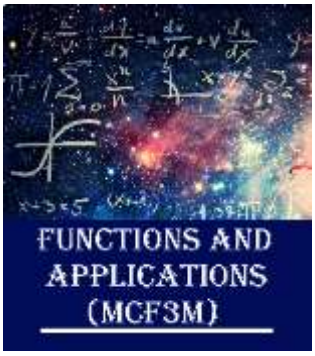

INUKSHUK ACADEMY

Course code: **Functions & Applications (MCF3M)**
Credit: **1.0** Total Hours: **110 hours**
Prerequisite: **Principles of Mathematics, Grade 10, Academic, or Foundations of Mathematics, Grade 10, Applied**
Curriculum basis**: Ontario Curriculum, Grades 11–12: Science (Revised 2008)**
Last Update: **Inukshuk Academy 2026**

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Course Description

This course introduces basic features of the function by extending students' experiences with quadratic relations. It focuses on quadratic, trigonometric, and exponential functions and their use in modelling real-world situations. Students will represent functions numerically, graphically, and algebraically; simplify expressions; solve equations; and solve problems relating to applications. Students will reason mathematically and communicate their thinking as they solve multi-step problems.

1. Course Rationale

Functions provides the theoretical and mathematical framework for understanding relationships, patterns, and change. MCF3M strengthens students' ability to represent functions, analyze mathematical models, and construct logical arguments using multiple representations. Through inquiry, problem solving, and modelling, students:

- Develop a deeper understanding of functions and how they describe relationships in real-world contexts;
- Explore quadratic, exponential, trigonometric, and discrete functions;
- Refine algebraic and graphical skills essential for senior mathematics and STEM disciplines;
- Learn to analyze patterns, solve multi-step problems, and communicate mathematical reasoning clearly;
- Recognize the role of functions in finance, science, technology, and everyday decision-making.

The course fosters mathematical literacy, critical thinking, and problem-solving fluency, skills essential for success in university-level programs and careers in mathematics, science, engineering, business, and technology.

2. Overall Curriculum Expectations

The Ontario Curriculum organizes MCF3M into four major strands. The following expectations are paraphrased for clarity and alignment with Inukshuk Academy's course design.

a. Characteristics of Functions

Students will:

- Demonstrate an understanding of functions, their representations, and their inverses;
- Make connections between algebraic and graphical representations using transformations;
- Analyze quadratic functions, including zeros, maximum and minimum values, and real-world applications;
- Simplify polynomial, radical, and rational expressions and determine equivalence.

b. Exponential Functions

Students will:

- Evaluate powers with rational exponents and simplify expressions involving exponents;
- Describe and compare exponential functions using tables, graphs, equations, and verbal descriptions;
- Solve problems involving exponential growth and decay in real-world contexts.

c. Discrete Functions

Students will:

- Represent recursive sequences in a variety of ways;
- Analyze arithmetic and geometric sequences and series;
- Make connections between sequences, series, compound interest, and ordinary annuities;
- Apply discrete functions to financial and practical problem-solving situations.

d. Trigonometric Functions

Students will:

- Determine trigonometric ratios for angles less than 360°;
- Prove simple trigonometric identities;
- Solve problems using primary trigonometric ratios, the sine law, and the cosine law;
- Analyze periodic and sinusoidal functions using numerical, graphical, and algebraic representations;
- Model and solve real-world problems involving sinusoidal behaviour.

3. Learning Goals for Students

By the end of MCF3M, students will be able to:

- Analyze functions using algebraic, graphical, numerical, and verbal representations;
- Apply transformations to parent functions and interpret their effects on graphs and equations;
- Solve problems involving quadratic, exponential, trigonometric, and discrete functions;
- Simplify and manipulate polynomial, radical, rational, and exponential expressions;
- Model real-world relationships involving growth, decay, periodic behaviour, sequences, series, and financial applications;
- Communicate mathematical reasoning clearly using appropriate notation, terminology, graphs, and technology.

