GEORGE S. HENRY ACADEMY COURSE OUTLINE

Grade 12 Calculus & Vectors

COURSE CODE	Calculus and Vectors	**GRADE**	12
TEACHER(S)	B. Herbst	**CREDIT VALUE**	1.0
DEPARTMENT	Mathematics, Numeracy, & Computer Science	**PREREQUISITE**	Functions, Grade 11, University Preparation, OR Mathematics for College Technology, Grade 12

COURSE DESCRIPTION:	This course extends students' experience with functions. Students will investigate the properties of polynomial, rational, logarithmic, and trigonometric functions; develop techniques for combining functions; broaden their understanding of rates of change; and develop facility in applying these concepts and skills. Students will also refine their use of the mathematical processes necessary for success in senior mathematics. This course is intended both for students taking the Calculus and Vectors course as a prerequisite for a university program and for those wishing to consolidate their understanding of mathematics before proceeding to any one of a variety of university programs. Additional information can be found at: http://www.edu.gov.on.ca/eng/curriculum/secondary/subjects.html

COMMUNICATION

Please direct all questions or concerns regarding student progress or program of study to the course teacher. Please call the main office to leave a message at 416-395-3240.

CONCRETE LEARNING RESOURCES	DIGITAL LEARNING RESOURCES
Textbook: Calculus and Vectors (Nelson, Replacement Cost $100)	i.e. My School Day App - An App that allows you to stay up-to-date with in-class tasks and receive reminders about upcoming evaluations.
Texas Instrument scientific graphing calculators	Google Classroom, where students can post assignments and projects, collaborate, inquire, and communicate with each other and with the teacher.
	Desmos online scientific graphing calculator

GEORGE S. HENRY ACADEMY'S COURSE WORK POLICY

For each evaluation, the teacher will inform students of the **due date** and the **ultimate deadline**. The ultimate deadline is the last opportunity for students to submit an assignment for evaluation. Teachers may also use a variety

of other methods for dealing with late and missed assignments at their discretion.

Strategies to assist students in meeting deadlines include:

- Peer tutoring
- Using the school app
- Using a personal agenda
- Seeking extra help from teachers
- Requesting for assistance with time management and organizational skills
- Getting help from parents/guardians
- Getting help from a caring adult in the school

ASSESSMENT AND EVALUATION OF STUDENT ACHIEVEMENT

Each course follows an achievement chart which enables teachers to make judgements about student work that are based on clear performance standards and on a body of evidence collected over time. Additional information can be found on the Ministry of Education website noted within the course description.

ACHIEVEMENT CHART CATEGORIES

Knowledge and Understanding (K & U): Subject-specific content acquired in each course (knowledge), and the comprehension of its meaning and significance (understanding)
Thinking (T): The use of critical and creative thinking skills and/or processes
Communication (C): The conveying of meaning through various forms
Application (A): The use of knowledge and skills to make connections within and between various contexts

COURSE WORK (70% of your overall grade)

Categories	%	Possible Assessments of Learning
K & U	**20%**	**Knowledge of content** (facts, terms, procedural skills, use of tools) **Understanding of content** (Understanding of mathematical concepts)
T	**15%**	**Use of planning skills** – understanding the problem (e.g., formulating and interpreting the problem, making conjectures) – making a plan for solving the problem **Use of processing skills** – carrying out a plan (e.g., collecting data, questioning, testing, revising, modelling, solving, inferring, forming conclusions) – looking back at the solution (e.g., evaluating reasonableness, making convincing arguments, reasoning, justifying, proving, reflecting) **Use of critical/creative thinking processes** (e.g., problem solving, inquiry)
C	**15%**	**Expression and organization of ideas and information** (e.g., clarity of expression, logical organization), using oral, visual, and written forms (e.g., pictorial, graphic, dynamic, numeric, algebraic forms; concrete materials) **Communication for different audiences and purposes** (e.g., peers, teachers) and purposes (e.g., to present data, justify a solution, express a mathematical argument) **in oral, visual, and written forms** **Use of conventions** (e.g., terms, symbols) in oral, visual, and written forms
A	**20%**	**Application of knowledge and skills in familiar contexts** **Transfer of knowledge and skills to new contexts** **Making connections within and between various contexts** (e.g., connections between concepts, representations, and forms within mathematics; connections involving use of prior knowledge and experience; connections between mathematics, other disciplines, and the real world)

FINAL EVALUATION (30% of your overall grade)

Type	Description	%
Midterm Exam	Chapters 6 – 9 on Vectors	15%
Final Exam	There will be a written exam during the exam week. This exam will consist of a variety of question types (e.g. short answers, full-solutions, multiple choice, extended tasks) sampling all strands and categories within the span of 2 hours.	15%

UNITS OF STUDY/COURSE ROAD MAP (subject to change)

Unit 2: Exploring Derivatives

This unit begins by examining those rules including: the power rule, the product rule, the quotient rule and the chain rule followed by a study of the derivatives of composite functions. The next section is dedicated to finding the derivative of relations that cannot be written explicitly in terms of one variable. Next students will simply apply the rules they have already developed to find higher order derivatives. As students saw earlier, if given a position function, they can find the associated velocity function by determining the derivative of the position function. They can also take the second derivative of the position function and create a rate of change of velocity function that is more commonly referred to as the acceleration function which is where this unit ends.

