



School of Technology, Energy, and Apprenticeship

Mathematics and Physics Department

Course Outline – Winter 2014

Course Code: MTH 2105

Course Title: Mathematics II

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Date:

Revised By: A. Warren

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Approved By: Ranjan Bhattacharya, Dean

Prerequisite: MTH 1105

Corequisite: None

Prerequisite for: ICS3305, MTH3103, OES4114

1. Course Description

This course surveys elementary functions and their graphs, regression, and descriptive statistics. A major focus is differential calculus, providing the foundation for further technology mathematics courses.

2. General Education and Essential Employability Skills

This course provides the following provincial Essential Employability Skills:

#1: Communication

#2: Numeracy

#3: Critical Thinking and Problem Solving

Is this course approved as a General Education course?

☒

No

☐

Yes

Students should refer to their program's restricted General Education courses for final determination.

3. Learning Outcomes

Upon successful completion of this course the student will be able to:

1. Solve exponential and logarithmic equations.
2. Relate graphs of elementary functions and transformations of these functions to their equations and vice versa.
3. Apply the concepts and techniques of elementary probability to problems of chance.
4. Organize and interpret statistical data at the introductory level.
5. Calculate and graph linear, power, and exponential regression equations for data sets acquired in laboratory experimentation.
6. Apply the principles of differentiation to polynomial and transcendental functions.
7. Define and apply parametric equations.
8. Solve problems of more than one variable using partial derivatives.
9. Solve applications of differentiation.

4. Learning Objectives

	Learning Outcomes
	Reference Number
Unit 1 – Exponential and Logarithmic Functions	
1.1 Review the key features of exponential and logarithmic equations	[1]
1.2 Evaluate, manipulate and simplify logarithmic expressions using the properties of logarithms	[1]
1.3 Find the logarithm of a positive number to any positive base	[1]
1.4 Solve exponential and logarithmic equations	[1]
Unit 2 – Graphing Functions	
2.1 Review the key characteristics of linear, quadratic, cubic, polynomial, root, and reciprocal graphs	[2]
2.2 State the equation of a function, given its graph	[2]
2.3 Sketch the graph of a linear, polynomial, sideways quadratic, root, reciprocal, circle, exponential, logarithmic, or trigonometric relation where the equation is modified by replacing x with $-x$, x with kx , x with $(x - a)$, y with $-y$, y with ky , or y with $y + a$	[2]
2.4 Define parametric equations	[7]
2.5 Make a table of values and plot the graph of given parametric equations for x and y	[7]
2.6 Read values of either the dependent or independent variable, given the value of the other, from an accurate graph	[2]
2.7 Describe the graphs of these functions in terms of rate of change	[2]
Unit 3 – Statistics and Probability	
3.1 Set up a frequency table using raw data	[4]
3.2 Draw a histogram and relative cumulative frequency curves	[4]
3.3 Define and contrast sample and population	[4]
3.4 Calculate the mean, median, and mode of data presented in a list or as a frequency distribution	[4]
3.5 Define outliers and discuss their impact on data summary	[4]
3.6 Calculate the range of a set of data	[4]
3.7 Calculate the sample and population standard deviation of a set of data	[4]
3.8 Define the probability of an event	[3]
3.9 Illustrate a probability using Venn diagrams	[3]
3.10 Define mutually exclusive events	[3]
3.11 State the addition law of probabilities	[3]
3.12 Define independent events	[3]
3.13 State the multiplication law of probabilities	[3]
3.14 Solve simple probability problems using complementary events and/or the addition/multiplication laws	[3]
3.15 Solve problems involving conditional probability	[3]
Unit 4 – Regression	
4.1 State the purpose of regression analysis	[5]
4.2 Define correlation and relate it to cause and effect	[5]
4.3 Calculate the correlation coefficient for a given set of data	[5]

- 4.4 Plot experimental data and say whether it is suitable for linear, power, or exponential regression [5]
- 4.5 Define the best straight line through a set of points in the least squares sense [5]
- 4.6 Plot experimental data on semi-log and log-log paper where appropriate to illustrate the regression line [5]
- 4.7 Calculate the regression line equation given a set of suitable observations [5]
- 4.8 Graph the data and the regression line on appropriate graph paper [5]
- 4.9 State slope and y intercept of the regression line for linear, power, or exponential relations [5]
- 4.10 Use the regression equation to predict values of the response variable using interpolation or extrapolation [5]
- 4.11 Define and interpret the coefficient of determination [5]