Course Structure and Instructional Units

Unit	Description	Hours
Unit 0: Prerequisite Skills and Algebra Review	Linear relations, factoring, exponent laws, equation solving, graphing skills, function notation readiness	5
Unit 1: Characteristics of Functions	Function notation, domain and range, transformations, inverses, graphical and algebraic representations	18
Unit 2: Quadratic Functions	Quadratic models, zeros, vertex, maximum/minimum values, completing the square, real-world applications	18
Unit 3: Equivalent Algebraic Expressions	Polynomial, radical, and rational expressions; simplifying, factoring, restrictions, and equivalence	15
Unit 4: Exponential Functions	Rational exponents, exponential graphs, growth and decay, applications and comparisons with other functions	15
Unit 5: Trigonometric Functions	Trigonometric ratios, unit circle, sine law, cosine law, identities, sinusoidal functions, periodic modelling	20
Unit 6: Discrete Functions and Financial Applications	Recursive sequences, arithmetic and geometric sequences and series, compound interest, ordinary annuities	17
Culminating Task	Mathematical investigation or applied modelling project	5
Final Exam	Proctored examination	2
	Total	**115**

4. Course Structure, Unit Overview and Instructional Plan

1. Unit 0: Prerequisite Skills and Algebra Review

Approx. Hours: 5

a. Unit Overview

This introductory unit strengthens the foundational algebra and graphing skills students require for success in Grade 11 Functions. Students review linear relations, factoring, exponent laws, equation solving, graphing techniques, and function notation while developing confidence in mathematical reasoning and problem solving.

Emphasis is placed on connecting algebraic procedures to graphical representations and preparing students for advanced function concepts explored throughout the course.

b. Key Learning Goals

Students will:

- Apply algebraic skills to simplify and solve equations;
- Review graphing techniques and interpretation of linear relations;
- Use function notation appropriately;
- Apply exponent laws and factoring strategies accurately;
- Demonstrate readiness for advanced function analysis and modelling.

c. Sample Learning and Assessment Activities

- Algebra review problem sets and graphing tasks;
- Function notation and equation-solving exercises;
- Graph interpretation and transformation activities;
- Diagnostic skills assessment and collaborative review activities;
- Quizzes, review assignments, and readiness tasks.

2. Unit 1: Characteristics of Functions

Approx. Hours: 18

a. Unit Overview

In this unit, students investigate the defining characteristics of functions and their representations. Students analyze domain, range, transformations, inverses, and multiple representations of functions using algebraic, graphical, numerical, and verbal methods.

Students also examine how transformations affect parent functions and how functions can model real-world relationships and patterns.

b. Key Learning Goals

Students will:

- Identify and represent functions using multiple forms;
- Determine domain and range in various contexts;
- Apply transformations to parent functions and interpret their effects;
- Analyze and compare graphical and algebraic representations;
- Investigate inverse relationships and functional behaviour.

c. Sample Learning and Assessment Activities

- Transformation investigations using graphing technology;
- Function notation and representation exercises;
- Domain and range analysis tasks;

- Real-world function modelling activities;
- Assignments, quizzes, graphing investigations, and unit test.

3. Unit 2: Quadratic Functions

Approx. Hours: 18

a. Unit Overview

Students investigate quadratic functions and their applications through graphical, algebraic, and numerical representations. Topics include vertex form, standard form, factoring, completing the square, zeros, maximum and minimum values, and quadratic modelling.

Students apply quadratic functions to solve real-world problems involving optimization, motion, geometry, and design.

b. Key Learning Goals

Students will:

- Analyze and graph quadratic functions in different forms;
- Determine zeros, vertex coordinates, and optimal values;
- Apply factoring and completing-the-square techniques;
- Model and solve real-world problems using quadratic relations;
- Interpret quadratic behaviour using multiple representations.

c. Sample Learning and Assessment Activities

- Quadratic graphing and transformation investigations;
- Factoring and completing-the-square exercises;
- Optimization and modelling tasks;
- Real-world application problems and technology-based explorations;
- Problem sets, quizzes, modelling assignments, and unit test.

4. Unit 3: Equivalent Algebraic Expressions

Approx. Hours: 15

a. Unit Overview

This unit focuses on simplifying, manipulating, and comparing algebraic expressions. Students investigate polynomial, radical, and rational expressions while developing fluency in algebraic reasoning and symbolic manipulation.

