

General Information.

Discipline: Mathematics

Ponderation: 3-2-3

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 in H-216; teachers are on duty from 8:30 until 15:30 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.

Textbook. There is no required textbook for this course. Sets of exercises will be provided by your teacher. A good reference for the course material is *Applied Calculus for the Managerial, Life, and Social Sciences, 10th edition*, by Soo T. Tan. Note that this book may not be available for purchase at the bookstore, but reference copies are available in the Math Study Area and at the Library.

Course Costs. The textbook costs about \$130, and the approved model of scientific calculator costs about \$25.

Evaluation Plan. The Final Evaluation in this course consists of the Final Exam, which covers all elements of the competency. 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.

Course Outline Change. Please note that course outlines may be modified if health authorities change the access allowed on-site. This includes the possibility of changing between an in-person and online format.

Departmental Attendance Policy. Due to the COVID-19 health crisis, attendance policies may need to be adjusted by your teacher. Regular attendance is expected, and your teacher will inform you of any details or modifications as needed. Please note that attendance continues to be extremely important for your learning, but your teacher may need to define it in different terms based on the way your course is delivered during the semester.

Additional Software. In addition to LEA, Teams and Moodle, additional software may be used for the submission of essays or projects or for testing. Further details will be provided if applicable.

Class Recordings. Classes on Teams or other platforms may be recorded by your teacher and subsequently posted on Teams and/or LEA to help for study purposes only. If you do not wish to be part of the recording, please let your teacher know that you wish to not make use of your camera, microphone or chat during recorded segments. Any material produced as part of this course, including, but not limited to, any pre-recorded or live video is protected by copyright, intellectual property rights and image rights, regardless of the medium used. It is strictly forbidden to copy, redistribute, reproduce, republish, store in any way, retransmit or modify this material. Any contravention of these conditions of use may be subject to sanction(s) by John Abbott College.

College Policies.

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

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 teacher's 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 one's own words), of another person's work or the use of another person's 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 topics listed below will be covered in the course. Your teacher will provide you with practice problems 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

6.2 Integration by Substitution

6.3 Area and the Definite Integral

[Supplement A](#)

6.4 The Fundamental Theorem of Calculus

6.5 Evaluating Definite Integrals

[Supplement B](#)

6.6 Area Between Two Curves

6.7 Applications of the Definite Integral to Business and Economics

[Supplement C](#)

7.1 Integration by Parts

Teacher's Notes: Partial Fractions

[Supplement D](#)

12.4 Integration of Trigonometric Functions

Review of Integrals

[Supplement E](#)

7.3 Numerical Integration

9.1 Differential Equations

9.2 Separation of Variables

9.3 Applications of Separation of Variables

Appendix B2: The Indeterminate Forms $\frac{0}{0}$ and $\frac{\infty}{\infty}$ and l'Hôpital's Rule

7.4 Improper Integrals

[Supplement F](#)

11.2 Infinite Sequences

11.3 Infinite Series

[Supplement G](#)

11.4 Series with Positive Terms + Teacher's notes: The Ratio Test

[Supplement H](#)

(Integral test: at the instructor's discretion)

OBJECTIVES	STANDARDS
<p>Statement of the competency</p> <p>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)</p> <p>Elements of the Competency</p> <ol style="list-style-type: none"> To place the development of integral calculus in historical context. To determine the indefinite integral of a function using integration techniques. To calculate the definite integral of a function on an interval and provide the interpretation thereof. To calculate the limits of a function with indeterminate forms using L'Hôpital's rule. To calculate the improper integral of a function on an interval and provide the interpretation thereof. To analyze a phenomenon using differential equations with separable variables. To analyze a phenomenon by checking for convergence of a series. 	<p>General Performance Criteria</p> <ul style="list-style-type: none"> 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 <p>Specific Performance Criteria</p> <p><i>[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 ...".]</i></p>

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