Camosun College
Department of Mathematics
Course Outline

MATH 100 Calculus I

This is a first course in calculus for mathematics and science students. Topics: limits, derivatives of algebraic, trigonometric, logarithmic and exponential functions, applications of differentiation including related rates, curve sketching and optimization problems, and an introduction to the indefinite and definite integral. Students will complete some assignments using Maple, a computer Algebra System.

OFFERED:	Fall, Winter
CREDIT	4
IN-CLASS WORKLOAD:	5 lecture hrs
OUT-OF-CLASS WORKLOAD:	5 - 10
PREREQUISITES:	A recent B in MATH 115 or Math 12
Instructor:	Bill Calver (office E248 Tel 370-3504, Email: calver@camosun.bc.ca

OUTLINE	Topic	Sections
Chapter P	Preparation for Calculus	P.1 – P.3,
Chapter 1	Limits and Their Properties	1.1 – 1.5
Chapter 2	Differentiation	2.1 – 2.6
Chapter 3	Applications of Differentiation	3.1 – 3.9
Chapter 4	Integration	4.1 – 4.6
Chapter 5	Logarithmic and Exponential Functions	5.1 – 5.6

Scientific calculators only are allowed on tests and exams; no graphing calculators or programmable calculators.

Evaluation

50% of your final grade will be taken from a 3-hour final examination.
The final exam will be written between Monday Dec 13 and Tuesday Dec 21 inclusive (posted in Oct).

30% of your final grade will be taken from a series of tests written during the semester.
Test 1 Friday Oct 1, Test 2 Friday Oct 29, Test 3 Friday Nov 26

10% of your final grade will be taken from a series of lab exercises
10% from a series of assignments

If your final exam mark is greater than your term mark, only your final exam mark will be used to compute your grade, provided you have satisfactorily completed the lab exercises and assignments.

Grading:

A+	95-100%	B+	80-84	C+	65-69	F	0-49
A	90-94	B	75-79	C	60-64		
A-	85-89	B-	70-74	D	50-59		

TEXT

Larson, Hostetler, Edwards, Calculus of a Single Variable, 7th edition, Houghton Mifflin Company

MATH 100

		Fall 2004		
Sept 7	Introduction		Nov 1	3.7
8	**Lab 0**		2	3.9
9	1.1		3	**Lab 5**
10	1.2/1.3		4	3.9/4.1
			5	4.1
13	1.3			
14	1.3/1.4		8	4.2
15	**Lab 1**		9	4.2
16	1.4		10	4.3
17	1.5		11	Remembrance Day
			12	4.4
20	Trig review			
21	2.1		15	4.4
22	**Lab 2**		16	4.5
23	2.1/2.2		17	**Lab 6**
24	2.2		18	4.5
			19	5.1
27	2.2 (proofs)			
28	2.3		22	5.1
29	2.3		23	5.2
30	Review		24	5.2
Oct 1	**Test 1**		25	Review
			26	**Test 3**
4	2.4			
5	2.4		29	5.3
6	**Lab 3**		30	5.3/5.4
7	2.5		Dec 1	5.4
8	2.6		2	5.5
			3	5.5
11	Thanksgiving Day			
12	2.6		6	5.6
13	**Lab 4**		7	3.8
14	3.1		8	4.6
15	3.2		9	
			10	Last day of classes
18	3.3			
19	3.3		13	Exams begin.
20	3.4		14	
21	3.4		15	
22	3.5		16	
			17	
25	3.6			
26	3.6		20	
27	3.7		21	Exams end.
28	Review			
29	**Test 2**			

Suggested Exercises and Study Examples for Math 100

Text: **Calculus**, Larson, 7th ed., Houghton-Mifflin, 2001

This list of exercises and examples from the text, combined with the problems worked on in class and on assignments and tests, make up at least 85% of the types of problems that you can expect to be tested on.

Suggested Odd Exercises: Exercises in **Bold** Print are suggested because they are an aid to the understanding of the concepts but are not typical test examples because they are either too difficult for tests or they require the use of a graphing utility (calculator or computer)
Examples to Study: These are the worked and explained examples in each section of the text that are worth studying