Students also explore restrictions, equivalence, and the importance of algebraic accuracy in mathematical modelling and problem solving.

b. Key Learning Goals

Students will:

- Simplify polynomial, radical, and rational expressions;
- Identify restrictions and determine equivalence of expressions;
- Apply factoring and algebraic manipulation strategies;
- Analyze algebraic relationships using symbolic reasoning;
- Communicate mathematical reasoning clearly and accurately.

c. Sample Learning and Assessment Activities

- Algebraic simplification exercises;
- Rational and radical expression investigations;
- Factoring and equivalence analysis tasks;
- Collaborative problem-solving activities;
- Practice assignments, quizzes, and unit test.

5. Unit 4: Exponential Functions

Approx. Hours: 15

a. Unit Overview

Students investigate exponential functions and their applications in growth and decay situations. Topics include rational exponents, exponential equations, graphical analysis, and comparisons between linear, quadratic, and exponential models.

Students examine real-world applications involving population growth, finance, technology, and environmental change.

b. Key Learning Goals

Students will:

- Simplify expressions involving rational exponents;
- Analyze and graph exponential functions;
- Compare exponential models with other function types;
- Solve problems involving exponential growth and decay;
- Apply exponential functions to real-world situations.

c. Sample Learning and Assessment Activities

- Exponential graphing and modelling investigations;
- Growth and decay problem-solving tasks;
- Financial and population modelling activities;

- Technology-based graphing explorations;
- Assignments, quizzes, modelling tasks, and unit test.

6. Unit 5: Trigonometric Functions

Approx. Hours: 20

a. Unit Overview

In this unit, students investigate trigonometric ratios, periodic relationships, and sinusoidal functions. Students use the sine law, cosine law, unit circle, and trigonometric identities to solve problems involving angles, triangles, and periodic behaviour.

Students also explore sinusoidal modelling in contexts such as sound, tides, motion, and seasonal patterns.

b. Key Learning Goals

Students will:

- Determine trigonometric ratios for angles less than 360°;
- Solve problems using the sine law and cosine law;
- Prove and apply simple trigonometric identities;
- Analyze and graph sinusoidal functions;
- Model periodic behaviour using trigonometric functions.

c. Sample Learning and Assessment Activities

- Trigonometric ratio investigations;
- Unit circle and identity activities;
- Sinusoidal graphing and modelling tasks;
- Real-world periodic modelling investigations;
- Problem sets, quizzes, graphing assignments, and unit test.
- Trigonometry assignments, graphing investigations, quizzes, unit test.

7. Unit 6: Discrete Functions and Financial Applications

Approx. Hours: 17

a. Unit Overview

Students investigate recursive sequences, arithmetic and geometric sequences and series, and financial applications involving compound interest and annuities. The unit emphasizes pattern recognition, recursive reasoning, and practical applications of discrete mathematics.

Students analyze financial growth and decision-making using mathematical models and technology.

b. Key Learning Goals

Students will:

- Represent recursive sequences using multiple forms;
- Analyze arithmetic and geometric sequences and series;
- Solve financial problems involving compound interest and annuities;
- Apply discrete functions to practical situations;
- Use technology to model and analyze financial relationships.

c. Sample Learning and Assessment Activities

- Recursive sequence investigations;
- Compound interest and annuity calculations;
- Financial modelling and budgeting tasks;
- Spreadsheet-based sequence analysis activities;
- Problem sets, quizzes, financial investigations, and unit test.

Culminating Task

Approx. Hours: 5

Students complete a mathematical investigation or applied modelling project integrating multiple strands of the course. The culminating task emphasizes mathematical reasoning, problem solving, modelling, communication, and application of functions to real-world situations.

Final Exam

Approx. Hours: 2

Students complete a proctored final examination assessing conceptual understanding, algebraic fluency, graph interpretation, mathematical reasoning, problem-solving skills, and application of knowledge across all course strands.

