

Developing Mathematical skills

Today, a wide variety of disciplines require their students to have knowledge of certain mathematical tools. Students of the biological sciences, finance, business and management are now finding that they routinely need to perform calculations which require them to have a firm understanding of basic ideas in algebra and calculus. Furthermore some employers use standard mathematics tests as a screen for recruiting graduates regardless of their degree discipline.

There is a wealth of mathematical material in many books, handouts and other resources, but getting the most from these requires a particular approach. The following points may help you to develop your own mathematical skills.

- new ideas are built upon existing ones
- learning mathematics needs active participation
- a lot of practice is required
- technology can help you to learn

New ideas are built upon existing ones

In mathematics almost all early building blocks are required in advanced work. New ideas are usually built upon existing ones. This means that if some early topics are not adequately mastered, difficulties are almost certain to arise later on. For example, if you have not mastered the arithmetic of fractions, then you will find some aspects of algebra confusing. Without a firm grasp of algebra you will not be able to perform the techniques of calculus, and so on. It is therefore essential to try to master the full range of topics in your mathematics course and to remedy deficiencies in your prior knowledge.

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Did you know that there are computer programs that can help you learn mathematics?

Learning mathematics needs active participation

What does this mean?

In order to get a sound understanding of any mathematical topic it is essential that you actually perform the calculations yourself. You can't learn mathematics by being a spectator. You use your brain to solve the problem and you write out the full solution. These are essential parts of the learning process. It is not sufficient to watch someone else solve a similar problem, or read a solution in a book, although these things of course can help. This is rather like trying to do a crossword puzzle. If someone provides you with the answers you might be able to see how each answer fits its clue. This however, is very different from working out the answers yourself. The test of real understanding is whether or not you can do the necessary work on your own.

How do I do it?

When looking through a worked example, read it through carefully and ensure you understand each stage of the calculation. Then try to solve the same problem again yourself without reference to the worked solution. Then try similar problems from a set of exercises.

A lot of practice is required

To understand fully and be competent in handling a particular topic it is vital that practice exercises are undertaken. This is because practice enhances understanding, reinforces the technique and aids memory.

Carrying out exercises allows you to experience a greater variety of problems, thus building your expertise and developing confidence. In some ways learning mathematics is like learning to play a musical instrument. As anyone who plays a musical instrument knows, many hours of practice, including scales and studies, are essential before a difficult piece of music can be played well.

What maths will I need?

Engineers, Scientists

- thorough knowledge of basic algebra
- *common functions and their graphs*
- basic understanding of differentiation and Integration
- *ability to draw and interpret graphs and charts*
- trigonometry and geometry
- **matrix algebra, vector algebra**
- differential equations

Business, Economics, Social Sciences

- thorough knowledge of arithmetic
- application to percentages, ratios, interest and exchange rate calculations
- interpreting graphs and charts
- basic ideas in statistics and probability

Numerical skills useful for graduates in any discipline

- knowledge of arithmetic and its application to financial calculations and percentages
- understanding of common ways in which data is presented e.g. bar chart, histogram
- probability, elementary statistics e.g. mean, standard deviation

The following topics form an essential foundation for most programmes of study:

- arithmetic of whole numbers
- adding, subtracting, multiplying and dividing fractions
- basic algebra (handling symbols)
- evaluating and rearranging formulas
- graph plotting
- understanding tables and charts

How might maths and statistics be used on my course?

in Business or Management?

- data analysis following a survey or questionnaire
- working out the optimum route taken by a travelling salesman
- warehouse stocking and re-ordering
- analysing the effect on profit of a T.V. advertising campaign

in Science and Engineering?

- analysis of engineering systems
- predicting air flow over an aerofoil
- describing orbits of planets or satellites
- deciding the most effective drug dosage
- analysis of experimental data

Overcome gaps in your knowledge...

- identify key support services who can offer guidance e.g. Mathematics Learning Support Centre, Careers Service
- seek advice about a suitable text book through your department or the Library

**Have you thought about revising maths from videos?
The Mathematics Learning Support Centre can advise.**

Technology can help you to learn

Did you know that...

...you can learn mathematics using self-study computer packages?

Computer-assisted learning (CAL) packages are designed to teach you mathematics and statistics. They act like tutors or textbooks but you can work at your own pace, in your own time, on the topics you need, and they exhibit other attractive features such as interactivity, graphics and sound. Some packages use video clips to bring the mathematics to life.

Two such packages are Mathwise and Transmath, but there are many more. Other packages are diagnostic and you can use them to assess your strengths and weaknesses. Some packages are written for specific student groups such as 'maths for chemists', or 'stats for social sciences'. Ask your tutors where you can obtain access to CAL material like this.

...there are simple-to-use computer packages which will solve problems in algebra, calculus and an enormous number of other mathematical areas?

Mathematicians have always used tools to help solve mathematical problems, for example the ancient abacus and slide rule. Today there are sophisticated computer packages which make it simple to solve equations, plot graphs, and perform calculations in algebra, calculus, trigonometry and so on. They do for symbols what calculators do for numbers. Two such packages are Derive and Maple. Ask your tutors where you can obtain access to packages like these.

...graphical calculators are now available?

These have a very wide range of mathematical functions, can plot graphs and perform statistical calculations. Many can handle matrices, and solve equations. Ask your tutors for advice before buying a calculator.

A final word or two...

To learn mathematics requires some hard work and effort on your part. No one else can do this for you and there is no easy way out. You must assume responsibility for the scope and direction your learning takes.

Identify your needs and take action and remember, you can succeed!

Good luck!

This Study Advice Sheet has been developed by Professional Development and the Mathematics Learning Centre on behalf of the Library. All study advice sheets are also available to view and download from:- <http://www.lboro.ac.uk/library/skills>

The Mathematics Learning Support Centre website: <http://mlsc.lboro.ac.uk>



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