

Canterbury High School

Ottawa-Carleton District School Board

Mathematics Department

Semester I – 2010 / 11 – Course Outline

Course Title: Functions	Grade Level: 11
Course Code: MCR3U	Credit Value: 1.0
Prerequisite: MPM2D	

Teachers: J. Burke, R. Majerovich, C. Siwy

Course Overview 110 hours

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.

Strands:

Course Expectations

As students work through the course they will develop a set of skills that will support lifelong learning in mathematics. These skills are a set of seven mathematical processes that are embedded throughout all of the course expectations; they are, problem-solving, reasoning and proving, reflecting, selecting tools and computational strategies, connecting, representing, and communicating. This course will provide students with rich problem-solving opportunities that will help the student develop and apply these processes.

A. Characteristics of Functions

By the end of the course, students will:

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 problems arising from real-world applications;
3. demonstrate an understanding of equivalence as it relates to simplifying polynomial, radical, and rational expressions.

B. Exponential Functions

By the end of the 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.

C. Discrete Functions

By the end of the 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. 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.

D. Trigonometric Functions

By the end of the course, students will:

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 problems arising from real-world applications.

Units of Study

1. Introduction to Functions (~2 weeks)
Relations and Functions
Function notation
Exploring properties of parents functions
Determining the domain and range of a function
The inverse function and its properties
Exploration transformations of parent functions
Investigating horizontal stretches, compressions, and reflections
Using transformations to graph functions of the form $y = a[f(k(x-d))] + c$

2. Equivalent Algebraic Expressions (~2 weeks)
 - Adding and subtracting polynomials
 - Multiplying polynomials
 - Factoring polynomials
 - Simplifying rational functions
 - Multiplying and dividing rational expressions
 - Adding and subtracting rational expressions

3. Quadratic Functions (~2.5 weeks)
 - Properties of quadratic functions
 - Determining maximum and minimum values of a quadratic function
 - Operations with radicals
 - Quadratic function models: Solving quadratic equations
 - The zeroes of a quadratic function
 - Linear-quadratic systems

4. Exponential Functions (~2.5 weeks)
 - Working with integer exponents
 - Working with rational exponents
 - Simplifying algebraic expressions involving exponents
 - Exploring the properties of exponential functions
 - Transformations of exponential functions
 - Applications involving exponential functions

5. Trigonometric Ratios (~3 weeks)
 - Trigonometric ratios of acute angles
 - Evaluating trigonometric ratios for special angles
 - Exploring trigonometric ratios for angles greater than 90°
 - Evaluating trigonometric ratios for any angle between 0° and 360°
 - Trigonometric identities
 - The sine law
 - The cosine law
 - Solving three-dimensional problems by using trigonometry

6. Sinusoidal Functions (~2 weeks)
 - Periodic functions and their properties
 - Investigating the properties of sinusoidal functions
 - Interpreting sinusoidal functions
 - Exploring transformations of sinusoidal functions
 - Using transformations to sketch the graphs of sinusoidal functions
 - Investigating models of sinusoidal functions
 - Solving problems using sinusoidal models

7. Discrete Functions (~2 weeks)
 - Arithmetic sequences
 - Geometric sequences
 - Exploring recursive sequences
 - Arithmetic series
 - Geometric series
 - Pascal's triangle and binomial expansions

8. Discrete Functions: Financial Applications (~2 weeks)
 Simple interest
 Compound interest: Future value
 Compound interest: Present value
 Annuities [Future value]
 Annuities [Present value]
 Using technology to investigate financial problems

Teaching Strategies

Students will have the opportunity to learn in a variety of ways; individually, cooperatively, investigative, teacher directed class discussion and notes.

Assessment and Evaluation Strategies

Student achievement will be monitored through the use of formative assessments in the form of quizzes, assignments, observations. Feedback on these assessments will provide the student with information to determine their level of understanding of the concepts. Student achievement will be recorded through the use of quizzes, tests, assignments/tasks. The percentage grade will represent the quality of the student's overall achievement of the expectations for the course and reflect the corresponding level of achievement as described in the achievement chart.

Evaluation Summary

Term Evaluation (70%) comprised of:

- | | | |
|----|--|---------|
| a) | <u>Knowledge and Understanding</u>
(understand the concepts and computational skills of specific expectations) | - 24.5% |
| b) | <u>Application</u>
(knowing when and how to use appropriate tools and concepts to solve problems) | - 24.5% |
| c) | <u>Thinking, Inquiry, Problem Solving</u>
(being able to use critical and creative thinking skills to solve problems, connect ideas from other strands) | - 10.5% |
| d) | <u>Communication</u>
(reflect and express through writing a mathematical solution or concept) | - 10.5% |

Summative Evaluation (30%) comprised of:

- | | | |
|----|---|-------|
| a) | <u>Summative Task</u> (problems using a variety of tools) | - 10% |
| b) | <u>Examination</u> | - 20% |

References

www.edu.gov.on.ca/eng/curriculum/secondary/math1112currb.pdf

Student Resources / Texts

1. Functions 11, Nelson, 2007