Instructional Approaches

Teaching and learning in MCR3U at Inukshuk Academy incorporate a wide range of strategies to ensure students develop strong conceptual understanding, analytical thinking, and confidence in applying mathematics to real-world situations. Instruction is guided by the mathematical processes and inquiry-based principles outlined in the Ontario Curriculum.

a. Inquiry-Based and Experiential Learning

Students learn mathematics most effectively through exploration, investigation, and problem solving. Lessons regularly include modelling activities, guided inquiry tasks, technology-based investigations, and real-world applications that reinforce mathematical concepts.

Examples include:

- Investigating transformations of parent functions using graphing technology;
- Exploring quadratic models through projectile motion and optimization tasks;
- Analyzing exponential growth and decay in financial and scientific contexts;
- Modelling periodic behaviour using trigonometric functions and sinusoidal graphs.

b. Multiple Representations of Concepts

Students encounter mathematical ideas through a combination of:

- Algebraic expressions and equations;
- Graphs, tables, and diagrams;
- Numerical patterns and data analysis;
- Verbal explanations and mathematical reasoning;
- Technology-based visualizations and dynamic models.

This approach supports deeper conceptual understanding and helps students make connections between different representations of functions and mathematical relationships.

c. Use of Technology and Digital Tools

Digital tools are integrated throughout the course to enhance learning, support inquiry, and strengthen visualization skills. Technology is used to:

- Graph and analyze functions dynamically;
- Model transformations and inverses;
- Investigate sequences, series, and financial applications;
- Compare multiple representations of functions;
- Analyze real-world data and mathematical models;
- Verify algebraic solutions and explore patterns.

Examples include Desmos, GeoGebra, spreadsheets, graphing calculators, and online simulations.

d. Collaborative Problem Solving

Mathematical learning is strengthened through collaboration. Students work in pairs or small groups to:

- Solve multi-step problems;

- Compare and justify solution strategies;
- Investigate mathematical patterns and relationships;
- Communicate and critique mathematical reasoning;
- Complete inquiry and modelling activities collaboratively.

Collaborative learning supports communication skills, critical thinking, and confidence in mathematical problem solving.

e. Differentiated Instruction

Instruction is adapted to support a variety of learning styles, readiness levels, and interests. Strategies include:

- Scaffolded problem sets with increasing complexity;
- Enrichment and extension tasks for advanced learners;
- Visual, numerical, and algebraic representations to support conceptual understanding;
- Guided practice and targeted intervention for students requiring additional support.

f. Explicit Teaching of Mathematical Processes

Students receive direct instruction and ongoing support in the mathematical processes emphasized in the Ontario Curriculum, including:

- Problem solving;
- Reasoning and proving;
- Reflecting on mathematical thinking;
- Selecting tools and computational strategies;
- Connecting mathematical concepts;
- Representing ideas in multiple ways;
- Communicating mathematical reasoning clearly and accurately.

Assessment and Evaluation

Assessment in MCF3M aligns with the principles of *Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools (2010)* [1]. Evaluation reflects students' most consistent achievement, with particular emphasis on recent evidence of learning.

Assessment serves three purposes:

a. Assessment for Learning (Diagnostic)

- Initial review of prerequisite algebra, equation solving, graphing, and function skills;
- Diagnostic quizzes to identify gaps in mathematical understanding and reasoning;
- Informal observations, discussions, and readiness checks;
- Introductory activities related to graphing technology, modelling, and problem solving.

b. Assessment as Learning (Formative)

- Homework and guided problem-solving activities;
- Function investigations and modelling tasks with ongoing feedback;
- Reflection tasks and self-assessment activities;
- Collaborative discussions and inquiry-based problem solving;
- Draft submissions of mathematical investigations and modelling assignments.

c. Assessment of Learning (Summative)

- Unit tests on major strands and function concepts;
- Mathematical investigations and modelling assignments;
- Performance tasks involving real-world applications of functions;
- Quizzes, cumulative problem-solving tasks, and projects;
- Culminating performance task;
- Final examination.

d. Achievement Chart Categories

Student achievement is evaluated across the four categories defined in the Ontario Curriculum for Mathematics:

Knowledge & Understanding (25 percent)

Understanding of mathematical concepts, procedures, properties, and relationships involving functions, algebraic expressions, quadratic relations, exponential models, trigonometry, and mathematical reasoning.