Calculus, Larson (7th ed.)	**Bare Minimum**	**Extra Practice**	**Examples to Study**
P.1 Graphs and Models	#1 → 4, 19, 23, 59, 73	# 1 → 11, 17 → 31, 41, 49, 59, 61, 65, 67, 73, 81, 83	Ex. 1 → 5
P.2 Linear Models and Rates of Change	#27, 41, 59, 69, 85	# 5, 27, 41, 45, 47, 53, 59, 69, 71, 73, 85, **89**	Ex. 1 → 4
P.3 Functions and Their Graphs	#5 → 19, 25, 27, 31, 43, 47, 55, 59, 61, 71	# 3 → 31, 43, 45, 47, 49, 50, 51, 55, 59, 61, 63, 71, 72, 73, 75	Ex. 1 → 5
1.1 A Preview of Calculus	# 1 → 7, 10, 11	# 1 → 7, 10, 11	
1.2 Limits Graphically and Numerically	#3, 7, 11, 15, 39, 45,51	#1 → 15, **39, 41**, 43, 45, **47**, 49, 51	Ex. 1 → 5
1.3 Evaluating Limits Analytically	#3, 13, 33, 39, 43, 51, 55, 57, 61, 63, 73, 77, 85	# **3**, 13, 19, 25, 27 → 35, 39, 41, 43, 49 → 61, **63**, 67 → 77, **79**, 85, **89, 91**, 99	Ex. 1 →10
1.4 Continuity and One-sided Limits	#3, 15, 19, 25, 31, 41, 47 51, 71, 73, 77, 79, 87, 89	# 1 → 11, 15, 17, 19, 25, 29, 31, 35, 41, 45 → 51, 57, 69, 71, **73**, 75, 77, **79**, 83 → 89, **94**, 95, 99 → 103	Ex. 1 → 8
1.5 Infinite Limits	#3, 5, 11, 17, 23, 29, 31, 37, 41, 55, 61, 63,68, 71	# 3, 5, 9 → 17, 23, 27, 29 → 43, **51**, 55, 57, 61, 63, **65**, 68 → 72	Ex. 1 → 5

Calculus, Larson (7th ed.)	**Bare Minimum**	**Extra Practice**	**Examples to Study**
2.1 The Derivative and the Tangent Line Problem	#3, 7, 19, 21, 23, 31, 35, 41, 49, 55, 75, 85, 89	# 1 → 11, 15, 19, 21, 23, 27, 31, 35, 37, 39 → 42, 43 → 49, **53**, 55, **57**, **59**, 71 → 79, 83, 85, 89, 91, **93**	Ex. 1 → 7
2.2 Basic Differentiation Rules and Rates of Change	#1, 7, 9, 23, 25 → 29, 37 43, 51, 55, 61, 65, 67, 93	# 1 → 29, 33, 37, 39 → 55, 57, 61 → 69, **73**, 81 → 86, 87 → 97, 107, 109, 111	Ex. 1 → 10
2.3 Product and Quotient Rules and Higher Order Derivatives	#5, 7, 11, 17, 21, 23, 29, 41, 61, 67, 69, 79, 87, 93	# 1, 5, 7, 9 → 25, 29, 33, 37 → 45, 53, 61, 65 → 73, 79 → 103, 109 → 114	Ex. 1 → 9
2.4 The Chain Rule	#3, 11, 27, 53, 59, 61, 65, 73, 75, 81, 897, 89, 111	# 1 → 33, 39, 45, 47 → 67, 73 → 77, 81 → 89, 93, 99, 101, 111 →113	Ex. 1 → 12
2.5 Implicit Differentiation	#9, 15, 19, 25, 29, 43, 55	# 3, 5, 9, 11, 19, 21, 25 → 35, **41**, 43, 47, 55, 59,	Ex. 1 → 8
2.6 Related Rates	#3, 7, 9, 19, 27, 31, 35 45	# 1 → 11, 15, 19 → 31, 32, 35, 37, 43, 44, 45, 46, **54**	Ex. 1 → 6
3.1 Extrema on an Interval	#3, 9, 15, 21, 23, 25, 35, 47, 51, 53, 55, 61	# 3, 5, 9 → 15, 21, 23, 25, 29 → 35, **41**, 47, 49 → 55, 61, 63	Ex. 1 →4
3.2 Rolle's Theorem and the Mean Value Theorem	#5, 9, 11, 17, 25, 27, 29, 31, 35, 41, 43, 45, 51, 55	# 1, 5, 7, 9, 11, 15, 17, 25 →35, **41**, 43, 45, 51, 53, 55, 59	Ex. 1 → 4
3.3 Increasing and Decreasing Functions and the First Derivative Test	#3, 9, 15, 23, 27, 29, 33, 45, 49→55, 71, 75	# 3, 7, 9, 15, 19, 21, 23, 27, 29, 33, 37, 43 → 55, 61, 67, 71, 73, 75	Ex. 1 → 5
3.4 Concavity and the Second Derivative Test	#3, 9, 13, 23, 25, 27, 39, 51, 55, 58, 79, 81, 83	# 1 → 27, 35, 37, 39, 45 → 55, 58, 63, 75, 79, 81, 83	Ex. 1 → 4
3.5 Limits at Infinity	#3, 13, 17, 25, 49, 53, 71	# 1 → 6, 13 → 31, 45 → 55, 63, **71, 75**, 87	Ex. 1 → 4
3.6 A Summary of Curve Sketching	#1→5, 11, 15, 23, 31, 41, 53, 55, 57, 67	# 1 → 4, 5, 7, 11, 15, 17, 23, 31, **41, 45**, 51 → 57, **59, 61**, 67, 69	Ex. 1 → 6

