading and viewing and writing skills also occurs regularly through unobtrusive teacher observation and conferencing.

Units conclude with performance tasks, e.g., interviews and from essays that build towards and prepare students for the end-of-course culminating task in Unit Five. Teachers are encouraged to share goals with students early in the course and to connect unit learning experiences frequently and explicitly with big ideas, overall expectations, and performance tasks, i.e. check bricks; teacher-adapted generic rubrics available in many sources, including the *Ontario Secondary School Literacy Course (OSSLC) Profile,* so that they are more task-specific. The teacher might ask: "What does the criteria look like for this particular task?" Or "What does limited effectiveness look like?" The teacher could involve students in the discussion, modification, or creation of rubrics, and teach students to use rubrics as a learning tool that can support the writing process and practice.

ASSESSMENT ACTIVITIES

- ❑ Homework assignments
- ❑ Individual conference meetings
- ❑ Discussion Forums
- ❑ Diagnostic tests and writing tasks
- ❑ Free-writing journals/blogs
- ❑ Outlining and planning sheets
- ❑ Completed Templates & Graphic Organizers
- ❑ Editing Checklists
- ❑ Reflections
- ❑ Oral presentations & Active Listening
- ❑ Tests & Exam
- ❑ Essay Writing
- ❑ Evaluations

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 will 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.

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

Weightings	
Course Work	**70**
Knowledge/Understanding	25
Thinking/Inquiry	10
Communication	15
Application	20
Final	**30**
Final Exam	30

TERM WORK EVALUATIONS (70%):

Evaluation Item	Description	Category
Unit 1 Assignment	Assignment to test students understanding about characteristics of functions	K,I,C,A
Unit 1 and 2 Problem Set	Problem set creation to allow students to think critically of the concepts of the first two units. This happens through problem creation thinking.	K,I,C,A
Unit 2 Mini-Assignment	Short assessment to prepare to show understanding of exponential functions.	K,A
Unit 2 Assignment	Assignment to show understanding of exponential functions.	K,I,C,A
Unit 3 Infographic Assignment	Infographic to show the differences between quadratic, trigonometric and exponential functions	K,I,C,A
Unit 3 Assignment	Assignment to show understanding of trigonometric functions.	K,I,C,A
Video Conference	Student has a discussion with the teacher to illustrate their understanding of the first 3 units.	K,I,C,A
Unit 4 Assignment	Assignment to show the understanding of Discrete Functions and Financial Applications	K,I,C,A

FINAL EVALUATIONS (30%):

Evaluation Item	Description	Category
Culminating Project	Final Examination to test student's understanding of MCR3U material.	K,I,C,A

AFL/AAL/AOL Tracking sheet:

Unit 1: Characteristics of Functions – 33 hours

AAL	AFL	AOL
Unit 1 Resource Forum	Lesson 1.1 Simplifying Expressions Worksheet	Unit 1 Characteristics of Functions Assignment
Lesson 1.2 Functions, Relations, Domain and Range Forum	Lesson 1.6 Functions and Equivalent Expressions Worksheet	
Lesson 1.10 Combinations of Transformations Forum	Reflection Conference	

Unit 2: Exponential Functions – 28 hours

AAL	AFL	AOL
Unit 2 Resource Forum	Lesson 2.2 Submission Box	Unit 1 and 2 Problem Set
Lesson 2.1 Exponential Growth Forum	Lesson 2.5 Submission Box	Mini Assignment for Unit 2
Lesson 2.4 Properties of Exponential Functions Forum		Unit 2 Assignment

Unit 3: Trigonometric Functions – 25.5 hours

AAL	AFL	AOL
Unit 3 Resource Forum	Lesson 3.6 Graphing Sine and Cosine Worksheet	Unit 3 Assignment
Lesson 3.1 Introduction to Trigonometry Forum	Lesson 3.7 Rapid Review of Trigonometric Functions Worksheet	
Lesson 3.5 Trigonometric Identities Practice		
Unit 3 Reflection		

