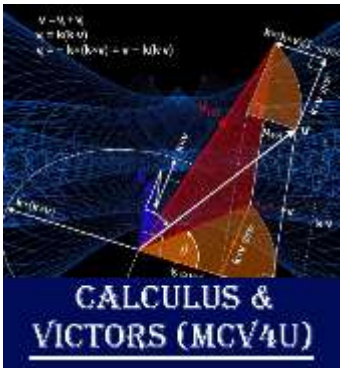

INUKSHUK ACADEMY

Course code: **Calculus and Victors (MCV4U)**
Total Hours: **110 hours** and Credit: **1.0**
Prerequisite: **Advanced Functions course (MHF4U)**
Curriculum basis: **Ontario Curriculum, Grades 11–12: Science (Revised 2008)**
Last Update: **Inukshuk Academy 2026**

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Course Description

This course builds on students' previous experience with functions and their developing understanding of rates of change. Students will solve problems involving geometric and algebraic representations of vectors and representations of lines and planes in three dimensional space; broaden their understanding of rates of change to include the derivatives of polynomial, sinusoidal, exponential, rational, and radical functions; and apply these concepts and skills to the modelling of real-world relationships. Students will also refine their use of the mathematical processes necessary for success in senior mathematics. This course is intended for students who choose to pursue careers in fields such as science, engineering, economics, and some areas of business, including those students who will be required to take a university-level calculus, linear algebra, or physics course.

1. Course Rationale

Calculus and Vectors provides the mathematical framework for understanding rates of change, motion, spatial relationships, and mathematical modelling. MCV4U strengthens students' ability to analyze dynamic systems, interpret mathematical behaviour, and solve complex problems using algebraic, graphical, numerical, and geometric representations.

Through inquiry, problem solving, and modelling, students:

- Develop a deeper understanding of limits, derivatives, rates of change, and vector geometry;
- Explore how calculus can be used to model motion, optimization, growth, and real-world change;
- Refine algebraic, analytical, and spatial reasoning skills essential for university-level mathematics, science, engineering, and technology programs;
- Learn to apply differentiation techniques to analyze functions and solve multi-step applied problems;
- Investigate vectors in two- and three-dimensional space and apply vector operations to geometric and physical situations;
- Recognize the role of calculus and vectors in physics, engineering, economics, computer science, and other STEM-related disciplines.

The course fosters mathematical literacy, critical thinking, analytical reasoning, and problem-solving fluency, skills essential for success in university-level studies and careers in mathematics, engineering, science, economics, technology, and related fields.

2. Overall Curriculum Expectations

The Ontario Curriculum organizes MCV4U into three major strands. The following expectations are paraphrased for clarity and alignment with Inukshuk Academy's course design.

a. Rate of Change

Students will:

- Analyze average and instantaneous rates of change using numerical, graphical, and algebraic methods;
- Investigate limits and their role in defining derivatives;
- Apply differentiation rules to polynomial, rational, exponential, logarithmic, and trigonometric functions;
- Interpret derivatives as rates of change and slopes of tangent lines;
- Use derivatives to analyze and model real-world relationships and motion.

b. Derivatives and Their Applications

Students will:

- Analyze the behaviour of functions using first and second derivatives;
- Determine intervals of increase and decrease, concavity, critical points, and points of inflection;
- Apply curve sketching techniques to represent functions accurately;
- Solve optimization problems involving geometric, scientific, and economic applications;
- Model and solve real-world problems involving rates of change and derivatives.

c. Geometry and Algebra of Vectors

Students will:

- Represent vectors algebraically and geometrically in two- and three-dimensional space;
- Perform vector operations including addition, subtraction, scalar multiplication, dot products, and cross products;
- Analyze geometric relationships involving lines, planes, intersections, and distances;
- Represent lines and planes using vector, scalar, and parametric equations;
- Apply vector concepts and spatial reasoning to solve theoretical and real-world problems.