Calculus, Larson (7th ed.)	**Bare Minimum**	**Extra Practice**	**Examples to Study**
3.7 Optimization Problems	#5, 13, 17, 19, 25, 27, 33, 37, 41, 49	# 5, 7, 11, 13, 17, 19, 20, 24, 25, 27, 33, 35, 37, 41, 49, **59**	Ex. 1 → 5
3.8 Newton's Method	#1,3,5, 15, 27, 33	# 1, 3, 5, 13, 15, 19, 21, 27, 31, 33, **43**	Ex. 1 → 3
3.9 Differentials	#3, 9, 17, 21, 29, 37, 45	# 3, 9, 11, 17, 21, 25, 29, 33, 37, 45, 47, 49, 53	Ex. 1 → 7
4.1 Antiderivatives and Indefinite Integration	#3, 7, 11, 13, 21, 25, 27, 31, 33, 35, 41, 53, 63, 71	# 1 → 41, 45 → 53, 57, 61, 63, 65, 71, 73, 77, 79, 89 → 95	Ex. 1 → 8
4.2 Area and Sigma Notation	#3, 17, 21, 29, 33, 41, 51	# 1 → 11, 15, 17, 21 → 41, 47, 49, 51, 71, 75, 77	Ex. 1 → 6
4.3 Riemann Sums and Definite Integrals	#7, 9, 17, 27, 29, 43, 45	# 3 → 55, 61, 65	Ex. 1 → 6
4.4 The Fundamental Theorem of Calculus	#9, 15, 21, 29, 31, 37, 39, 43, 47, 51, 57, 63, 79, 97	# 7, 9, 13, 15, 21, 23, 27 → 39, 43 → 53, 55 → 60, 63, 69 → 93, 97, 99, 103, 105	Ex. 1 → 8
4.5 Integration by Substitution	#15, 25, 33, 45, 47, 57 69	# 7 → 33, 37 → 81, 85, 89, 95 → 101, 109, 111, 113	Ex. 1 →10
4.6 Numerical Integration	# 3, 7	# 3, 7, **15, 39**, 41	Ex. 1 → 2
5.1 The Natural Logarithmic Function and its Derivative	#9, 13, 25, 33, 37, 41, 49, 55, 57, 71, 73, 75, 79, 89	#3, 5, 7 → 10, 11 → 33, **35**, 37, 41 →63, 71 → 79, **85**, 87 → 97, 105, 106	Ex. 1 → 8
5.2 The Natural Logarithmic Function and Integration	#5, 15, 19, 21, 27, 29, 33, 37, 43, 45, 51, 67, 73, 75	# 1 → 37, 41 → 51, 61, 67, 71, 73, 75, 87 → 90	Ex. 1 → 11
5.3 Inverse Functions	#5, 11, 19, 37, 63, 71, 79	# 5, 9 → 15, 19, 37, 39, **53, 55**, 63→71, 79, 81, 101	Ex. 1 → 6
5.4 Exponential Functions: Differentiation and Integration	#9, 15, 27, 31, 37, 41, 45, 49, 55, 59, 61, 67, 89, 99	# 1 → 21, **23**, 25 → 28, 29, 31, 37, 38, 39→ 61, 64, 65 → 69, 73, 77, 87 → 107, 113, 115, 117, 125, 127	Ex. 1 → 10
5.5 Bases Other than ***e*** and Applications	#5, 15, 23, 25, 31, 43, 45, 49, 57, 6379, 89, 97	# 5 → 25, 31, 35, 41 → 51, 57 → 63, 73, 77 → 81, 89, 97, 101, 103	Ex. 1 → 7

Calculus, Larson (7^{th} ed.)	**Bare Minimum**	**Extra Practice**	**Examples to Study**
5.6 Differential Equations/Growth/Decay	# 3, 7, 13, 15, 23, 27, 43	# 1 $\rightarrow$ 33, 41, 43, 57, 61	Ex. 1 $\rightarrow$ 5

