

## MATHEMATICS AT WARWICK: PRELIMINARY READING

You may still be busy with examinations and you should certainly be spending your energy on these. However, once they are all over, it is a good thing to prepare yourself for your university mathematics course by doing some preliminary reading.

In the first year at Warwick, some topics are covered rather rapidly. These include complex numbers, manipulating inequalities, trigonometric identities (e.g.  $a \sin x + b \cos x = R \sin(x + \varphi)$  where  $R = \sqrt{a^2 + b^2}$  and  $R \cos \varphi = a$ , writing  $\sin x + \sin y$  as a product, etc.), hyperbolic trigonometric functions (sinh, cosh, etc.), advanced integration techniques (partial fractions, reduction formulae, substitution by  $\tan(x/2)$ , etc.), differential equations (at least first order by separation of variables), vectors (including dot and cross product),  $2 \times 2$  matrices and their use in solving pairs of simultaneous linear equations in two variables, and proof by induction. These topics may well have been covered in your A-Level syllabus but, if not, you would be wise to look them up in a text book and work on a good number of problems prior to coming to Warwick. If your textbook does not cover these topics then we suggest the following books:

*Mathematics – The Core Course for A-Level* by L. Bostock and S. Chandler, (Publisher: Nelson Thornes, 1981; ISBN: 0859503062). The revised version of this, *Core Maths for A-Level*, is less suitable. The older version, *Pure Mathematics Vols. 1 and 2* by the same authors, is also suitable.

*Further Pure Mathematics* by L. Bostock, S. Chandler, and C. Rourke (Publisher: Nelson Thornes, 1982; ISBN: 0859501035).

*Further Pure Mathematics* by B. Gaultier and M. Gaultier (Publisher: OUP Oxford, 2001; ISBN: 0199147353).

University mathematics is somewhat different from A-Level mathematics in that it has a theoretical flavour to it. In particular, definitions (even of relatively familiar terms like ‘limit’) are stated carefully in order to formulate concepts unambiguously and concisely. Careful study of examples reveals facts which are observed to hold true in a variety of circumstances. These are often stated as theorems which are then proved. This admittedly rather abstract development leads to powerful methods for solving problems that are inaccessible by the more direct methods of A-Level mathematics. For instance, mathematicians were surprised to discover that there is no formula for finding the roots of a general polynomial of degree five that is analogous to the quadratic formula for solving polynomials of degree two. This discovery required a detailed study of the permutations of 5 objects which, at first, seems to be totally unrelated to polynomials.

The following two books below can serve to introduce you to university mathematics.

*A Concise Introduction to Pure Mathematics* by M. Liebeck (CRC Press, 2005; ISBN: 1584885475).

*Guide to Analysis* by M. Hart (Macmillan 2001; ISBN: 0333794494).

The book by Hart is a recommended text for the first-year module “Analysis”.

The books in the next list are not textbooks and will not be required for any course. You should be able to get hold of at least one of them through your school or public library. They are great fun to read (at least in parts) but do not expect to read them as you would a novel. In particular, you may choose not to read them from cover to cover but to browse through the chapters and select sections which grab your attention. Do not be discouraged if you become confused during the first reading. Read on; new ideas are usually easier to assimilate at a second or third reading. Getting to grips with mathematical ideas requires many hours of careful reflection. Be patient, and persist until enlightenment dawns!

*Mathematics: a Very Short Introduction* by T. Gowers (Oxford Paperbacks, 2002; ISBN: 0192853619).

*What is Mathematics?* by Richard Courant and Herbert Robbins, 2nd edition revised by Ian Stewart (Oxford University Press, 1996; ISBN: 0195105192).

*The Pleasures of Counting* by T. W. Körner (Cambridge University Press, 1996; ISBN: 0521568234).

*The Book of Numbers* by John H. Conway and Richard G. Guy (Springer NY, 1998; ISBN: 038797993X).

*The Mathematical Experience* by P. Davis & R. Hersh (Penguin 1990; ISBN: 0140134743).

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We will be contacting you again in early September, after it is confirmed that you have gained a place on one of the Mathematics courses at Warwick, with further details on how you should prepare yourself for coming here.