Unit 5 – Derivatives of Polynomial Functions

- 5.1 Calculate the value of a limit of a linear, polynomial, and exponential function where x approaches a given real number or infinity [6]
- 5.2 Calculate the value of a one-sided limit [6]
- 5.3 Compare and contrast continuous and discontinuous functions [6]
- 5.4 Define the derivative in terms of a limit [6]
- 5.5 Define and illustrate the derivative as the slope of a tangent [6]
- 5.6 Find the derivative of a power function from first principles [6]
- 5.7 State the derivative of x^n , where n is a real number [6]
- 5.8 State the derivative of a sum or difference of powers [6]
- 5.9 Apply the chain rule to find the derivative of nested power functions [6]
- 5.10 State and apply the product rule [6]
- 5.11 State and apply the quotient rule [6]
- 5.12 Calculate higher order derivatives [6]
- 5.13 Calculate the value of a derivative at a specific point [6]
- 5.14 Calculate the value of a derivative at a specific point using the calculator's d/dx function [6]
- 5.15 Find the derivative of an implicit function by solving first for the dependent variable [6]
- 5.16 Find the derivative of an implicit polynomial function by using implicit differentiation [6]

Unit 6 – Derivatives of Trigonometric, Logarithmic, and Exponential Functions

- 6.1 Find the derivative of $\sin x$, $\cos x$, $\tan x$, $\cot x$, $\sec x$, $\csc x$, $\sin^{-1} x$, $\cos^{-1} x$, $\tan^{-1} x$, $\cot^{-1} x$, $\sec^{-1} x$, $\csc^{-1} x$, $\ln x$, $\log x$, $\log_b x$, b^x , and e^x [6]
- 6.2 Apply the addition and subtraction rule, product rule, quotient rule, and chain rule to combinations of trigonometric, logarithmic, and exponential functions [6]
- 6.3 Find higher order derivatives [6]
- 6.4 Calculate the value of a derivative at a specific point [6]

- 6.5 Find the derivative of an implicit function by solving first for the dependent variable [6]
- 6.6 Find the derivative of an implicit trigonometric, logarithmic, or exponential function by using implicit differentiation [6]

Unit 7 – Partial Differentiation

- 7.1 Discuss the geometric interpretation of the first partial derivatives of a function of two variables [8]
- 7.2 Write partial derivatives using either ‘curly dee’ or suffix notation [8]
- 7.3 Find the first and second partial derivatives of a function with several variables [8]
- 7.4 Find the total differential of a function with several variables [8]
- 7.5 Estimate using differentials and calculate the approximate percentage change in a function using the total differential of the function [8]

Unit 8 – Applications of Derivatives

- 8.1 Calculate and illustrate graphically average and instantaneous change [9]
- 8.2 Calculate the rate of change of one variable with respect to another [9]
- 8.3 Find the acceleration and velocity given the displacement as a function of time [9]
- 8.4 Define parametric distance equations for a falling object and for an object projected upwards at an angle [9]
- 8.5 Find the velocity and acceleration components of parametric distance equations [9]
- 8.6 Calculate the magnitude and direction of the velocity of a moving object at a specific time [9]
- 8.7 Locate minima, maxima, points of inflection, and intervals of increase, decrease, concave upwards, and concave downwards on a graph [9]
- 8.8 Solve for minima, maxima, points of inflection, and intervals of increase, decrease, concave upwards, and concave downwards using derivatives [9]
- 8.9 Solve applied maximum and minimum problems [9]
- 8.10 Determine the equation of a tangent line to a curve passing through a specific point on the curve [9]
- 8.11 Solve problems involving related rates [9]
- 8.12 Solve problems involving electrical applications [9]

5. Resources

a. Required

Calter, M., Calter P., Spencer, D., & Wraight, P. (2012). *Technical mathematics with calculus* (Second Canadian ed.). Toronto: John Wiley & Sons.

Mendenhall, et. al. (2013). *Mathematics material for lambton college: MTH2105, MTH3103, MTH4404 (custom)*. Toronto: Nelson.

The Sharp EL-W516 calculator is required.

b. Supplemental

Washington, A. (2005). *Basic technical mathematics with calculus* (8th ed.). Toronto: Pearson Education.

Weiner, J. (2009). *The mathematics survival kit* (2nd ed.) Toronto: Nelson.

6. Methodology

This course consists of classroom lectures, problem-solving exercises, solving numerical problems using the calculator and classroom discussion. Lecture: 5 hours/week.

7. Student Evaluation

The final grade in this course will be based on the assessment of the learning outcomes. There will be assignments/quizzes, four equally weighted tests, and a final comprehensive exam given during the semester.

The marks will be weighted as follows:

Assignments/Quizzes	10%
Tests	60%
Final Exam	<u>30%</u>
Total	100%

Plagiarism or cheating on any assignment or test will result in a zero and a letter on file. See the college policy on student conduct for details.