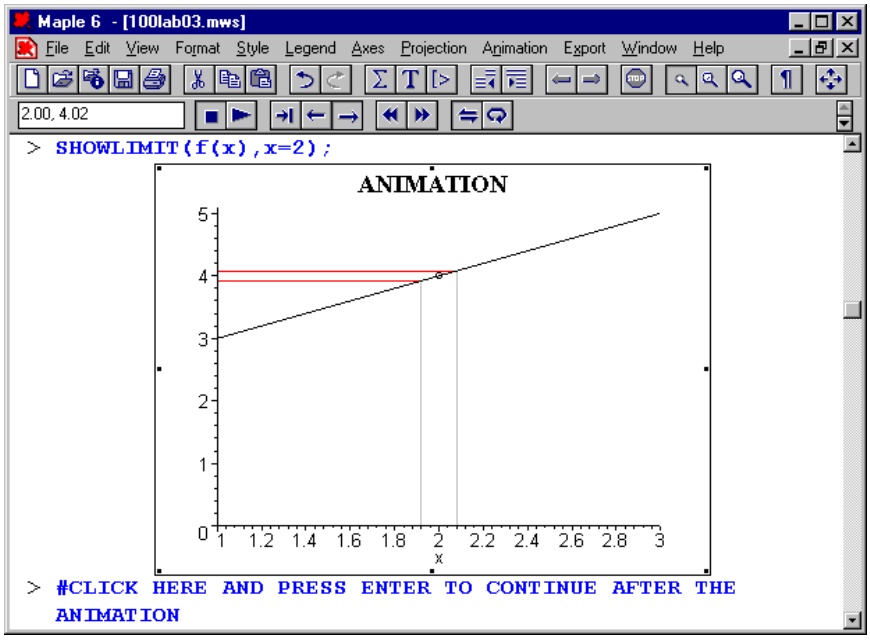
Plots and Animations

Maple plots and animations appear in the worksheet after the command which creates them is executed. After viewing a plot, one may simply proceed to the next command. Animations, however, require you to use the mouse.

1. Click on the animation plot with the mouse pointer. (A selection frame will appear around the plot and a row of VCR buttons will appear at the top of the screen.)

2. Click on the play button  or the single step button  .

3. When you have finished viewing the animation, you must click the mouse pointer on the command line ">#CLICK HERE AND PRESS ENTER TO CONTINUE". Press enter to continue in the lab.



Button	Action	Button	Action
	STOP		PLAY
	SINGLE STEP		SLOW DOWN
	SPEED UP		FORWARD/REVERSE TOGGLE
	LOOP TOGGLE		

Introduction to Maple Labs

Maple is a computer program that can do algebra. Many of the computations we do by hand can be done by Maple. Equations can be solved for variables, polynomials can be factored, expressions can be algebraically simplified, and much more.

The program is operated by executing typed commands. There are many commands and a lot of mathematics involved in mastering Maple. Mastering Maple, however, is not the objective of the labs. The labs are meant to expose you to a Computer Algebra System (CAS) and teach you some of the basic commands.

You will learn these commands by going through pre-typed tutorial lab files called Maple script sheets. The sheets are made up of different coloured type. There are text lines (black, grey, or dark blue type), command lines (blue type preceded by a > and ending with a ; or :), and output lines from Maple (centred red type). The text lines are for you to read. The command lines have to be executed by pressing the Enter key. Many commands have to be typed by you. Other commands are already typed and only have to be executed. When a command is executed, Maple displays the result in red.

Completing a Maple lab is a two-step process:

1. Work through the tutorial lab on the computer.
2. Do the assignment using the commands you have learned in the tutorial.

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GETTING INTO MAPLE

The computer labs are located on the first floor of the Ewing Building. You must go to one of the labs which has Maple installed on its computers. Follow the instructions posted in the lab to log onto Windows and get into Maple.

LOADING AND STARTING THE LAB SHEET

The Maple program will load and you will be see the Camosun College Math Labs main screen. Move the mouse pointer to the underlined name of the Math course you are taking. Click the left mouse button. Click on "Wayne's Labs'. Another window will appear which shows the lab list for your course. Click on the lab you want and the lab will be loaded into Maple. Press ENTER to begin. The commands in the labs must be **sequentially typed and/or executed**. Do not use the mouse to skip command lines. **The mouse should be used only for scrolling and interacting with plots or animations** (see Plots and Animations).

