



**School of Technology, Energy, and Apprenticeship**

Mathematics and Physics Department

**Course Outline – W 2014**

**Course Code:** MTH 1105

**Course Title:** Mathematics I

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*Date:* May 1999

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*Date:* June 2013

*Approved By:* Ranjan Bhattacharya, Dean

*Prerequisite:* None

*Corequisite:* None

*Prerequisite for:* MTH 2105

## 1. Course Description

This course, taught in all technology programs, reviews, emphasizes and develops concepts in algebra, functions, trigonometry, and complex numbers.

## 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 learner will be able to:

1. Perform calculations with different types of numbers and notations including arithmetic with integers, fractions, and decimals without a calculator
2. Simplify algebraic expressions
3. Solve linear, polynomial, radical, and trigonometric equations and inequalities
4. Graph linear, quadratic, exponential, logarithmic, and trigonometric functions
5. Solve systems of equations
6. Apply trigonometry to technical problems
7. Express, illustrate, and perform operations with complex numbers in various formats
8. Solve technical problems by using percents, ratios, proportions, equations, variation, vectors, and measurement
9. Use function notation and the properties of functions
10. Identify and use the characteristics of exponential and logarithmic functions

## 4. Course Objectives

### Unit 1 – Arithmetic of Real Numbers

- |     | <i>Learning Outcome</i>                                                         | <i>Reference Number</i> |
|-----|---------------------------------------------------------------------------------|-------------------------|
| 1.1 | Classify real numbers as natural, integer, rational or irrational               | [1]                     |
| 1.2 | Apply order of operations including nested brackets to any numerical expression | [1]                     |
| 1.3 | Convert standard notation to scientific or engineering notation and vice versa  | [1]                     |
| 1.4 | Estimate the approximate value of an extended numerical expression              | [1]                     |

- 1.5 Solve percent problems including relative change, percent error, and percent efficiency [1,8]
- 1.6 Perform calculations with approximate numbers and measurements [1,8]
- 1.7 Convert units of measurement from one denomination to another using ratios and dimensional analysis [1,8]
- 1.8 Evaluate expressions with absolute value [1]

## Unit 2 - Algebra

- 2.1 Simplify expressions and combine like terms [2]
- 2.2 Add, subtract, multiply and divide algebraic expressions [2]
- 2.3 Factor expressions by factoring common factors [2]
- 2.4 Factor the difference of two squares [2]
- 2.5 Factor trinomials [2]
- 2.6 Simplify algebraic fractions [2]
- 2.7 Add, subtract, multiply and divide algebraic fractions [2]
- 2.8 Simplify complex algebraic fractions [2]

## Unit 3 - Linear Functions

- 3.1 Solve and verify linear equations using algebra [3]
- 3.2 Solve and verify linear inequalities using algebra [3]
- 3.3 Solve literal linear equations and formulas for any given variable [2,3]
- 3.4 Solve technical problems involving linear equations [3]
- 3.5 Graph a straight line and identify slope and y-intercept [5]

## Unit 4 - Functions

- 4.1 Distinguish between relations and functions [9]
- 4.2 Recognize functions in equation, table and graph form [9]
- 4.3 Distinguish between independent and dependent variables [9]
- 4.4 Distinguish between implicit and explicit forms of functions [9]
- 4.5 Express a function explicitly, given its implicit form (where possible) [9]
- 4.6 Find domain and range of a function [9]
- 4.7 Express a function using functional notation [9]
- 4.8 Use functional notation to manipulate, combine and evaluate functions [9]
- 4.9 Find the inverse of a function and express it using inverse functional notation [9]
- 4.10 Graph a function by using a table of values [4,9]

## Unit 5 - Exponents, Radicals, and Logarithms

- 5.1 Use laws of integral and fractional exponents [2]
- 5.2 Simplify expressions with radicals [2]
- 5.3 Solve radical equations, including literal equations and formulas [2,3]
- 5.4 Define exponential and logarithmic functions [10]
- 5.5 Evaluate common and natural logarithms [10]
- 5.6 Convert expressions between exponential and logarithmic form [10]
- 5.7 Graph exponential and logarithmic functions and identify key characteristics [4,10]
- 5.8 Graph data on semi-logarithmic graph paper [4,10]

## Unit 6 - Polynomial Functions

6.1	Distinguish between linear and non-linear functions	[3]
6.2	Solve and verify quadratic equations using algebra	[3]
6.3	Graph quadratic equations and identify vertex, roots, and y-intercept	[4]
6.4	Solve polynomial equations of a higher degree	[3]
6.5	Solve literal polynomial equations and formulas for any given variable	[3]
6.6	Solve technical problems using quadratic equations	[3]

## Unit 7 - Systems of Equations

7.1	Distinguish between a system of linear and non-linear equations	[5]
7.2	Solve a system of two simultaneous equations graphically	[4,5]
7.3	Solve and verify a system of two equations algebraically	[5]
7.4	Define matrix and express a system of equations in matrix form	[5]
7.5	Solve systems of three and four linear equations using the calculator	[5]
7.6	Solve technical problems using simultaneous equations	[5]