The instructor will provide notice for tests at least one week in advance. Please notify the instructor if you plan to be absent for a test or the exam. Tests and the exam must be taken on the date scheduled unless you contact the instructor prior to the scheduled test/exam time with your reason for being absent. The instructor may request documentation to validate the absence. With no prior notification of absence for that assignment/quiz/test/exam, a mark of zero will be given. No rewrites. See the Missed Evaluation Policy for details.

A grade of D is the minimum passing grade. Grades of less than D are not acceptable for credit towards graduation in this course and program.

The round off mathematical principle will be used. Percentages are converted to letter grades and grade points as follows:

Mark (%)	Grade	Grade Point	Mark	Grade	Grade Point
94-100	A+	4.0	67-69	C+	2.3
87-93	A	3.7	63-66	C	2.0
80-86	A-	3.5	60-62	C-	1.7
77-79	B+	3.2	50-59	D	1.0
73-76	B	3.0	0-49	F	0.0
70-72	B-	2.7			

The passing grade in this course is 50%. Some programs, however, may require a higher grade for progression though, or graduation from, the program. Students should check the program requirements.

School of Technology, Energy & Apprenticeship Missed Evaluation Policy

In general, only illness and domestic affliction (i.e. death in the family, sick children, family conflict, legal appointments etc.) will be considered as valid reasons for a missed or late evaluation (test, quiz, assignment, or lab). In cases where, in the judgment of the instructor, other circumstances clearly beyond the control of the student (i.e. Co-op Job Interviews, Jury duty, etc.) have led to a missed evaluation, consideration may also be granted.

In the event a student misses an evaluation, the student must attempt to:

a) Contact the instructor in advance, if at all possible, informing the instructor of the particular situation and attempt to make alternate arrangements. Presented with a valid reason for a missed test, the instructor will consult with the student to set up a mutually agreeable test date, aiming for the earliest time available. The instructor will provide a suitable test at that time and mark it. For other missed or late evaluations, the instructor may instill a penalty, any of which the student will be made aware of at the beginning of the course.

In the event a student cannot contact the instructor in advance, the student must:

b) Inform the instructor in writing as soon as possible after the missed evaluation and attempt to make alternate arrangements.

In all cases in which a student seeks remedy for a missed evaluation, the instructor may require a medical certificate or other substantiating documents by way of validation. When, in the judgment of the instructor, the student's reason is invalid, the student shall be refused any further remedy. The decision of the instructor not to allow the student the opportunity to reschedule the evaluation may be appealed under the Academic Appeal policy which is available on the Web under Registration on the Current Student page.

8. Academic Integrity

Lambton College is committed to high ethical standards in all academic activities within the College, including research, reporting and learning assessment (e.g. tests, lab reports, essays).

The cornerstone of academic integrity and professional reputation is principled conduct. All scholastic and academic activity must be free of all forms of academic dishonesty, including copying, plagiarism and cheating.

Lambton College will not tolerate any academic dishonesty, a position reflected in Lambton College policy. Students should make themselves familiar with the [Students Rights and Responsibilities Policy](#), located on the MyLambton website for details concerning academic dishonesty and the penalties for dishonesty and unethical conduct.

Questions regarding this policy, or requests for additional clarification, should be directed to the [Lambton College Centre for Academic Integrity](#)

9. Related Items

Students with Disabilities

If a student has a disability, please identify personal needs to the professor and/or the Services for Students with Disabilities so that support services can be arranged. This can be done by making an appointment at the SSD, Room L103 ext.3427 or by arranging a personal interview with the professor.

Student Rights and Responsibility Policy

Acceptable behaviour in class is established by the instructor and the Code of Conduct. These policies are expected to be followed by all students. Any form of misbehaviour, harassment or violence will not be tolerated. Action will be taken as outlined in Lambton College policy.

Cheating and plagiarism are serious academic offences subject to disciplinary action. It is the student's responsibility to be aware of the cheating policy as described in the Lambton College Student Rights and Responsibilities policy. For further information on all of these policies, links may be found on the Lambton College website.

Prior Learning Assessment Statement

This course is eligible for Prior Learning Assessment

☒ Yes

☐ No

If yes has been selected, contact the Counselling Department for advice on Prior Learning Assessment.

Date of Withdrawal without Academic Penalty

Please consult the Academic Regulations and Registrar's published dates.

Waiver of Responsibility

Every attempt has been made to ensure the accuracy of this information as of the date of publication. The content may be modified, without notice, as deemed appropriate by the College.

Note: It is the student's responsibility to retain course outlines for possible future use to support applications for transfer of credit to other educational institutions.