Unit 4: Discrete Functions and Financial Applications – 21 hours

AAL	AFL	AOL
Unit 4 Resource Forum	Lesson 4.1 Submission Box	Unit 4 Assignment
Lesson 4.3 Geometric Sequences Worksheet	Lesson 4.5 Arithmetic and Geometric Series Worksheet	
Lesson 4.6 Simple and Compound Interest Worksheet	Lesson 4.7 Annuities Worksheet	
Unit 4 Reflection		

Finals

AOL
Final Exam

CONSIDERATION FOR PROGRAM PLANNING

Students learn best when they are engaged in a variety of ways of learning. Guidance and career education courses lend themselves to a wide range of approaches in that they require students to research, think critically, work cooperatively, discuss relevant issues, and learn through practice in a variety of settings. Helping students become self-directed, lifelong learners is a fundamental aim of the guidance and career education curriculum. When students are engaged in active and experiential learning strategies, they tend to retain knowledge for longer periods and develop meaningful skills. Active and experiential learning strategies also enable students to apply their knowledge and skills to real-life issues and situations.

ANTIDISCRIMINATION EDUCATION IN GUIDANCE AND CAREER EDUCATION

Classroom teachers are the key educators of students who have special education needs. They have a responsibility to help all students learn, and they work collaboratively with special education teachers, where appropriate, to achieve this goal. Special Education Transformation: The Report of the Co-Chairs with the Recommendations of the Working Table on Special Education, 2006 endorses a set of beliefs that should guide program planning for students with special education needs in all disciplines. Those beliefs are as follows: All students can succeed. Universal design and differentiated instruction are effective and interconnected means of meeting the learning or productivity needs of any group of students. Successful instructional practices are founded on evidence-based research, tempered by experience.

PROGRAM CONSIDERATIONS FOR ENGLISH LANGUAGE LEARNERS

Ontario schools have some of the most multilingual student populations in the world. The first language of approximately 20 per cent of the students in Ontario's English language schools is a language other than English. Ontario's linguistic heritage includes several Aboriginal languages; many African, Asian, and European languages; and some varieties of English, such as Jamaican Creole. Many English language learners were born in Canada and raised in families and communities in which languages other than English were spoken, or in which the variety of English spoken differed significantly from the English of Ontario classrooms. Other English language learners arrive in Ontario as newcomers from other countries; they may have experience of highly sophisticated educational systems, or they may have come from regions where access to formal schooling was limited. When they start school in Ontario, many of these students are entering a new linguistic and cultural environment.

THE ROLE OF TECHNOLOGY IN THE ENGLISH PROGRAM

Information and communications technologies (ICT) provide a range of tools that can significantly extend and enrich teachers' instructional strategies and support students' language learning. ICT tools include multimedia resources, databases, Internet websites, digital cameras, and word-processing programs. Tools such as these can help students to collect, organize, and sort the data they gather and to write, edit, and present reports on their findings. Information and communications technologies can also be used to connect students to other schools, at home and abroad, and to bring the global community into the local classroom. Whenever appropriate, therefore, students should be encouraged to use ICT to support and communicate their learning.

ACCOMMODATIONS

Accommodations will be based on meeting with parent, teachers, administration and external educational assessment report. The following three types of accommodations may be provided:

- ***Instructional accommodations:*** such as changes in teaching strategies, including styles of presentation, methods of organization, or use of technology and multimedia.
- ***Environmental accommodations:*** such as preferential seating or special lighting.

- ***Assessment accommodations:*** such as allowing additional time to complete tests or assignments or permitting oral responses to test questions.

Other examples of modifications and aids, which may be used in this course, are:

- Provide step-by-step instructions.
- Help students create organizers for planning writing tasks.
- Record key words on the board or overhead when students are expected to make their own notes.
- Allow students to report verbally to a scribe (teacher/ student) who can help in note taking.
- Permit students a range of options for reading and writing tasks.
- Where an activity requires reading, provide it in advance.
- Provide opportunities for enrichment.