

1. Software

Calculus Connections: A Multimedia Adventure

Douglas Quinney and Robert Harding, John Wiley, 1996. (<http://www.wiley.com>)

Calculus Connections is a multimedia package that uses video, sound and interactive simulations to illustrate how the concepts of calculus are connected to physical phenomena. Each module starts with a multimedia presentation followed by a simulation of this to allow students to explore the underlying mathematics (which acts as a back up for more formal presentations of the maths).

DIAGNOSYS

(free demo version at <http://www.staff.ncl.ac.uk/john.appleby/diagpage/diagindx.htm>)

DIAGNOSYS is a knowledge-based (or expert) system package primarily for testing background knowledge of basic mathematics or other technical subjects. The entry level for this program is set by any prior qualification the user has. It does not serve to teach, but rather show where a particular candidate's weaknesses lie.

Fourier Series in Mathematical Physics

Tatjana S. Belozerova and Victor K. Henner, Physics Academic Software, 1996.

(<http://www.webassign.net/pasnew>)

Fourier Series in Mathematical Physics is a package that allows you to plot Fourier series that approximate analytic functions or discrete values from experimental data. Functions are presented in analytic or tabular form and can be expanded using orthogonal basis sets such as Chebyshev, Jacobi, Hermite, and Laguerre polynomials. It is possible to graph the initial functions, individual members of the series or certain partial sums of the expansion. In addition the software offers two physical systems for analysis: the Dirichlet problem for a circle and the forced one-dimensional oscillator. Includes a 60pp student and instructor guide.

Mathcad

Adept Scientific. (<http://www.adeptsience.co.uk>)

Mathcad Professional is a desktop application that combines the maths, visualization and collaboration power to meet the calculation, analysis, and reporting demands of professionals in every branch of science and engineering research as well as students in very quantitative disciplines. Mathcad combines a powerful technical computing environment centred on real math notation with a flexible, full-featured word processor and presentation. It enables users to enter, edit, and solve equations, to visualize and communicate results graphically. This package can be further extended for teaching by using add-ons (see <http://mathcad.adeptsience.co.uk/eduindex.html>).

Mathematica

Stephen Wolfram, Wolfram Research Europe Ltd, 1996. (<http://www.wolfram.com>)

Mathematica is a fully integrated technical computing system with extensive computational power, including 2D and 3D visualization and programming. One of its main features is its ability to manipulate and solve mathematical expressions both algebraically and numerically. Mathematica will run under several operating systems and platforms.

Maple

Adept Scientific. (<http://www.adeptsience.co.uk>)

Maple is a multimedia package for teaching mathematics. It is simple to use and can be used to define, model, analyse, solve and report on almost any imaginable mathematical scenario.

MATLAB

(<http://www.mathworks.com/products/matlab>)

MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis, and numerical computation.

Mathletics

Martin J. Greenhow, Brunel University. (<http://www.brunel.ac.uk/~mastmmg>)

Mathletics is a suite of software that consists of a vast collection of mathematics and statistics questions collated by Martin Greenhow. This provides the user with material to improve numeracy skills and mathematics tests ranging from GCSE to first year undergraduate. The questions are written in Question Mark for Windows version 3.

Transmath

Department of Applied Mathematics, University of Leeds. (<http://caliban.leeds.ac.uk>)

Transmath is a computer-based mathematics tutor designed to strengthen and consolidate the basic mathematical knowledge of students commencing numerate degrees. Developed by research mathematicians, the software has been used since 1994 in many UK universities to ease the transition to undergraduate studies.

TLTP Chemistry Tutor

TLTP, Chemistry Courseware Consortium, Liverpool University.

(<http://www.liv.ac.uk/ctichem/c3intro.html>)

This undergraduate teaching package contains maths modules covering algebraic equations, basic factorisation, partial fractions, SI Units, differentiation in chemistry, line $y=mx+c$ and using tables and graphs.

TLTP Mathwise

TLTP, NAG. (<http://www.bham.ac.uk/mathwise>)

The Mathwise resource consists of a total of 48 mathematical and application modules. It covers most of the mathematical topics taught in pre-university and first year university together with a number of key topics in second-year university courses in science and engineering such as Astronomy, Mechanics and Earth Sciences.

2. Web-sites

Physical Sciences Centre homepage (<http://www.physsci.heacademy.ac.uk>)

The Higher Education Academy Physical Sciences Centre web-site offers support for maths under its 'Subject Themes' heading. There are also reviews of books, software and web sites at <http://physsci.liv.ac.uk/Resources/Reviews.aspx> and guides to equations & formulae for chemistry and for physics at <http://physsci.liv.ac.uk/Publications/Publications.aspx> on this site.

Math, Stats and OR Network homepage (<http://ltsn.mathstore.ac.uk>)

This Network's web-site is generally helpful. In particular it has a number of booklets that are useful both for undergraduate mathematics students and scientists (eg Facts and Formulae, Algebra Refresher, Calculus Refresher). See <http://mathstore.ac.uk/publications/index.shtml#facts>.

