CURRICULUM GUIDELINES

A: Instructional Division

B: Faculty of Science & Technology

Date: November 15, 1999

New Course ○ **Revision** ●

If Revision, Section(s) Revised: sections G and Q
Date of last revision: September 1998

C: MATH 120	**D:** CALCULUS I	**E:** 3
Subject and Course Number	**Descriptive Title**	**Semester Credits**

F: Calendar Description: Math 120 is an introductory calculus course for science students. The course includes limits, continuity, and the differentiation of algebraic, trigonometric, inverse trigonometric, exponential and logarithmic functions. Differentiation techniques are applied to graphing, extrema, related rates, and rectilinear motion, as well as to parametric and polar equations.
This course is taught using a graphing calculator.

G: Allocation of Contact Hours to Types of Instruction/Learning Settings

Primary Methods of Instructional Delivery and/or Learning Settings:

The course has four (4) hours of lecture per week. Some sections are offered with a two (2) hour per week lab component.

Note: the maximum lab size is 28.

Number of Contact Hours per week:
4 or 6

Number of Weeks per Semester:
14

H: Course Prerequisites:
either Math 110 or
a grade of A or B in B.C. Principles of Math 12

I: Course Corequisites: none

J: Courses for which this Course is a Prerequisite:
Math 220, Math 232

K: Maximum Class Size:
35 (See note in item G)

L: PLEASE INDICATE:

- ○ **Non-Credit**
- ○ **College Credit Non-Transfer**
- ● **College Credit Transfer:** ~~requested~~/granted

If transfer has been granted, specify course equivalents, unassigned credit or block-transfer component, as appropriate:
SFU: Math 151 **UBC:** Math 100 **UNBC:** Math 100

UVIC: Math 100 (1.5 credits) **Other:** Math 110/120 = UBC Math111

M: Course Objectives/Learning Outcomes
General comments:

Math 120 is a first course in calculus. The four-semester sequence of Math 120, 220, 321, and 421 provides the foundation for continued studies in science, engineering, computer science, and a major in mathematics.

Specific objectives:

At the conclusion of this course, the student should be able to:

- find limits involving algebraic, exponential, logarithmic, trigonometric, and inverse trigonometric functions by inspection as well as by limit laws
- calculate infinite limits and limits at infinity
- apply L'Hôpital's rule to evaluating limits of the types: $\frac{0}{0}, \frac{\infty}{\infty}, \infty - \infty, 0^0, \infty^0, 1^\infty$
- determine intervals of continuity for a given function
- calculate a derivative from the definition
- differentiate algebraic, trigonometric and inverse trigonometric functions as well as exponential and logarithmic functions of any base using differentiation formulas and the chain rule
- differentiate functions by logarithmic differentiation
- apply above differentiation methods to problems involving implicit functions, curve sketching, applied extrema, related rates, and growth and decay problems
- use a differential to estimate the value of a function in the neighbourhood of a given point, and estimate errors
- apply derivatives to solve problems in velocity and acceleration, related rates, and functional extrema
- interpret and solve optimisation problems
- sketch graphs of functions including rational, trigonometric, logarithmic and exponential functions, identifying intercepts, asymptotes, extrema, intervals of increase and decrease, and concavity
- compute simple antiderivatives, and apply to velocity and acceleration
- recognise and apply the Mean Value Theorem and the Intermediate Value Theorem
- be able to convert between parametric and Cartesian forms for simple cases
- use parametric forms to determine first and second derivatives of a function
- sketch graphs of parametric equations and find the slope of a line tangent to the graph at a specified point
- sketch the graph of a polar equation $r = f(\theta)$, and be able to find intercepts and points of intersection
- find the slope of a line tangent to the graph of a polar equation at a point (r, θ)

N: Course Content

1. Limits and Continuity
   - calculations of limits
   - limit theorems
   - continuity at a point and on an interval
   - essential and removable discontinuities
   - intermediate value theorem

2. The Derivative
   - rates of change and tangent lines
   - differentiation from definition
   - differentiation formulas and rules
   - chain rule
   - implicit differentiation
   - higher derivatives
   - related rates
   - the differential and differential approximations
   - linear approximations

3. Inverse Functions: Exponential, Logarithmic and Inverse Trigonometric Functions
   - definitions, properties, and graphs
   - differentiation of logarithmic and exponential functions (any base)
   - applications to graphing, extrema, related rates
   - logarithmic differentiation
   - growth and decay problems
   - differentiation of inverse trigonometric functions
   - applications to graphing, extrema, related rates
   - limits involving combinations of exponential, logarithmic, trigonometric, and inverse trigonometric functions
   - L'Hôpital's rule

4. Graphing and Algebraic Functions
   - increasing and decreasing functions
   - local extrema
   - Rolle's Theorem and Mean Value Theorem
   - curve sketching
   - concavity; inflection points
   - asymptotic behaviour ; limits at infinity; infinite limits
   - applied maximum and minimum problems
   - antidifferentiation
   - rectilinear motion

5. Parametric Equations and Polar Coordinates
   - parametric representation of curves in R^2
   - derivatives and tangent lines of functions in parametric form
   - tangent lines to graphs in polar form
   - definitions and relationships between polar and Cartesian coordinates
   - graphing of $r = f(\theta)$

6. Optional Topics (included at the discretion of the instructor).

- a formal limit proof (using epsilonics)
- application of the absolute value and greatest integer functions
- proofs of the rules of differentiation (differentiation formulas) for algebraic functions
- proofs of the differentiation formulas for trigonometric functions from the definition of
- a proof of L'Hôpital's rule for the case of "0/0"
- Newton's Method

O: Methods of Instruction

Lectures, problem sessions and assignments

P: Textbooks and Materials to be Purchased by Students

Stewart, **Calculus: Early Transcendentals**, 4th Edition, Brooks/Cole

A graphing calculator is also required.

Q: Means of Assessment

Evaluation will be carried out in accordance with Douglas College policy. The instructor will present a written course outline with specific evaluation criteria at the beginning of the semester. Evaluation will be based on the following criteria:

1.	Weekly quizzes	..... 0 - 40%
2.	Tests	..... 20 - 70%
3.	Assignments	..... 0 - 15%
4.	Attendance	..... 0 - 5%
5.	Class participation	..... 0 - 5%
6.	Final examination	..... 0 - 40%

Note: All sections of a course with a common final examination will have the same weight given to that examination.

R: Prior Learning Assessment and Recognition: specify whether course is open for PLAR

Not open for PLAR.

Course Designer(s)

Education Council/Curriculum Committee Representative

Faculty Dean

Registrar