3. Learning Goals for Students

By the end of MCV4U, students will be able to:

- Analyze limits, rates of change, derivatives, and vector relationships using algebraic, graphical, numerical, and geometric representations;
- Interpret average and instantaneous rates of change and connect them to secant lines, tangent lines, and derivatives;
- Differentiate polynomial, rational, radical, exponential, logarithmic, and trigonometric functions using appropriate derivative rules;
- Apply derivatives to analyze function behaviour, including intervals of increase and decrease, concavity, critical points, and points of inflection;

- Solve optimization and modelling problems involving motion, geometry, economics, science, and engineering contexts;
- Represent and manipulate vectors in two- and three-dimensional space using algebraic and geometric methods;
- Analyze lines, planes, intersections, distances, and spatial relationships using vector, parametric, and scalar equations;
- Communicate mathematical reasoning clearly using appropriate notation, terminology, diagrams, graphs, technology, and justified solution steps.

Course Structure and Instructional Units

Unit	Description	Hours
Unit 1: Foundations and Rates of Change	Prerequisite skills, limits, continuity, secants, tangents, average and instantaneous rates of change	12
Unit 2: Limits and Derivatives	Definition of the derivative, first principles, power rule, product rule, quotient rule, chain rule, derivative interpretation	13
Unit 3: Optimization and Curve Sketching	First and second derivative tests, critical points, concavity, inflection points, optimization, curve sketching	17
Unit 4: Derivatives of Exponential and Trigonometric Functions	Derivatives of exponential, logarithmic, and trigonometric functions; mixed function differentiation; applied modelling	11
Unit 5: Vectors in Two- and Three-Space	Vector operations, magnitude, direction, components, dot product, cross product, geometric and physical applications	18
Unit 6: Lines and Planes in Three-Space	Vector, parametric, and scalar equations; intersections, distances, parallel/skew relationships, spatial modelling	18
Culminating Task	Calculus or vector investigation, applied modelling task, or integrated performance project	8
Final Exam	Proctored examination	13
	Total	**110**

4. Course Structure, Unit Overview and Instructional Plan

1. Unit 1: Foundations and Rates of Change

Approx. Hours: 12

a. Unit Overview

This introductory unit strengthens the prerequisite algebraic, graphical, and analytical skills students require for success in Calculus and Vectors. Students investigate average and instantaneous rates of change using numerical, graphical, and algebraic methods while developing an understanding of secant and tangent lines.

The concept of the limit is introduced as the foundation for differential calculus. Students analyze continuity, estimate limits graphically and numerically, and explore how rates of change can model motion and real-world change.

b. Key Learning Goals

Students will:

- Analyze average rates of change using graphs, tables, and equations;
- Investigate instantaneous rates of change using tangent lines;
- Estimate and interpret limits numerically and graphically;
- Connect secant and tangent concepts to rates of change;
- Apply rates of change to real-world contexts involving motion and growth.

c. Sample Learning and Assessment Activities

- Secant and tangent line investigations;
- Motion and velocity modelling activities;
- Graphical limit explorations using technology;
- Rate-of-change comparison tasks;
- Problem sets, graphing investigations, quizzes, unit test.

2. Unit 2: Limits and Derivatives

Approx. Hours: 13

a. Unit Overview

Students develop the formal concept of the derivative as a measure of instantaneous rate of change. Using first principles and derivative rules, students differentiate polynomial, rational, radical, exponential, logarithmic, and trigonometric functions.

Students explore the relationship between derivatives and function behaviour while strengthening algebraic fluency and mathematical reasoning.

b. Key Learning Goals

Students will:

- Determine derivatives using first principles;
- Apply derivative rules to differentiate functions efficiently;
- Interpret derivatives as slopes of tangent lines and rates of change;
- Differentiate polynomial, rational, exponential, logarithmic, and trigonometric functions;
- Analyze derivatives numerically, graphically, and algebraically.

c. Sample Learning and Assessment Activities

- First-principles differentiation investigations;
- Tangent slope analysis activities;
- Derivative rule practice and applications;
- Technology-based derivative visualizations;
- Derivative assignments, quizzes, investigations, unit test.