Engineering Subject Centre homepage (<http://www.ltsneng.ac.uk>)

This site features details of the 'Measuring the Mathematics Problem' findings and contains a link to a site where the report can be downloaded. It also has excellent reviews of mathematics learning software of particular use to engineers.

CTI Mathematics' resources sheet (prepared in 1997)

(<http://www.bham.ac.uk/ctimath/workshops/w-napier.htm>)

This contains links that are primarily aimed at teaching and learning in degree-level mathematics, but some sites may be of use at other levels. Another, more up-to-date version (prepared in 2000) is at <http://ltsn.mathstore.ac.uk/workshops/loughborough.htm>.

Imperial College maths education technology (<http://metric.ma.imperial.ac.uk/new/html/index.html>)

Imperial College are heavily involved in researching transitional maths education for scientists. This site contains some useful links and information on the software packages Mathematica and Maple.

Wolfram Research (<http://www.wolfram.com>)

The site for Mathematica - allows purchase of the package on-line and access to its many applications.

Waterloo Maple homepage (<http://www.maplesoft.com>)

Offers a detailed guide and tour of the Maple software package and shows examples of teaching materials prepared using the software. There is also the opportunity to apply for a free trial CD.

Durham University Mathematics for Engineers and Scientists homepage

(<http://maths.dur.ac.uk/~dma0ck/mes.html>)

This web-site, although designed for students at Durham, is of interest to anyone thinking about remote learning. It contains problem sheets and answers, presumably available after students have submitted them. There are also recommended books and software packages and access to Maple.

Adept Scientific homepage (<http://www.adeptscience.co.uk>)

The Adept Scientific site gives details of Maple and Mathcad, as well as other science software packages. There is an on-line shop where all the available software can be purchased.

Transmath homepage (<http://caliban.leeds.ac.uk>)

The Transmath homepage allows visitors to download a demo version of the Transmath software. There is a mailing list, which keeps subscribers up to date with new advances in software and also offers solutions to any problems experienced.

University of Newcastle-upon-Tyne, John Appleby's homepage

(<http://www.staff.ncl.ac.uk/john.appleby>)

This site allows the download of a trial version of DIAGNOSYS and other software. There is also a list of publications on teaching undergraduates mathematics, covering maths for scientists.

LATEX/PDF Support Materials for Learning Mathematics

(<http://www.tech.plym.ac.uk/maths/resources/PDFLaTeX/mathaid.html>)

Robin Horan and Martin Lavelle have produced a library of portable, interactive, web based support packages to help students learn various mathematical ideas and techniques. The packages are in Adobe's Portable Document Format (PDF) and include exercises and quizzes which give students immediate feedback on their understanding of the material. This project uses LaTeX and PDF, to produce mathematical formulae of a professional standard, which are easy for students to read.

New Web-based Learning tools for Maths in Physical Chemistry

(<http://www.staff.lboro.ac.uk/~cmksr/index.html>)

Karl Ryder's project focuses on the development of student-centred web-based learning software tools to help students with mathematical manipulations and calculations; in particular, the application of fundamental equations, relations, and functions to problems in Physical Chemistry.

A Modular Library of Resources for the Development of Mathematical Skills in the Physical Sciences

(http://physsci.liv.ac.uk/resources/math_hierarchy/home.html)

A modular bank of question sets which provide a means of testing a particular top level skill relevant to the physical sciences together with its associated subordinate skills. Created by Paul C Yates, Keele University.

3. Books and publications

Basic Mathematics for the Physical Sciences (& Further Mathematics for the Physical Sciences)

Robert Lambourne and Michael Tinker, John Wiley and Sons Ltd, 2000. (<http://www.wiley.co.uk>)

These books provide a thorough introduction to the essential mathematical techniques needed in the physical sciences. Carefully structured as a series of self-paced and self-contained chapters, the texts cover the basic techniques on which more advanced material is built. The reader is guided through these different techniques with the help of numerous worked examples, applications, problems, figures and summaries.

Mathematics for Physical Chemistry

Robert G. Mortimer, Academic Press, 1999. (<http://books.elsevier.com/>)

This book requires some prior knowledge of mathematics, but not necessarily A-Level standard. It is useful in that it provides students with reviews of all basic mathematics required for physical chemistry at degree level and applies the ideas directly to problems they will encounter.

Maths Skills for Advanced Sciences

Ken Price, Oxford University Press, 2000. (<http://www.oup.co.uk>)

This small book is aimed primarily at A-Level students, in order to provide them with sufficient maths to succeed in the physical sciences. However, it also acts as a useful refresher course for undergraduate scientists. The book is aimed specifically at those students obtaining lower grades in GCSE maths, and uses science concepts to explain the mathematics studied. It also provides a revision of very basic mathematics.

Foundations of Science Mathematics (and Worked Problems)

Devidrjit Singh Sivia and S. G. Rawlings, Oxford University Press, 1999. (<http://www.oup.co.uk>)

These texts span a large range of mathematics from basic algebra to calculus and Fourier transforms. The tutorial style of the books bridges the gap between school and university while its conciseness provides a useful reference for the professional. The Worked Problems companion volume gives a broad range of worked mathematical examples that assume no more than GCSE-level maths.