Thinking (25 percent)

Use of critical and creative thinking skills to solve problems, analyze relationships, select strategies, investigate mathematical models, and justify reasoning.

Communication (25 percent)

Clarity and precision in mathematical explanations, notation, graphs, diagrams, calculations, and communication of reasoning and solutions.

Application (25 percent)

Application of mathematical knowledge and skills to real-world contexts, modelling situations, financial applications, technology-based investigations, and interdisciplinary problem solving.

e. Final Evaluation (30 percent)

The final evaluation consists of:

1. Culminating Performance Task (10–15 percent)

A multi-step mathematical investigation or applied modelling project integrating multiple course expectations. Examples may include:

- Modelling real-world situations using functions;
- Investigating financial growth and applications of exponential models;
- Designing and analyzing quadratic or trigonometric models;
- Technology-based inquiry project involving graphing and data analysis.

2. Final Examination (15–20 percent)

A proctored examination assessing conceptual understanding, algebraic fluency, mathematical reasoning, graph interpretation, problem-solving skills, and application of knowledge across all course strands.

3. Summary of Achievement Levels and Percentage Grade Ranges

Student achievement in secondary school courses is evaluated according to the Ontario Ministry of Education's four-level achievement scale. Each percentage grade corresponds to a level of achievement, as outlined below.

Percentage Grade Range	Achievement Level	Summary Description
80–100%	Level 4	Demonstrates a very high to outstanding level of achievement. Performance exceeds the provincial standard.
70–79%	Level 3	Demonstrates a high level of achievement. Performance meets the provincial standard. (This is the provincial expectation for student performance.)
60–69%	Level 2	Demonstrates a moderate level of achievement. Performance is below but approaching the provincial standard.
50–59%	Level 1	Demonstrates a passable level of achievement. Performance is significantly below the provincial standard. Further improvement is required for continued success.
Below 50%	Level 0	Insufficient achievement. Curriculum expectations have not been met. A credit will not be granted.

Academic Honesty and Integrity Policy

Inukshuk Academy is committed to fostering a learning environment based on honesty, responsibility, respect, and academic integrity. Students are expected to submit original work and properly acknowledge all sources of information, ideas, images, data, and wording used in assignments and investigations. Academic honesty is essential to maintaining fairness and trust in the evaluation process.

All submitted work must represent the student's own understanding and effort. Sources must be documented appropriately using MLA or APA citation style, as directed by the teacher. The use of generative artificial intelligence tools (e.g., ChatGPT) or other forms of external assistance must be disclosed and approved by the teacher. Undisclosed or inappropriate use of such tools may be treated as academic dishonesty.

Students may be asked to provide process work, rough drafts, notes, calculations, or planning documents to verify authorship and learning progress. If academic dishonesty occurs, the student and Principal may be notified, and consequences will be applied in accordance with school policy. Repeated incidents may result in escalating consequences.

1. Improper Citation

Improper citation occurs when a student fails to use appropriate citation formatting when referencing sources.

Grade Level	First Instance	Subsequent Instances
Grades 9–10	Warning and opportunity to resubmit	Warning and opportunity to resubmit
Grades 11–12	Warning and opportunity to resubmit	Opportunity to resubmit, maximum grade of 75%

2. Unaccredited Paraphrasing

Unaccredited paraphrasing occurs when a student rewrites another person's ideas without giving proper credit.

Grade Level	First Instance	Subsequent Instances
Grades 9–10	Warning and resubmission allowed	Resubmission allowed, maximum grade of 75%
Grades 11–12	Resubmission allowed, maximum grade of 75%	Resubmission allowed, maximum grade of 50%

3. Unaccredited Verbatim Copying

This occurs when a student copies sentences or passages directly from a source without proper citation.

Grade Level	First Instance	Subsequent Instances
Grades 9–10	Resubmission allowed, maximum grade of 75%	Resubmission allowed, maximum grade of 50%
Grades 11–12	Resubmission allowed, maximum grade of 50%	Grade of zero. No resubmission permitted

4. Full Plagiarism

Full plagiarism occurs when a student submits work entirely created by another person or source.