3. Unit 3: Optimization and Curve Sketching

Approx. Hours: 17

a. Unit Overview

In this unit, students apply derivatives to analyze and model the behaviour of functions. Students investigate increasing and decreasing intervals, critical points, concavity, inflection points, and optimization problems using first and second derivatives.

Curve sketching and modelling activities emphasize interpretation, reasoning, and real-world application in scientific, economic, and geometric contexts.

b. Key Learning Goals

Students will:

- Analyze functions using first and second derivative tests;
- Determine intervals of increase, decrease, and concavity;
- Identify critical points and points of inflection;
- Solve optimization problems involving real-world applications;
- Sketch functions accurately using calculus-based analysis.

c. Sample Learning and Assessment Activities

- Optimization investigations involving geometry and economics;
- Curve sketching activities using derivatives;
- Critical point and concavity analysis tasks;
- Applied modelling investigations;
- Modelling assignments, quizzes, optimization problems, unit test.

4. Unit 4: Derivatives of Exponential and Trigonometric Functions

Approx. Hours: 11

a. Unit Overview

Students extend differentiation techniques to exponential, logarithmic, and trigonometric functions and apply derivatives to increasingly complex models. Emphasis is placed on interpreting real-world behaviour involving periodic motion, exponential growth and decay, and scientific change.

Students also explore mixed-function differentiation and apply calculus concepts to modelling and analysis.

b. Key Learning Goals

Students will:

- Differentiate exponential and logarithmic functions;
- Differentiate trigonometric functions and related expressions;
- Apply derivative rules to composite and mixed functions;
- Interpret derivatives in scientific and real-world contexts;
- Model dynamic relationships involving change and periodic behaviour.

c. Sample Learning and Assessment Activities

- Exponential growth and decay investigations;
- Trigonometric derivative modelling tasks;
- Applied rate-of-change analysis activities;
- Technology-supported graphing and differentiation explorations;
- Assignments, modelling investigations, quizzes, unit test.

5. Unit 5: Vectors in Two- and Three-Space

Approx. Hours: 18

a. Unit Overview

Students investigate vectors geometrically and algebraically in two- and three-dimensional space. Topics include vector operations, magnitude, direction, scalar multiplication, dot product, and cross product.

Applications involving physics, navigation, geometry, and spatial modelling help students connect vector concepts to real-world situations and STEM disciplines.

b. Key Learning Goals

Students will:

- Represent vectors algebraically and geometrically;
- Perform vector operations in two and three dimensions;
- Apply dot products and cross products to solve problems;
- Analyze geometric and physical relationships involving vectors;
- Solve problems involving magnitude, direction, and spatial reasoning.

c. Sample Learning and Assessment Activities

- Vector addition and subtraction investigations;
- Dot product and cross product applications;
- Geometric modelling and navigation tasks;
- Three-dimensional vector visualization activities;
- Vector assignments, problem-solving investigations, quizzes, unit test.

6. Unit 6: Lines and Planes in Three-Space

Approx. Hours: 18

a. Unit Overview

In this unit, students investigate analytic geometry in three-dimensional space using vectors. Students represent lines and planes using vector, parametric, and scalar equations and analyze intersections, distances, parallelism, and perpendicularity.

Spatial reasoning and visualization are emphasized through geometric modelling and real-world applications.

b. Key Learning Goals

Students will:

- Represent lines and planes using vector, scalar, and parametric equations;
- Determine intersections between lines and planes;
- Analyze parallel, perpendicular, and skew relationships;
- Calculate distances in three-dimensional space;
- Apply vector geometry to spatial modelling problems.

c. Sample Learning and Assessment Activities

- Three-dimensional geometry investigations;
- Line and plane equation modelling tasks;
- Spatial visualization and intersection analysis activities;

- Technology-supported vector geometry explorations;
- Geometry assignments, modelling tasks, quizzes, unit test.

