Canterbury High School

Ottawa-Carleton District School Board

Mathematics Department

Semester I – 2010/ 11 – Course Outline

Course Title: Calculus and Vectors	**Grade Level: 12**
Course Code: MCV4U	**Credit Value: 1.0**
Prerequisite: MCR3U	

Teachers: C. Siwy

Course Overview 110 hours

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.

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. Rate of Change

By the end of this course, students will:

1. demonstrate an understanding of rate of change by making connections between average rate of change over an interval and instantaneous rate of change at a point, using the slopes of secants and tangents and the concept of the limit;
2. graph the derivatives of polynomial, sinusoidal, and exponential functions, and make connections between the numeric, graphical, and algebraic representations of a function and its derivative;
3. verify graphically and algebraically the rules for determining derivatives; apply these rules to determine the derivatives of polynomial, sinusoidal, exponential, rational, and radical functions, and simple combinations of functions; and solve related problems.

B. Derivatives and Their Applications

By the end of this course, students will:

1. make connections, graphically and algebraically, between the key features of a function and its first and second derivatives, and use the connections in curve sketching;
2. solve problems, including optimization problems, that require the use of the concepts and procedures associated with the derivative, including problems arising from real-world applications and involving the development of mathematical models.

C. Geometry and Algebra of Vectors

By the end of this course, students will:

1. demonstrate an understanding of vectors in two-space and three-space by representing them algebraically and geometrically and by recognizing their applications;
2. perform operations on vectors in two-space and three-space, and use the properties of these operations to solve problems, including those arising from real-world applications;
3. distinguish between the geometric representations of a single linear equation or a system of two linear equations in two-space and three-space, and determine different geometric configurations of lines and planes in three-space;
4. represent lines and planes using scalar, vector, and parametric equations, and solve problems involving distances and intersections.

Units of Study

1. Geometric Vectors (~2 weeks)
   Vectors are represented as directed line segments, then further broken down into components. Operations are performed on vectors, both in a theoretical and problem-solving context dealing with force and velocity.
2. Algebraic Vectors (~2 weeks)
   Vectors are determined using the Cartesian coordinate system, in 2- and 3-dimensions. Vectors are described using ordered pair/triple notation and unit vector notation. Addition, subtraction, scalar multiplication are performed on algebraic vectors. Dot and cross products of geometric and algebraic vectors are determined, interpreted, and applied.
3. Lines and Planes (~3 weeks)
   Vectors are used to determine equations of lines and planes in 2- and 3-dimensions. Parametric, vector, symmetric, and scalar forms of lines, and parametric, vector, and scalar forms of planes are examined. Intersections of lines, planes, and lines and planes are determined.
4. Limits (~2 weeks)
   The average and instantaneous rates of change are determined using tangents and secants. The limits of polynomial functions are determined and connected to the graph of the function.

5. Differentiation Rules (~3 weeks)
   The derivative is introduced by connecting it to the slope of the tangent at a point. The power, product, quotient rules are determined using polynomial and rational functions. The second derivative is determined. The graph of the first and second derivative is connected to the graph of the function.
6. Derivatives of Exponential, Logarithmic, and Trigonometric Functions (~3 weeks)
   Exponential, logarithmic, and trigonometric functions are reviewed and their derivatives determined.
7. Curve Sketching and Extreme Value Problems (~3 weeks)
   Information from the function and first and second derivative are used to sketch the curve of functions. This information is also used to solve problems drawn from a variety of applications (e.g., physics, economics).

Teaching Strategies

Students will have the opportunity to learn in a variety of ways; individually, cooperatively, investigative, teacher directed class discussion and notes, visual aids and manipulatives (e.g., linking cubes, straws).

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)	Knowledge and Understanding (understand the concepts and computational skills of specific expectations)	- 21%
b)	Application (knowing when and how to use appropriate tools and concepts to solve problems)	- 24.5%
c)	Thinking (being able to use critical and creative thinking skills to solve problems, connect ideas from other strands)	- 14%
d)	Communication (reflect and express through writing a mathematical solution or concept)	- 10.5%

Summative Evaluation (30%) comprised of:

a)	Summative Task (problems using a variety of tools)	- 10%
b)	Examination	- 20%

References

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

Student Resources / Texts

1. Calculus and Vectors, Nelson

2. Geometry and Discrete Mathematics: Harcourt Mathematics 12, 2002

3. Calculus and Advanced Functions, McGraw-Hill Ryerson, 2002

3. Various other texts and resources (e.g., www.oame.on.ca)