Beginning Mathematics for Chemistry

Stephen K. Scott, Oxford University Press, 1995. (<http://www.oup.co.uk>)

This workbook is designed for candidates without A-Level chemistry. It aims to be a mathematics 'toolkit' rather than a formal course and this flexibility allows the student to study alone or in a group. The material covered is taken from examples of first year chemistry courses in approximately six three-hour sessions.

Engineering Mathematics

K. A. Stroud and Dexter Booth, Palgrave Publishers Ltd, 2001/5th Edition. (<http://www.palgrave.com>)

This well-known textbook has been fully revised to meet the needs of students entering engineering without prior qualifications. It comes with a CD-ROM that provides stepped hints, worked solutions and immediate feedback on exercises or problems. The CD-ROM is also available in a networkable version, which allows channelling of student progress through to the tutor.

Basic Training in Mathematics – A Fitness Program for Science Students

R. Shankar, Springer, 1995. (<http://www.springeronline.com>)

Based on course material in use at Yale University, this practical text addresses the widening gap found between the mathematics required for courses in the physical sciences and the knowledge of the incoming students. The book offers students an opportunity to strengthen their skills by solving the given problems.

Mathematics in Engineering and Science

L. R. Mustoe and M. D. J. Barry, John Wiley and Sons Ltd, 1998. (<http://www.wiley.co.uk>)

This textbook is the follow-up to 'Foundation Mathematics' by the same authors, and features a brief synopsis of the topics covered as a preface. The authors have experience in educating a wide variety of students with all manner of entry qualifications and the text reflects this.

Engineering Mathematics – A Programmed Approach

C. W. Evans, Nelson Thornes Publishing, 1997/3rd Edition. (<http://www.thornes.co.uk>)

This text covers mathematics for first year engineering students. It has recently been modified to reflect the change both in the Engineering syllabus and in the mathematical knowledge of the incoming students. The book starts with a basic introduction to the mathematics required and subsequent chapters build on these.

Chemical Calculations

Paul C. Yates, Nelson Thornes Publishing, 1997. (<http://www.thornes.co.uk/>)

Chemical Calculations provides an introduction to the mathematics required for physical chemistry courses. This book is unique in that it provides a gentle introduction with a chemistry centered - rather than math centered - approach.

Mathematical Techniques

D. W. Jordan and P. Smith, Oxford University Press, 2002/3rd Edition. (<http://www.oup.co.uk>)

Comprehensive coverage of mathematics useful to undergraduates in the physical sciences and engineering.

Maths for Chemists Volume I & II

Martin C. R. Cockett and Graham Doggett, Royal Society of Chemistry, 2003. (<http://www.rsc.org>)

These books cover; Numbers, Functions and Calculus (vol I) and Power Series, Complex Numbers, Linear Algebra (vol II).

Studying Mathematics and its Applications

Peter Kahn, Palgrave Macmillan Ltd, 2001/1st Edition. (<http://www.palgrave.com>)

This book is a study guide to enhance undergraduate learning skills in mathematics.

Mathematics Teaching Practice

John H. Mason, Horwood Publishing (in association with Open University), 2002.

(<http://www.horwoodpublishing.net>)

A guide for university and college lecturers.

The MathsTEAM Project

(<http://mathstore.ac.uk/mathsteam/index.htm>)

A joint initiative by LTSN Engineering, LTSN Maths, Stats & OR Network, UK Centre for Materials Education and LTSN Physical Sciences aimed at utilising the knowledge of methods current in the science and engineering communities.

The information has been published in three booklets:

Maths Support for Students (http://mathstore.ac.uk/mathsteam/packs/student_support.pdf)

Maths for Engineering and Science (http://mathstore.ac.uk/mathsteam/packs/engineering_Science.pdf)

Diagnostic Testing for Mathematics (http://mathstore.ac.uk/mathsteam/packs/diagnostic_test.pdf)

4. FDTL Phase 4 Projects

Promoting Physics Learning And Teaching Opportunities (PPLATO)

(<http://www.rdg.ac.uk/AcaDepts/sp/PPLATO/publish>)

PPLATO is producing resources to support the teaching of physics and maths at university first year and foundation year levels. The materials will be designed for teaching, assessment and diagnostics and may be studied within a university course or in self study. Delivery will be via CD-ROM and the teaching support may vary from face-to-face to on-line. Flexibility of use for both the teacher and the learner is a key feature of the resource.

HELM: Helping Engineers Learn Mathematics

(<http://www.lboro.ac.uk/research/helm>)

HELM aims to enhance the mathematical education of engineering undergraduates by the provision of a range of flexible learning resources and to drive student learning via a computer based assessment regime. The intention is to produce workbooks, computer aided assessment modules and computer aided learning resources.

National Mathematics Support for the School/University Interface

(<http://www.mathcentre.ac.uk>)

mathcentre offers students quick reference guides, practice and revision materials, workbooks and online practice exercises on many branches of mathematics, including: Algebra, Arithmetic, Complex Numbers, Differentiation, Finance, Functions & Graphs, Geometry, Guides & Case Studies, Integration, Matrices, Numeracy Skills, Sequences & Series, Statistics, Trigonometry and Vectors.