Teaching and Learning Strategies

Instruction in MCV4U is grounded in the seven mathematical processes identified in the Ontario Curriculum. These processes guide lesson design, assessment, and classroom interaction to ensure students develop deep conceptual understanding alongside procedural fluency. Teaching strategies emphasize inquiry, exploration, and the thoughtful application of calculus and vector concepts to real-world and theoretical contexts.

• **Problem solving:** Students engage in rich tasks that require them to apply prior knowledge, test strategies, and make decisions as they work toward solutions. Problems are designed to encourage perseverance, flexible thinking, and advanced mathematical reasoning.

• **Reasoning and proving:** Learners justify steps, explain relationships, and construct logical arguments. Opportunities to verify derivative rules, analyze limits, justify optimization strategies, and examine vector relationships strengthen mathematical reasoning.

• **Reflecting:** Students examine their own thinking, assess the effectiveness of strategies, and revise approaches based on feedback. Reflection is embedded through conferencing, post-assessment reviews, self-assessment, and correction analysis.

• **Selecting tools and strategies:** Learners choose appropriate tools, including graphing technology, algebraic methods, numerical techniques, derivative rules, and vector methods, to investigate mathematical relationships and solve problems.

• **Connecting:** Students link new concepts to prior learning, relate algebraic, graphical, numerical, and geometric representations, and recognize connections among functions, derivatives, rates of change, vectors, lines, and planes.

• **Representing:** Learners express mathematical ideas using equations, graphs, tables, tangent lines, vector diagrams, parametric equations, scalar equations, and verbal explanations.

• **Communicating:** Students articulate reasoning clearly in written, verbal, visual, and symbolic forms. Communication is fostered through discussion, collaborative work, structured mathematical explanations, and justified solution steps.

These strategies ensure that students develop strong conceptual understanding, confidence in problem solving, and the ability to use calculus and vectors effectively in both academic and applied contexts.

Culminating Task

Approx. Hours: 8

Students complete a mathematical investigation, modelling assignment, or applied performance task integrating calculus and vector concepts. The culminating task emphasizes analytical reasoning, mathematical communication, modelling, and application of advanced mathematics to real-world and theoretical contexts.

Final Exam

Approx. Hours: 13

Students complete a proctored final examination evaluating conceptual understanding, algebraic fluency, calculus applications, vector analysis, spatial reasoning, problem solving, and communication across all course strands.

Instructional Approaches

Teaching and learning in MCV4U at Inukshuk Academy a wide range of strategies to ensure students develop strong conceptual understanding, analytical thinking, spatial reasoning, and confidence in applying calculus and vectors to real-world and theoretical 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 calculus and vector concepts.

Examples include:

- Investigating limits and instantaneous rates of change using graphing technology;
- Exploring derivative behaviour through tangent slopes, motion graphs, and curve analysis;
- Solving optimization problems in geometric, scientific, and economic contexts;
- Modelling vectors in two- and three-dimensional space;
- Investigating lines, planes, intersections, and distances using spatial reasoning and vector methods.

b. Multiple Representations of Concepts

Students encounter mathematical ideas through a combination of:

- Algebraic expressions, equations, and function notation;

- Graphs, tables, and diagrams;
- Tangent lines, derivative graphs, and rate-of-change models;
- Vector diagrams, parametric equations, and scalar equations;
- Technology-based visualizations and dynamic models.

This approach supports deeper conceptual understanding and helps students make connections between calculus, vector geometry, and mathematical modelling.

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, derivatives, and rates of change dynamically;
- Model tangent lines, optimization scenarios, and curve behaviour;
- Represent vectors, lines, and planes in two- and three-dimensional space;
- Compare multiple representations of calculus and vector concepts;
- Analyze real-world data and mathematical models;
- Verify algebraic and geometric solutions.

