

McMaster University  
Detailed Math 1LS3 and Math 1LT3 Course Outlines

**Math 1LS3 course covers the same topics as the first term of the calculus for science Math 1A3 (functions, limits, derivatives, integrals); see below for a detailed list of topics. Math 1LT3 course covers most topics as the second term of the calculus for science Math 1AA3 (differential equations, functions of several variables); see below for a detailed list of topics. However, applications and material that we cover in Math 1LS3/1LT3 (such as dissolution of drugs in bloodstream, various allometric relationships (heart mass vs body mass), population models, models of spread of infectious diseases, basics of probability, chance and statistical reasoning and so on) make the courses more relevant to anyone in life sciences (and many other disciplines that need calculus) than Math 1A3/1AA3.**

Textbooks used:

**for 1LS3:** Chapters 1-6 from "[Calculus for the Life Sciences: Modelling the Dynamics of Life](#)", by F. R. Adler and M. Lovric, published by Nelson Education, 2011.

**for 1LT3:** Chapter 7 of "[Calculus for the Life Sciences: Modelling the Dynamics of Life](#)", by F. R. Adler and M. Lovric, published by Nelson Education, 2011 and selected topics from the books M. Lovric: "Functions of Several Variables" and M. Lovric: "Probability and Statistics," published by Nelson Education, 2011.

**Material covered in Math 1LS3**

**Introduction to Models and Functions**

- 0.1 Models in Life Sciences
- 0.2 Variables, Parameters, and Functions
- 0.3 Working with Functions

**Modelling Using Elementary Functions**

- 1.1 Elementary Models
- 1.2 Exponential and Logarithmic Functions
- 1.3 Trigonometric and Inverse Trigonometric Functions

**Discrete-Time Dynamical Systems**

- 2.1 Introduction to Discrete-Time Dynamical Systems
- 2.2 Analysis of Discrete-Time Dynamical Systems
- 2.3 Modelling with Discrete-Time Dynamical Systems

**Limits, Continuity and Derivatives**

- 3.1 Investigating Change
- 3.2 Limit of a Function
- 3.3 Infinite Limits and Limits at Infinity
- 3.4 Continuity
- 3.5 Derivatives and Differentiability

**Working With Derivatives**

- 4.1 Derivatives of Powers, Sums, and Polynomials
- 4.2 Derivatives of Products and Quotients
- 4.3 Derivatives of Exponential and Logarithmic Functions
- 4.4 The Chain Rule
- 4.5 Derivatives of Trigonometric and Inverse Trigonometric Functions
- 4.6 The Second Derivative, Curvature, Concavity, and Acceleration
- 4.7 Approximating Functions with Polynomials

## **Applications of Derivatives**

- 5.1 Extreme Values of a Function
- 5.2 Reasoning About Functions: Continuity and Differentiability
- 5.3 Leading Behaviour and L'Hôpital's Rule
- 5.5 Stability of Discrete-Time Dynamical Systems
- 5.6 The Logistic Dynamical System and More Complex Dynamics

## **Integrals and Applications**

- 6.1 Differential Equations
- 6.2 Antiderivatives
- 6.3 Definite Integral and Area
- 6.4 Definite and Indefinite Integrals
- 6.5 Techniques of Integration: Substitution and Integration by Parts
- 6.6 Applications
- 6.7 Improper Integrals

## **Material covered in Math 1LT3**

### **Differential Equations**

- 7.0 Review of Integration
- 7.1 Basic Models with Differential Equations
- 7.2 Equilibria and Display of Autonomous Differential Equations
- 7.3 Stability of Equilibria
- 7.4 Separable Differential Equations
- 7.5 Systems of Differential Equations; Predator-Prey Model

### **Functions of Several Variables** (selection of topics from the following sections)

- SV.1 Introduction
- SV.2 Graph of Function of Several Variables
- SV.3 Limit and Continuity
- SV.4 Partial Derivatives
- SV.5 Tangent Plane and Linearization
- SV.6 The Chain Rule
- SV.7 Second Order Partial Derivatives and Applications
- SV.8 Partial Differential Equations
- SV.9 Directional Derivative and Gradient
- SV.10 Extreme values

### **Probability and Statistics** (selection of topics from the following sections)

- PR.1 Introduction: Why Probability and Statistics
- PR.2 Stochastic Models
- PR.3 Basics of Probability Theory
- PR.4 Conditional Probability and the Law of Total Probability
- PR.5 Independence
- PR.6 Discrete Random Variables
- PR.7 The Mean, the Median, and the Mode
- PR.8 The Spread of a Distribution
- PR.10 The Binomial Distribution
- PR.12 The Poisson Distribution
- PR.13 Continuous Random Variables
- PR.14 The Normal Distribution