## Unit 8 - Trigonometric Functions

8.1	Define similar triangles	[6]
8.2	Define sine and cosine in terms of the unit circle and ratios of the sides of right angle triangles	[6]
8.3	Define the remaining trigonometric functions in terms of sine and cosine	[6]
8.4	Solve right triangles using trigonometric functions and the Pythagorean theorem, including applications	[6]
8.5	Find all trigonometric functions of any angle	[6]
8.6	Find the size of any angle given the value of one of its trigonometric functions	[6]
8.7	Solve triangles using the sine and cosine laws, including applications	[6]
8.8	Define radian measure	[6]
8.9	Solve applied problems related to triangles and circles using trigonometry	[6]
8.10	Graph trigonometric functions and identify frequency, period, amplitude, and phase shift	[4]
8.11	Solve trigonometric equations	[3]

## Unit 9 - Complex Numbers

9.1	Define $j$ as $\sqrt{-1}$	[7]
9.2	Evaluate powers of $j$	[7]
9.3	Write complex numbers in rectangular, polar, trigonometric and exponential form	[7]
9.4	Graph complex numbers in rectangular and polar form	[7]
9.5	Convert complex numbers from one form to another	[7]
9.6	State the complex conjugate for a complex number in rectangular form	[7]
9.7	Perform all arithmetic operations with complex numbers, including powers and roots of complex numbers in polar form	[7]

## Unit 10 – Vectors

10.1	Define vector and scalar	[8]
10.2	Convert vectors between polar and rectangular form	[7,8]
10.3	Add and subtract vectors and multiply a scalar times a vector	[7,8]
10.4	Graph vectors	[7,8]
10.5	Solve force and velocity vector problems	[8]

## Unit 11 - Ratios, Proportions, and Variation

11.1	Express a ratio in its simplest fractional form	[8]
11.2	Set up and solve a proportion for a missing quantity	[8]
11.3	Use linear interpolation on tabular data	[8]
11.4	Solve applied problems using proportions	[8]
11.5	Set up and solve problems using direct, inverse, joint and combined variation	[8]

## 5. Resources and Supplies

### a. Required

Calter, M., Calter P., Spencer, D., & Wraight, P. (2012). *Technical Mathematics with Calculus* (Second Canadian edition). Toronto: John Wiley & Sons.

The Sharp EL-W516 calculator is required.

### b. Supplemental

Lovric, M. (2011). *Calculus: Fear No More*. Toronto: Nelson.

Washington, A. (2009). *Basic Technical Mathematics with Calculus* (9th ed.). Toronto: Pearson Education.

Weiner, J. (2009). *The Mathematics Survival Kit* (2nd ed.). Toronto: Nelson.

## 6. Methodology

This course consists of lectures, problem solving exercises, classroom discussion, and homework assignments. Lecture: 5 hours/week.

## 7. Student Evaluation

A grade of D (50%) is the minimum passing grade. Some programs, however, may require a higher grade for progression though, or graduation from, the program. Students should check the program requirements.

MTH 1105 is based on a pre-requisite knowledge of computation without a calculator and basic algebra skills. The calculators allowed in the course cannot carry out algebraic simplifying or step-by-step equation solving. To simplify algebraic expressions and solve equations one step at a time, the basics of computation, including the commutative properties of addition and multiplication as well as order of operations, are essential background knowledge and are applied throughout this course (and throughout the mathematics courses in your program) when simplifying algebraic expressions, solving equations, and working with complex numbers.

Computation without a calculator and basic algebra are required and necessary knowledge in this course. These skills and knowledge are evaluated in this course and in the Mathematics Assessment.

The final grade in this course will be based on the assessment of the learning outcomes. There will be assignments/quizzes, five tests, and a cumulative final exam given during the semester. Test #1, worth 10%, is the initial Mathematics Assessment which is offered in August and early September. If you achieve a mark of 70% or more on this assessment your mark for Test #1 will be listed as 100%. If you achieve a mark of less than 70% you may accept that mark as your grade for Test #1 or you may sign up for the lab component (MTH1105L) to upgrade your Test #1 mark. The lab component consists of 14 classes, one hour per week; students will complete one assignment per week.

For further information regarding the Mathematics Assessment and Math Labs, visit the Math & Physics Department website ([http://www.mylambton.ca/Math\\_Physics/Home/](http://www.mylambton.ca/Math_Physics/Home/)), the "Important Math Assessment Information Page" on LION (<http://lion.lambtoncollege.ca>), or the "MTH1105 Mathematics Assessment Information for Fall 2013" document provided by the course professor.

The following elements will determine the student's final grade:

Assignments/Quizzes	10%
Test #1 (Assessment or Lab)	10%
Tests #2-5 (equally weighted)	50%
Final Exam	30%
<b>Total</b>	<b>100%</b>

Note: The Mathematics Assessment and Math Lab component are not applicable for online students. Online sections of this course will have assignments/quizzes worth 10%, four equally weighted tests worth 60%, and a cumulative final exam worth 30%.

Plagiarism or cheating on any assignment or test will result in a zero and a letter on file. See the college Student Rights and Responsibilities and Discipline Policy 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.

## 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.

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			

## 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).



**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.