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

d. Collaborative Problem Solving

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

- Solve multi-step and non-routine calculus and vector problems;
- Compare and justify solution strategies;
- Investigate mathematical patterns, rates of change, and spatial relationships;
- Communicate and critique mathematical reasoning;
- Complete inquiry and modelling activities collaboratively.

Collaborative learning supports communication skills, critical thinking, and confidence in advanced 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, graphical, algebraic, and geometric 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 MCV4U 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, advanced functions, graphing, trigonometry, and analytical geometry skills;
- Diagnostic quizzes to identify prerequisite gaps in calculus and vector concepts;
- Informal observations and mathematical discussions;
- Technology-based readiness checks and graphing investigations.

b. Assessment as Learning (Formative)

- Homework and practice problem sets;
- Calculus and vector investigations with iterative feedback;
- Reflection tasks and self-assessment activities;
- Collaborative inquiry and problem-solving exercises;
- Draft submissions of modelling tasks and mathematical investigations.

c. Assessment of Learning (Summative)

- Unit tests on major strands;
- Mathematical investigations and applied modelling assignments;
- Performance tasks involving calculus and vector applications;
- Spatial reasoning and analytical geometry tasks;
- Culminating mathematical project;

- Final examination.

d. Achievement Chart Categories

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

Knowledge & Understanding (30 percent)
Understanding of mathematical concepts, procedures, properties, and relationships involving limits, derivatives, rates of change, optimization, vectors, lines, planes, and spatial geometry.

Thinking (20 percent)
Use of critical and creative thinking skills to solve problems, analyze relationships, develop strategies, justify reasoning, and apply calculus and vector methods to theoretical and applied situations.

Communication (20 percent)
Clarity and precision in mathematical explanations, notation, diagrams, graphs, vector representations, equations, and communication of reasoning.

Application (30 percent)
Application of mathematical knowledge and skills to real-world contexts, modelling situations, optimization, motion, spatial reasoning, scientific applications, 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. Examples may include:

- Modelling motion and rates of change using derivatives;
- Solving optimization problems involving geometry, economics, or science;
- Investigating vector relationships in two- or three-dimensional space;
- Analyzing lines, planes, and spatial relationships using vector methods;
- Applying calculus and vectors to real-world scientific or engineering contexts.

2. Final Examination (15–20 percent)

A proctored examination assessing conceptual understanding, algebraic fluency, calculus applications, vector analysis, spatial reasoning, mathematical communication, and problem-solving skills 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 MCV4U emphasize:

- Inquiry-based learning through investigations, modelling tasks, and problem-solving activities;
- Conceptual understanding supported by real-world and theoretical applications of calculus and vectors;
- Mathematical modelling of rates of change, motion, spatial relationships, and dynamic systems;
- Multiple representations of mathematical concepts, including equations, graphs, tables, vector diagrams, geometric models, and written explanations;
- Collaboration through group problem solving, discussions, mathematical investigations, and peer review of solutions;
- Technology integration in graphing, modelling, data analysis, visualization of derivatives, and representation of vectors in two- and three-dimensional space.

This approach ensures students engage deeply with calculus and vector concepts while developing transferable problem-solving, reasoning, spatial visualization, communication, 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;
- Calculus and vector investigations, modelling tasks, and problem-solving activities;
- Graphing tools, vector models, 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, modelling, derivatives, and vector visualization;
- Spreadsheet software for data organization, pattern analysis, and mathematical modelling;
- Online graphing calculators and calculus exploration tools;
- Learning management system resources, instructional videos, and interactive activities;
- Digital assessment, collaboration, and presentation tools.

c. Supplementary Resources

- Mathematics problem banks and practice examinations;
- Real-world case studies involving calculus, optimization, motion, vectors, and spatial reasoning;
- Articles, videos, and multimedia related to mathematical and scientific applications;
- Review materials for advanced functions, derivatives, trigonometry, vector geometry, rates of change, and analytical 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.