

School of Mathematics

Module MA1M01 — Mathematical Methods
(JF Natural Science)

2009-10

Lecturer: Dr. Rupert Levene, Dr. Sinéad Ryan

Requirements/prerequisites: none

Duration: Michaelmas term, 11 weeks

Number of lectures per week: 8 hours per week total, including 5 lectures, 2 tutorials and 1 computer practical.

Assessment: Tutorial work and computer practical work will count 25% of the marks.

End-of-year Examination: 3 hour examination in Trinity term (for 75% of the total marks).

Description: The syllabus is largely based on [Bittinger-G-N].

Calculus for Life Scientists

This part will be lectured by Dr. Levene and there will be 3 lectures plus one tutorial per week.

The syllabus is approximately Chapter 1-5 along with a little of Chapter 8 on differential equations (sections 8.1 and 8.2) from [Bittinger-G-N].

- Functions and graphs. Lines, polynomials, rational functions, trigonometric functions and the unit circle.
- Differentiation. Limits, continuity, average rate of change, first principles definition, basic rules for differentiation.
- Graphical interpretation of derivatives, max/min.
- Exponential and log functions. Growth and decay applications.
- Integration (definite and indefinite). Techniques of substitution and integration by parts. Applications.
- Differential equations and initial value problems, solving first order linear equations. Some application in biology or ecology.

Discrete Mathematics for Life Scientists

Dr. Ryan will be the lecturer for this part. There will be 2 lectures per week, one tutorial and, for several of the weeks, a computer practical.

The syllabus is approximately:

- *Linear algebra.* Matrices, solving systems of linear equations, inverse matrices, determinants, eigenvalues and eigenvectors, solving difference equations. Population growth. (Chapter 6 of [Bittinger-G-N].)
- *Spreadsheets.* Basic concept of programming formulae in a spreadsheet such as Excel (absolute and relative cell references, some typical built in functions like sum, count, if). Formula for least squares fit of a line to points in the plane (without justification?). Graphs. Use of log scales.
- *Data.* Scientific notation, number of significant digits, relative error. Sample mean, median, sample variance.
- *Probability.* Basic concepts of probability. The binomial distribution, expectation and standard deviation for discrete random variables. (Sections 10.1, 10.3, 10.4 of [Bittinger-G-N].)

Textbook:

[Bittinger-G-N] Calculus for the Life Sciences. Marvin Bittinger, Neal Brand, John Quintanilla. Pearson Dec 2005

April 30, 2009