

Course Outline

School Name: **UMC High School**

Department Name: **MATHEMATICS**

Ministry of Education Course Title: Functions, Gr 11, University Preparation

Grade Level: 11, University Preparation

Ministry Course Code: MCR3UX

Instructor:

Department Head: Ms. Jenna Mok

Developed by: Ms. Younga Kim

Developed Date: March 2015

Revision Date: January 2018

Developed from: Ministry of Education, *Mathematics, the Ontario Curriculum, Grades 11 and 12, Revised 2007*

Required Texts:

Textbook: *Functions 11, Nelson (2008)*

Supplementary texts (Supplied by the instructor):

- Teacher-made Worksheets
- Graphing Calculators & Computers
- OAME/OMCA Materials (2007)
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Prerequisite: Principles of Mathematics, Grade 10, Academic

Credits: 1

Length: 110 hours

Head Teacher: _____

Vice-Principal: _____

Principal: _____

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 Curriculum Expectations

By the end of this course, students will:

Strand A: *Characteristics of Functions*

1. Demonstrate an understanding of functions, their representations, and their inverses, 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 those arising from real-world applications;
3. Demonstrate an understanding of equivalence as it relates to simplifying polynomial, radical, and rational expressions.

Strand B: *Exponential Functions*

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 numeric, graphical, and algebraic representations of exponential functions;
3. Identify and represent exponential functions, and solve problems involving exponential functions, including those arising from real-world applications

Strand C: *Discrete Functions*

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

Stand D: *Trigonometric Functions*

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;
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, including those arising from real-world applications.

Course Content

Unit 1	Introduction to Functions Strands: A. <i>Characteristics of Functions</i> Overall Expectations: A1	16 Hours
Unit 2	Equivalent Algebraic Expressions Strands: A. <i>Characteristics of Functions</i> Overall Expectations: A3	8 Hours
Unit 3	Quadratic Functions Strands: A. <i>Characteristics of Functions</i> Overall Expectations: A2 and A3	16 Hours
Unit 4	Exponential Functions Strand: B. <i>Exponential Functions</i> Overall Expectations: B1, B2, and B3	16 Hours
Unit 5	Trigonometric Ratios Strand: D. <i>Trigonometric Functions</i> Overall Expectations: D1	16 Hours
Unit 6	Sinusoidal Functions Strand: D. <i>Trigonometric Functions</i> Overall Expectations: D2 and D3	16 Hours
Unit 7	Discrete Functions: Sequences and Series Strand: C. <i>Discrete Functions</i> Overall Expectations: C1 and C2	10 Hours
Unit 8	Discrete Functions: Financial Applications Strand: C. <i>Discrete Functions</i> Overall Expectations: C3	10 Hours
	Final Exam Strands: A. <i>Characteristics of Functions</i> B. <i>Exponential functions</i> C. <i>Discrete functions</i> D. <i>Trigonometric functions</i> Overall Expectations: A1-A3, B1-B3,C1-C3,D1-D3	2 Hours

TOTAL 110 hours

Unit Descriptions

Unit 1 – Introduction to Functions

Time: 16 Hours

Description

In this unit, the students will learn about functions and related key terms such as relation, domain, and range. They will be able to recognize function in various representations and use function notation. Students will also learn about some basic properties of functions and make connections between the algebraic and graphical representations of functions using transformations. Student will learn about inverse functions and some of their properties.

Specific Expectations

A. *Characteristics of Functions*: 1.1,1.2.1.3,1.4,1.5,1.6,1.7,1.8,1.9

Assessment For Learning (AFL)	K/U	T	A	C
Homework questions	x	x	x	x
Note Taking				x
Quiz	x	x	x	x
Assessment As Learning (AAL)				
Exit Card	x	x	x	x
Reflection	x			x
Study Log				x
Conference	x	x	x	x
Math journal	x	x	x	x
Assessment Of Learning (AOL)				
Unit 1 Test	x	x	x	x

Unit 2 – Equivalent Algebraic Expressions

Time: 8 hours

Description

In this unit, students will be able to demonstrate an understanding of equivalence as it relates to simplifying polynomial, radical, and rational expressions.