Useful Buttons

 INSERTS A NEW COMMAND PROMPT

 TOGGLES BETWEEN DISPLAY MATH AND INPUT SYNTAX

 RETURNS TO THE PREVIOUS LAB SHEET OR MENU

EXITING MAPLE

When you have finished the lab, you may exit Maple by double clicking on the maple leaf icon in the upper left of the screen. Please do not save changes. Please do not turn off the computer.

Lab 0: Introduction to Maple

Reminders:

- Execute the line at the top of the file (in blue) by clicking on it and pressing Enter.

- Do all the exercises found in Lab 0. These exercises are chosen to demonstrate what Maple can do and how we can use Maple to solve problems. Maple is much more powerful than your (or my) calculator is and it requires that we know a bit more in order to use it. The commands that you practise with here are the commands that you will use in doing the assignment.

- Do not be afraid to experiment with the commands.

- All Maple commands end with a semi-colon (;). Forgetting the semi-colon is the most common error of all.

- The number 3.1415926.. is represented as Pi not pi. Maple will display the symbol in both cases but will only do calculations with Pi.

- Round brackets ( ) only are used in mathematical expressions. Do not use square brackets [ ] or parenthesis { }.

- Make notes of the features that you are using. We will be using these features later and your own notes are your best reference.

- After you have finished the exercise, do the assignment found in the file called IntroAnswers.mws.

- Don’t forget to log off.

Lab 1: Expressions

Reminders:

- Work through the tutorial first. Try the exercises you find there. This experience will make the assignment much easier.

- Entering trigonometric functions in Maple is a bit different from what you might expect.

To get	Type	You will see
$\sin^2 x$	`(sin(x))^2`	$\sin(x)^2$
$\sin(x^2)$	`sin(x^2)`	$\sin(x^2)$

- In order to reduce the amount of typing, we can use the % symbol to represent the last output generated by Maple. This works fine if you execute one statement at a time in the order shown on the screen. However if you jump around in the file executing commands here and there, the last output may not even be visible on the screen when you use %.

- There are optional sections at the end of most of the tutorials. These sections are marked by the following symbol.

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You are not responsible for the commands in these sections but if you have the time take a look at them. You will find different mathematical problems solved and more features in Maple demonstrated. Feel free to explore different commands.

- Don't forget to logoff.

Lab 2: Functions and Limits

Reminders:

- Maple uses the arrow or mapping notation to define a function. This notation is widely used in Britain and Europe and in the field of abstract algebra in North America. Recall that a function is a mapping from one set (the domain) to another (the range). See section P.3 page 19 in the text. For example, the squaring function maps the integer 2 to the integer 4 ($2 \to 4$), the integer 3 is mapped to 9 ($3 \to 9$) and in general, $x \to x^2$.

- Once we have defined the mapping, we will want to assign it a name. In Maple we use the assignment operator : =, a colon followed by an equals sign. (Recall that the = sign by itself is reserved for equations.) So, in Maple, we must use

$$f := x \to x^2$$

to define the function $f(x) = x^2$. If we forget and use $f(x) = x^2$ instead, then we will get all kinds of garbage when we try to use the function.

- Having defined a function correctly with the arrow notation, we can evaluate the function for various inputs. For example, $f(2)$, $f(a+b)$, $f(x)$, $f(t)$, and so on, are all valid Maple expressions.

- The chain rule in section 2.4 of the textbook requires a thorough knowledge of composite functions and how they can be constructed. Question 3 in the prelab is on composite function. There will be more practice in the tutorial part of the lab as well as several questions in the assignment.

- The function f is used in different questions in the assignment (just as it is in the textbook). Be sure that Maple is using the function you want to use.

Lab 3: Differentiation

Reminders:

- Recall that the point slope of a straight line is $y - y_1 = m(x - x_1)$ where the slope of the line is *m* and (x_1, y_1) is one of the points on the line. If we solve for *y* we get:

$$y = m(x - x_1) + y_1$$

If this straight line is tangent to a function f(x) at $(a, f(a))$ then the equation becomes:

$$y = f'(a)(x - a) + f(a)$$

We are going to use this form of the equation in the lab.

Lab 4: Curve Plotting

Reminders:

Theorem 3.4 – The Mean Value Theorem

If *f* is continuous on the closed interval $[a, b]$ and differentiable on the open interval (a, b), then there exists a number *c* in (a, b) such that

$$f'(c) = \frac{f(b) - f(a)}{b - a}.$$

Lab 5: Applications

Reminders:

- In this lab you will be solving optimization problems similar to those in section 3.7.

- You will be making functions, finding derivatives and solving equations. Be sure you know how to do these tasks using Maple.

Lab 6: Integration

Reminders: