General Information.

Discipline: Mathematics
Course code: 201-203-RE
Ponderation: 3-2-3
Credits: $2\frac{2}{3}$
Number of class hours: 75
Prerequisite: 201-103-RE
Objectives:

- 022Y: To apply the methods of integral calculus to the study of functional models in the field of Social Science
- 022R: To thoroughly analyze a human phenomenon
- 022S: To apply concepts related to Social Science disciplines to the understanding of the human phenomena in concrete situations

Introduction. Calculus II is the sequel to Calculus I, and so is the second Mathematics course in the Social Science Program. It is generally taken in the second semester. In Calculus II, the notions of indefinite and definite integration are studied in depth, and their use in other areas of social science, such as Business, Economics and Psychology is explored. In addition, the course introduces the student to the concept of infinite sequences and series, and to their applications in Finance.

The primary purpose of the course is the attainment of Objectives 022Y, 022R, 022S ("To apply the methods of integral calculus to the study of functional models in the field of Social Science. To thoroughly analyze a human phenomenon. To apply concepts related to Social Science disciplines to the understanding of the human phenomena in concrete situations"). To achieve this goal, the course must help the student understand the following basic concepts: limits, derivatives, indefinite and definite integrals, infinite sequences, infinite series, and improper integrals (including algebraic, trigonometric, exponential, and logarithmic functions).

Emphasis is placed on clarity and rigour in reasoning and in the application of methods. The student will learn to use the techniques of integration in several contexts related to the field of Social Science such as population growth, the spread of rumour or disease, financial math, cost-benefit analysis (cost, revenue and profit) and to interpret the integral both as an antiderivative and as a sum of products. The basic concepts are illustrated by applying them to various problems where their application helps arrive at a solution. In this way, the course encourages the student to apply learning acquired in one context to problems arising in another.

Only calculators which have previously been inspected and approved via sticker by the instructor will be permitted for use on quizzes, tests or the final examination. The only calculators that will be approved begin with the model number **SHARP EL-531**. An acceptable calculator model is available for purchase at the bookstore.

Students will have access to computers where suitable mathematical software programs, including MAPLE, are available for student use. The course uses a standard college level Calculus textbook, chosen by the Calculus I and Calculus II course committees.

Teaching Methods. This course will be 75 hours, meeting three times a week for a total of 5 hours a week. Most teachers of this course rely mainly on the lecture method, although most also employ at least one of the following techniques as well: question-and-answer sessions, labs, problem solving periods and class discussions, Generally, each class session starts with a question period of previous topics, then new material is introduced, followed by worked examples. No marks are deducted for absenteeism (however, see below). Failure to keep pace with the lectures results in a cumulative inability to cope with the material, and a failure in the course. A student will generally succeed or fail depending on how many problems have been attempted and solved successfully. It is entirely the student's responsibility to complete suggested homework assignments as soon as possible following the lecture, as the material will be fresher in his/her mind. This also allows the student the maximum benefit from any discussion of the homework (which usually occurs in the following class). The answers to a selected number of problems can be found in the back of the text. Each teacher will provide supplementary notes and problems as he/she sees fit.

Other Resources.

Math Website.
http://departments.johnabbott.qc.ca/departments/mathematics

Math Study Area. Located in H-200A and H-200B; the common area is usually open from 8:30 to 17:30 on weekdays as a quiet study space. Computers and printers are available for math-related assignments. It is also possible to borrow course materials when the attendant is present.

Math Help Centre. Located near H-211; teachers are on duty from 9:00 until 16:00 to give math help on a drop-in basis.

Academic Success Centre. The Academic Success Centre, located in H-117, offers study skills workshops and individual tutoring.

Departmental Attendance Policy. Regular attendance is expected. Missing six classes is grounds for automatic failure in this course. Many of the failures in this course are due to students missing classes.

Required Text. *Applied Calculus for the Managerial, Life, and Social Sciences, 10th edition*, by Soo T. Tan, available at the college bookstore.

Course Costs. The textbook costs about $137, and the approved model of scientific calculator costs about $22.

Evaluation Plan. The Final Grade is a combination of the Class Mark and the mark on the Final Exam. The Class Mark will include results from three or more tests (worth 75% of the Class Mark), homework, quizzes or other assignments/tests (worth 25% of the Class Mark). The specifics of the Class Mark will be given by each instructor during the first week of classes in an appendix to this outline. Every effort is made to ensure equivalence between the various sections of this course. The Final Exam is set by the Course Committee (which consists of all instructors currently teaching this course), and is marked by each individual instructor.

The Final Grade will be the better of:

50% Class Mark and 50% Final Exam Mark
or
25% Class Mark and 75% Final Exam Mark

A student *choosing not to write* the Final Exam will receive a failing grade of 50% or their Class Mark, whichever is less.

Students must be available until the end of the final examination period to write exams.

College Policies.

Policy No. 7 - IPESA, Institutional Policy on the Evaluation of Student Achievement: http://johnabbott.qc.ca/ipesa.

Changes to Evaluation Plan in Course Outline (Article 5.3). Changes require documented unanimous consent from regularly attending students and approval by the department and the program dean.

Religious Holidays (Article 3.2.13 and 4.1.6). Students who wish to miss classes in order to observe religious holidays must inform their teacher of their intent in writing within the first two weeks of the semester.

Student Rights and Responsibilities: (Article 3.2.18). It is the responsibility of students to keep all assessed material returned to them and/or all digital work submitted to the teacher in the event of a grade review. (The deadline for a Grade Review is 4 weeks after the start of the next regular semester.)

Student Rights and Responsibilities: (Article 3.3.6). Students have the right to receive graded evaluations, for regular day division courses, within two weeks after the due date or exam/test date, except in extenuating circumstances. A maximum of three (3) weeks may apply in certain circumstances (ex. major essays) if approved by the department and stated on the course outline. For evaluations at the end of the semester/course, the results must be given to the student by the grade submission deadline (see current Academic Calendar). For intensive courses (i.e.: intersession, abridged courses) and AEC courses, timely feedback must be adjusted accordingly.

Academic Procedure: Academic Integrity, Cheating and Plagiarism (Article 9.1 and 9.2). Cheating and plagiarism are unacceptable at John Abbott College. They represent infractions against academic integrity. Students are expected to conduct themselves accordingly and must be responsible for all of their actions.

College definition of Cheating: Cheating means any dishonest or deceptive practice relative to examinations, tests, quizzes, lab assignments, research papers or other forms of evaluation tasks. Cheating includes, but is not restricted to, making use of or being in possession of unauthorized material or devices and/or obtaining or providing unauthorized assistance in writing examinations, papers or any other evaluation task and submitting the same work in more than one course without the teachers permission. It is incumbent upon the department through the teacher to ensure students are forewarned about unauthorized material, devices or practices that are not permitted.

College definition of Plagiarism: Plagiarism is a form of cheating. It includes copying or paraphrasing (expressing the ideas of someone else in ones own words), of another person's work or the use of another persons work or ideas without acknowledgement of its source. Plagiarism can be from any source including books, magazines, electronic or photographic media or another student's paper or work.

Course Content (with suggested exercises). The exercises listed below should help you practice and learn the material taught in the course; they form a good basis for homework. Your teacher may supplement this list during the semester. Regular work done as the course progresses should make it easier for you to master the course.

6.1 Antiderivatives and the Rules of Integration
Self-Check: #1-2
Concept Questions #1-4
Exercises #1-4, 9-62, 68-70, 76, 81, 96-100

6.2 Integration by Substitution
Self-Check #1-3
Concept Questions #1-2
Exercises #1-54, 58, 59, 65, 69-72

6.3 Area and the Definite Integral
Self-Check #1
Concept Questions #1-2
Exercises #4, 6, 9, 12, 15
Supplement A

6.4 The Fundamental Theorem of Calculus
Self-Check #1-2
Concept Questions #1
Exercises #1-40, 43-45, 61-64

6.5 Evaluating Definite Integrals
Self-Check #1
Concept Questions #1
Exercises #1-34, 73-86
Supplement B

6.6 Area Between Two Curves
Self-Check #1-2
Concept Questions #1-2
Exercises #1-42, 48, 56
(Do not sketch the graph for #14, 16, 32, 34, 41 and 42)

6.7 Applications of the Definite Integral to Business and Economics
Self-Check #1
Concept Questions #1
Exercises #1-11
Supplement C

7.1 Integration by Parts
Self-Check #1
Concept Questions #1-2
Exercises #1-38, 53, 54

Teachers Notes: Partial Fractions
Supplement D

12.4 Integration of Trigonometric Functions
Self-Check #1
Concept Questions #1-2
Exercises #1-30

Review of Integrals
Supplement E

7.3 Numerical Integration
Self-Check #1
Exercises #1-22, 38, 40, 41 (Trapezoidal Rule Only)

9.1 Differential Equations
Self-Check #1-2
Concept Questions #1-3
Exercises #1-21, 29-32

9.2 Separation of Variables
Self-Check #1
Concept Questions #1-3
Exercises #1-31, 37, 38, 40-42

9.3 Applications of Separation of Variables
Exercises #1-18, 21-23

Appendix B2: The Indeterminate Forms $\frac{0}{0}$ and $\frac{\infty}{\infty}$ and l'Hôpital's Rule
Exercises #1-10, #12-26, #31-34

7.4 Improper Integrals
Concept Questions #1-a),b)
Exercises #1-14, 17-36, 45, 46
Supplement F

11.2 Infinite Sequences
Self-Check #2
Concept Questions #1
Exercises #1-19, 21-43, 46, 47

11.3 Infinite Series
Self-Check #1
Concept Questions #1-2
Exercises #1-30
Supplement G

11.4 Series with Positive Terms + Teachers notes: The Ratio Test
Self-Check #1
Exercises #1-26, 41, 42, 56, 57
Supplement H
(Integral test: at the instructor's discretion)

OBJECTIVES	STANDARDS
Statement of the competency To apply the methods of integral calculus to the study of functional models in the field of Social Science (022Y). To thoroughly analyze a human phenomenon (022R). To apply concepts related to Social Science disciplines to the understanding of the human phenomena in concrete situations (022S)	**General Performance Criteria** • Basic knowledge of the historical context of the development of integral calculus • Appropriate use of concepts • Satisfactory representation of situations as equations, series and graphs • Algebraic operations in conformity with rules • Correct selection and application of rules and techniques • Accuracy of calculations • Explanation of the steps involved in calculation and analysis • Correct interpretation of results • Appropriate use of terminology
Elements of the Competency 1. To place the development of integral calculus in historical context. 2. To determine the indefinite integral of a function using integration techniques. 3. To calculate the definite integral of a function on an interval and provide the interpretation thereof. 4. To calculate the limits of a function with indeterminate forms using L'Hôpital's rule. 5. To calculate the improper integral of a function on an interval and provide the interpretation thereof. 6. To analyze a phenomenon using differential equations with separable variables. 7. To analyze a phenomenon by checking for convergence of a series.	**Specific Performance Criteria** *[Specific performance criteria for each of these elements of the competency are shown below with the corresponding intermediate learning objectives. For the items in the list of learning objectives, it is understood that each is preceded by: "The student is expected to . . . ".]*

Specific Performance Criteria	**Intermediate Learning Objectives**
1. *The Development of Calculus*	
1.1 The history of Calculus	1.1.1. Place integral calculus in historical context by an investigation of area of a planar region bounded by an arbitrary curve, a problem posed by Newton and Leibniz and its relevance in today's society.
2. *Indefinite Integrals*	
2.1 Use of fundamental integration techniques	2.1.1. Give the definition of the indefinite integral as an antiderivative. 2.1.2. Express the basic differentiation formulas as antidifferentiation formulas. 2.1.3. Recognize when and how to use the constant multiple rule and the sum and difference rule in the evaluation of integrals. 2.1.4. Use the antidifferentiation formulas from 2.1.2 and the rules from 2.1.3 to evaluate indefinite integrals.
2.2 Use of basic substitutions to determine simple indefinite integrals.	2.2.1. Use these antidifferentiation rules and appropriate substitutions to calculate indefinite integrals.
2.3 Use of more advanced techniques to determine more complex indefinite integrals.	2.3.1. Use algebraic identities to prepare indefinite integrals for solution by substitution. 2.3.2. Evaluate an indefinite integral by integration by parts. 2.3.3. Evaluate indefinite integrals by using trigonometric identities. 2.3.4. Evaluate an indefinite integral by partial fractions. 2.3.5. Evaluate an indefinite integral by selecting the appropriate technique. 2.3.6. Evaluate an indefinite integral by using a combination of techniques.
3. *Definite Integrals and Area*	
3.1 Use of the Fundamental Theorem of Calculus to evaluate a definite integral.	3.1.1. Use the Fundamental Theorem of Calculus to calculate a definite integral. 3.1.2. Use numerical integration to evaluate a definite integral
3.2 Calculation of areas of planar regions	3.2.1. Use 3.1.1 to set up a definite integral to calculate an area. 3.2.2. Sketch a region bounded by 2 functions $y = f(x)$ and $y = g(x)$ and calculate its area. 3.2.3. Sketch a region bounded by 2 functions $x = f(y)$ and $x = g(y)$ and calculate its area.
4. *Limits of indeterminate forms*	
4.1 Use of L'Hôpital's rule to determine limits of indeterminate forms.	4.1.1. State L'Hôpital's rule and the conditions for which it is valid. 4.1.2. Calculate limits of the indeterminate forms $\frac{0}{0}$ and $\frac{\infty}{\infty}$ using L'Hôpital's rule.
5. *Improper integrals*	
5.1 Use of limits to calculate improper integrals.	5.1.1. Calculate an improper integral where at least one of the bounds is not a real number. 5.1.2. Calculate an improper integral where the integrand is discontinuous at one of the bounds.
6. *Differential equations*	
6.1 Use of antidifferentiation to obtain general solutions of simple differential equations.	6.1.1. Express a simple differential equation in the language of integration and obtain the general solution. 6.1.2. Express a simple initial value problem in the language of integration and obtain the particular solution.
6.2 Use of integration to solve a separable differential equation.	6.2.1. Express a simple differential equation in separable form. 6.2.2. Find the general solution of a separable differential equation. 6.2.3. Find a particular solution of a separable differential equation given an initial condition.
7. *Infinite Sequences and Series*	
7.1 Determination of the convergence of a sequence.	7.1.1. State the definition of the limit of a sequence. 7.1.2. Use 7.1.1 to calculate the limit of a sequence and indicate whether the sequence converges or diverges.
7.2 Determination of the convergence of an infinite series.	7.2.1. State the definition of convergence for an infinite series. 7.2.2. State and use the n^{th} term test for the divergence of a series. 7.2.3. State the criterion for the convergence of an infinite geometric series. 7.2.4. Calculate the sum of a converging geometric series. 7.2.5. Use 7.2.3 to solve applied problems in the Social Science disciplines. 7.2.6. Use 7.2.1 to determine if a telescoping series converges, and if so, find the sum. 7.2.7. Determine whether a p-series converges or diverges. 7.2.8. State and use the ratio test.