Grade Level	First Instance	Subsequent Instances
Grades 9–10	Grade of zero. No resubmission	Grade of zero. No resubmission
Grades 11–12	Grade of zero. No resubmission	Grade of zero and possible removal from the course

5. Missed Work

Students are responsible for reviewing lesson materials, completing missed assignments, and meeting established deadlines. Students are expected to remain informed about course expectations, due dates, and assessment requirements.

6. Homework Expectations

Students are expected to:

- Complete homework assignments, readings, and practice problems on time;
- Prepare for scheduled lessons, laboratories, discussions, and assessments;
- Participate actively and consistently in course activities and investigations.

If homework is repeatedly incomplete, the teacher may:

- Schedule a meeting with the student;
- Contact parents or guardians;
- Consult with school administration to support student success and progress.

Inclusion, accommodations & ELL supports

Inukshuk Academy is a small private school with limited accommodation resources. The school is committed to supporting students' access to learning within the scope of available staffing, programming, facilities, and course delivery structures.

Where possible, reasonable accommodations may be provided for students with documented learning needs, including limited support for Individual Education Plans (IEPs). Accommodations are considered on a case-by-case basis in consultation with the student, parents/guardians, teacher, and school administration.

Possible supports may include:

- Clear written instructions and success criteria;
- Guided notes, visual examples, and scaffolded practice;
- Reasonable extended time where appropriate;
- Preferential seating or reduced-distraction work space when available;
- Use of approved assistive technology;
- Check-ins with the teacher to support organization and progress;
- ELL support through simplified instructions, vocabulary support, and additional clarification.

Inukshuk Academy may not be able to provide specialized programming, intensive one-on-one support, modified curriculum expectations, or accommodations requiring resources beyond the school's capacity. Students requiring significant accommodations or specialized services may need additional external support.

Instructional Philosophy

Teaching and learning in MCF3M emphasize:

- Inquiry-based learning through investigations, modelling tasks, and problem-solving activities;
- Conceptual understanding supported by real-world applications of advanced functions;
- Mathematical reasoning and analysis of relationships, patterns, and rates of change;
- Multiple representations of functions, including equations, graphs, tables, diagrams, and written explanations;
- Collaboration through group problem solving, discussions, and mathematical investigations;
- Technology integration in graphing, modelling, data analysis, and visualization of function behaviour.

This approach ensures students engage deeply with advanced mathematical concepts while developing transferable analytical, reasoning, and STEM skills.

Course Learning Resources

Students will engage with a variety of mathematics learning materials, both digital and print, selected to support inquiry, modelling, problem solving, and conceptual development.

a. Primary Resources

- Teacher-created notes, examples, lessons, and practice sets;
- Advanced function investigations, modelling tasks, and problem-solving activities;
- Graphing tools and mathematical visualization resources;
- Scientific calculators and mathematics reference materials;
- *Ontario Curriculum, Grades 11–12:* Mathematics *(2008)* [2]

b. Digital Tools and Platforms

- Desmos or GeoGebra for graphing, transformations, and modelling advanced functions;
- Spreadsheet software for data organization, modelling, and pattern analysis;
- Online graphing calculators and algebra exploration tools;
- Learning management system resources, videos, and interactive mathematics activities;
- Digital assessment, collaboration, and presentation tools.

c. Supplementary Resources

- Mathematics problem banks and practice exams;
- Real-world case studies involving polynomial, exponential, logarithmic, and trigonometric functions;
- Articles, videos, and multimedia related to mathematical applications in science, finance, engineering, and technology;
- Review materials for algebraic reasoning, advanced functions, transformations, trigonometry, sequences, and mathematical modelling.

References

[1] Ministry of Education, "Growing Sucess," 2010. [Online]. Available: https://www.edu.gov.on.ca/eng/policyfunding/growsuccess.pdf.

[2] Ministry of Education, "Course Descriptions and Prerequisites," August 2024. [Online]. Available: https://www.dcp.edu.gov.on.ca/en/course-descriptions-and-prerequisites.