Unit 3: Curve Sketching

In previous math courses, functions were graphed by developing a table of values and smooth sketching between the values generated. This technique often hides key detail of the graph and produces a dramatically incorrect picture of the function. These missing pieces of the puzzle can be found by the techniques of calculus learned thus far in this course. The key features of a properly sketched curve are all reviewed separately before putting them all together into a full sketch of a curve.

Unit 4: Derivative Applications and Related Rates

A variety of types of problems exist in this unit and are generally grouped into the following categories: implicit differentiation, motion (position, velocity & acceleration),optimization , maximum/minimum on an interval and related rates of change which includes problem in Pythagorean Theorem Problems (these include ladder and intersection problems), Volume Problems (these usually involve a 3-D shape being filled or emptied), Trough Problems and General Rate Problems. During this unit students will look at each of these types of problems individually.

Unit 5: Derivative of Trigonometric, Exponential and Logarithmic Functions

A brief trigonometry review kicks off this unit. Then students turn their attention to two fundamental trigonometric limits. This unit continues with examples and exercises involving exponential and logarithmic functions using Euler's number (e). But as students have already seen, many other bases exist for exponential and logarithmic functions. Students will now look at how they can use their established rules to find the derivatives of such functions. The next topic should be familiar as the steps involved in sketching a curve that contains an exponential or logarithmic function are identical to those taken in the curve sketching unit studied earlier in the course. Because the derivatives of some functions cannot be determined using the rules established so far in the course, students will need to use a technique called logarithmic differentiation.

Unit 6: Vectors in 2-Space and 3-Space

There are four main topics pursued in this unit of the course. These topics are: an introduction to vectors and scalars, vector properties, vector operations and plane figure properties. Students will tell the difference between a scalar and vector quantity, they will represent vectors as directed line segments and perform the operations of addition, subtraction, and scalar multiplication on geometric vectors with and without dynamic geometry software. Students will conclude the first half of the unit by proving some properties of plane figures, using vector methods and by modeling and solving problems involving force and velocity. Next students learn to represent vectors as directed line segments and to perform the operations of addition, subtraction, and scalar multiplication on geometric vectors with and without dynamic geometry software. The final topic involves students in proving some properties of plane figures using vector methods.

Cartesian vectors are represented in two-space and three-space as ordered pairs and triples, respectively. The addition, subtraction, and scalar multiplication of Cartesian vectors are all investigated in this unit. Applications involving work and torque are used to introduce and lend context to the dot and cross products of Cartesian vectors. The vector and scalar projections of
Cartesian vectors are written in terms of the dot product. The properties of vector products are investigated and proven. These vector products will be revisited to predict characteristics of the solutions of systems of lines and planes in the intersections of lines and planes.

Unit 7: Lines and Planes

This unit begins with students determining the vector, parametric and symmetric equations of lines in R^2 and R^3. Students will learn to determine the intersections of two or three planes by setting up and solving a system of linear equations in three unknowns. Students will interpret a system of two linear equations in two unknowns geometrically, and relate the geometrical properties to the type of solution set the system of equations possesses. Solving problems involving the intersections of lines and planes, and presenting the solutions with clarity and justification forms the next challenge.

GEORGE S. HENRY ACADEMY'S LATE & MISSED EVALUATION POLICY

It is the responsibility of the student to make arrangements with their teacher for any missed course material and/or assignments. Extenuating circumstances will be considered on a case-by-case basis.

GEORGE S. HENRY ACADEMY'S ACADEMIC DISHONESTY POLICY

Cheating and plagiarism will not be condoned. For more information, refer to the Academic Honesty Policy found in the Student Handbook. The Student Handbook can be found in the George S. Henry Academy app.

SPECIALIST HIGH SKILLS MAJOR (SHSM) REQUIREMENTS

GRADE 11 AND 12 CREDITS	ENVIRONMENT	HEALTH & WELLNESS	HOSPITALITY &TOURISM
Major Credits	4	4	4
English *(including a CLA*)*	2	1	1
Mathematics *(including a CLA)*	1	1	1
Science or Social Sciences and Humanities *(including a CLA) (May be substituted with 1 coop credit)*	-	1	-
Business Studies or Science *(including a CLA) (May be substituted with 1 coop credit)*			1
Cooperative Education	2	2	2
TOTAL	**9**	**9**	**9**

*Contextualized Learning Activity