Specific Expectations

A. *Characteristics of Functions*: 3.1,3.3.3.4

Assessment For Learning (AFL)	K/U	T	A	C
Homework questions	x	x	x	x
Note Taking				x
Quiz	x	x	x	x
Assessment As Learning (AAL)				
Exit Card	x	x	x	x
Reflection	x			x
Study Log				x
Conference	x	x	x	x
Math journal	x	x	x	x
Assessment Of Learning (AOL)				
Unit 2 Assignment	x	x	x	x
Unit 2 Test	x	x	x	x

Unit 3 – Quadratic Functions

Time: 16 hours

Description

In this unit, students will graph and analyze the properties of quadratic functions. 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

Specific Expectations

A. *Characteristics of Functions:* 2.1,2.2,2.3,2.4,2.5, 3.2

Assessment For Learning (AFL)	K/U	T	A	C
Homework questions	x	x	x	x
Note Taking				x
Quiz	x	x	x	x
Assessment As Learning (AAL)				
Exit Card	x	x	x	x
Reflection	x			x
Study Log				x
Conference	x	x	x	x
Math journal	x	x	x	x
Assessment Of Learning (AOL)				
Unit 3 Test	x	x	x	x

Unit 4 – Exponential Functions

Time: 16 hours

Description

In this unit, student will learn to evaluate the powers with integer and rational exponents and simplify expressions involving them. They will also learn to describe the characteristics of exponential functions and their graphs. Use exponential functions to solve problems involving exponential growth and decay.

Specific Expectations

B. Exponential function: 1.1,1.2,1.3,1.4,2.1,2.2,2.3,2.4,2.5,3.1,3.2,3.3

Assessment For Learning (AFL)	K/U	T	A	C
Homework questions	x	x	x	x
Note Taking				x
Quiz	x	x	x	x
Assessment As Learning (AAL)				
Exit Card	x	x	x	x
Reflection	x			x
Study Log				x
Conference	x	x	x	x
Math journal	x	x	x	x
Assessment Of Learning (AOL)				
Unit 4 Assignment	x	x	x	x
Unit 4 Test	x	x	x	x

Unit 5 - Trigonometric Ratios

Time: 16 hours

Description

This unit concentrates students' attention on determining the values of the trigonometric ratios for angles less than 360° ; and proving simple trigonometric identities. Student will be able to solve real-life problems by using trigonometric ratios, properties of triangles, and the sine and cosine laws.

Specific Expectations

D. *Trigonometric Functions*:1.1,1.2,1.3,1.4,1.5,1.6,1.7

Assessment For Learning (AFL)	K/U	T	A	C
Homework questions	x	x	x	x
Note Taking				x
Solving and Analyzing of Word Problems	x	x	x	x
Assessment As Learning (AAL)				
Exit Card	x	x	x	x
Reflection	x			x
Study Log				x
Conference	x	x	x	x
Math journal	x	x	x	x
Assessment Of Learning (AOL)				
Unit 5 Test	x	x	x	x

Unit 6 – Sinusoidal Functions

Time: 16 hours

Description

In this unit, student will learn about periodic functions and their properties. Student will learn how to apply transformations to the functions $f(x) = \sin x$ and $f(x) = \cos x$. They will learn to determine the equation of sinusoidal functions in real-world situations and use those equations to solve problems.

Specific Expectations

D. *Trigonometric Functions*: 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 3.1, 3.2, 3.3, 3.4, 3.5

Assessment For Learning (AFL)	K/U	T	A	C
Homework questions	x	x	x	x
Note Taking				x
Quiz	x	x	x	x
Assessment As Learning (AAL)				
Exit Card	x	x	x	x
Reflection	x			x
Study Log				x
Conference	x	x	x	x
Math journal	x	x	x	x
Assessment Of Learning (AOL)				
Unit 6 Test	x	x	x	x

Unit 7 – Discrete Functions: Sequences and Series

Time: 10 hours

Description

In this unit, student will learn 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.

Specific Expectations

C. *Discrete Functions*: 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 2.1, 2.2, 2.3, 2.4

Assessment For Learning (AFL)	K/U	T	A	C
Homework questions	x	x	x	x
Note Taking				x
Assessment As Learning (AAL)				
Exit Card	x	x	x	x
Reflection	x			x
Study Log				x
Conference	x	x	x	x
Math journal	x	x	x	x
Assessment Of Learning (AOL)				
Unit 7 Test	x	x	x	x

Unit 8 – Discrete Functions: Financial Applications

Time: 10 hours

Description

In this unit, student will continue to learn about periodic functions and their properties and apply those concepts specifically to financial problems.

Specific Expectations

C. *Discrete Functions*: 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7

Assessment For Learning (AFL)	K/U	T	A	C
Homework questions	x	x	x	x
Note Taking				x
Quiz	x	x	x	x
Assessment As Learning (AAL)				
Exit Card	x	x	x	x
Reflection	x			x
Study Log				x
Conference	x	x	x	x
Math journal	x	x	x	x
Assessment Of Learning (AOL)				
Unit 8 Assignment	x	x	x	x

Teaching/Learning Strategies

A variety of strategies are used to allow students many opportunities to attain the necessary skills for success in this course and at university. The teacher uses a variety of whole class, small group and individual activities to facilitate learning. The following is a list of specific teaching/learning strategies that the teacher may use but is not limited to:

- Lecture
- Modeling/Direct Instruction
- Demonstration/exemplars
- Problem-Solving
- Homework questions
- Structured Discussions
- Brainstorming
- Conference/Interview
- Self-Assessment
- Peer-Assessment
- Teacher feedback
- Group work
- Pair work
- Independent work
- Exit/Entrance Cards
- Tests
- Quizzes
- Exam

ONLINE & OFFLINE COMPONENTS

The design of this course is intended to offer a rich balance between online and offline elements. The following is a summary of the course components and their delivery format. Please refer to the individual unit outlines for specific details. Course content & instruction: *online* Communication between teacher and students: *online & offline* Collaboration between students: *online* Assessment & evaluation: *online & offline* Practise exercises, textbook work, readings etc: *offline*

Assessment/Evaluation Strategies

Assessment For Learning (AFL) is the ongoing process of gathering and interpreting evidence about student learning for the purpose of determining where students are in their learning, where they need to go, and how best to get there. It is a combination of diagnostic and formative assessments. Assessment As Learning (AAL) is the process of developing and supporting student metacognition (self-awareness). AAL teaches students to be more self-directed learners by encouraging personal goal-setting, reflection, and self-assessment. Assessment Of Learning (AOL) is the process of collecting and interpreting evidence for the purpose of summarizing learning at a given point in time, to make judgments about the quality of student learning on the basis of established criteria, and to assign a value to represent that quality. The specific assessment/evaluation strategies used by the teacher has been listed in the unit descriptions.

Students passing courses will be marked according using the following four levels of achievement:

- Level 1 (50-59%)
- Level 2 (60-69%)
- Level 3 (70-79%) **(Level 3 is the provincial standard for student achievement.)**
- Level 4 (80-100%)

Level R (<50%) will be used to indicate students who are performing below the provincial passing standard for a course.

Final Grade: The final grade will include the following weighting:

Knowledge/ Understanding 20%	Thinking/ Inquiry 30%	Communication 20%	Application 30%
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Seventy percent (70%) of the grade will be based on evaluations conducted throughout the course.

Thirty percent (30%) of the grade will be based on the final evaluation, which will take into account the entire course, including the student's most recent and most consistent performance. The final evaluation may take the form of a written examination, an independent study project, a presentation, etc. or a combination of these formats.

The final evaluation will take the form of a 2-hour written exam (30%).

Total: 100%

Program Planning

In order to accommodate students' needs, the teachers of UMC High School incorporate appropriate considerations in their program planning and delivery. These considerations may include, but not be limited to:

- ❑ Have a positive attitude towards mathematics
- ❑ Help students activate prior knowledge in math
- ❑ Help students develop mathematical understanding and gives meaning to skills and concepts in all strands
- ❑ Reading aloud strategies that enable ESL students to develop their oral communication skills
- ❑ Allow students to reason, communicate ideas, make connections, and apply knowledge and skills
- ❑ Provide opportunities to learn in a variety of ways – individually, cooperatively, independently, with teacher direction, through investigation involving hands-on experience, and through examples followed by practice
- ❑ Use concrete learning tools, such as connecting cubes, measurement tools, algebra tiles, and number cubes, invite students to explore and represent abstract mathematical ideas in varied, concrete, tactile, and visually rich ways
- ❑ Use graphical and algebraic representations to represent mathematical problems
- ❑ Link mathematical concepts learned in class with real-world applications
- ❑ Develop, select, apply, compare, and adapt a variety of problem-solving strategies as they pose and solve problems and conduct investigation, to help deepen their mathematical understanding
- ❑ Provide student with problems that are challenging but not beyond their ability to solve
- ❑ Provide collaborative learning groups to enhances students' understanding of mathematics