

# FP020-30 Pure Mathematics

**22/23**

**Department**

Warwick Foundation Studies

**Level**

Foundation

**Module leader**

Abdel Modawi

**Credit value**

30

**Assessment**

40% coursework, 60% exam

**Study location**

University of Warwick main campus, Coventry

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## Description

### Introductory description

FP020-30 Pure Mathematics

[Module web page](#)

### Module aims

To develop the students understanding of mathematics and mathematical processes to enable progression onto a range of undergraduate degree programmes.

To develop an understanding of how mathematics can be used in different areas of study and to use mathematics as an effective means of communication.

### Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

1. Outline Syllabus

Introduction to Mathematical logic

- Logical connectives.
- Truth tables and equivalent statement.
- Definition of a proof.

- Proofs by contradictions.  
Sets, Functions and Number systems
- Number systems.
- Natural numbers, Rational numbers and Real numbers.
- Mathematical Induction.
- Basic Set Theory: Unions and Intersections of sets. Venn Diagrams and De Morgan laws.  
Cartesian Products and Power sets.
- Functions. Domains, codomains and ranges. Injective, surjective and bijective functions.  
Inverse functions. Graphs of functions.
- The modulus function and its properties.  
Polynomials and Rational Functions
- Polynomials.
- Multiplication and long division of polynomials.
- The remainder theorem and the factor theorem. Solution of quadratic cubic equations and equations involving higher order polynomials.  
Curves Sketching
- Sketching curves and graphs of functions defined by polynomials and rational functions.
- Sketching graphs involving the modulus function.
- Transformations of graphs: Translation, stretches and reflections. Symmetries.
- Solution of inequalities involving rational functions and the modulus function.  
Coordinate Geometry in 2- and 3-Dimensions
- Equation of a straight line.
- Equation of circle.
- Parametric equations of curves.
- Equation of a plane.
- Intersection of line and curve.
- Equations of tangents and normals.
- Parabolas. Ellipses. Hyperbolas.  
Sequences and Series
- Arithmetic and geometric series sum to  $n$  terms, sum to infinity.
- Binomial expansion.
- Trigonometry
- Sine, cosine, tangent functions.
- Triangles and area.
- Sine rule and cosine rule.
- Radian measurement.
- Reciprocal and inverse trigonometric functions.
- Graphs of trigonometric functions.
- Trigonometric identities. Addition formulae.
- Solution of trigonometric equations in a given interval.  
Exponentials and Logarithms
- $\log_a(x)$  and its relation to  $a^x$ .
- Properties of exponentials and logarithms.
- Solutions to equations of the form  $a^x=b$ .
- The function  $e^x$ ,  $\ln x$  and their graphs.

- Exponential growth and decay
- Differentiation
- Derivative of  $f(x)$  as the gradient of the tangent to the graph of  $y=f(x)$ .
- Derivatives of  $x^n$ ,  $e^x$ ,  $\ln x$ , and trigonometric functions.
- Sum rule, products rule, quotient rule, chain rule.
- Application of differentiation to gradients, tangents and normals, maxima and minima, stationary points, increasing and decreasing functions.
- Implicit and parametric differentiation.
- Integration
- Indefinite integration as the reverse of differentiation.
- Definite integrals and relation to area under graph.
- Fundamental theorem of calculus.
- Integrals of  $x^n$ ,  $e^x$ ,  $1/x$ ,  $\sin x$ ,  $\cos x$ .
- Evaluation of definite integrals.
- Volume of revolution.
- Integration by substitution, parts, and partial fractions.
- Differential Equations
- Formation of simple differential equations.
- Rates of growth.
- Solution of first order equations by separation of variables.
- Complex Numbers
- Basic arithmetic.
- Argand diagram.
- Polar form. Exponential form.
- de Moivre's theorem.
- Roots of polynomials.
- Application to trigonometric identities

## Learning outcomes

By the end of the module, students should be able to:

- Demonstrate competence in mathematical reasoning skills, and in tackling the mathematical principles and processes to enable progression onto an undergraduate degree course.
- Construct and present mathematical arguments through appropriate use of logical deduction and precise statements involving correct use of symbols and appropriate mathematical language.
- Identify, formulate, abstract, and solve mathematical problems that use tools from a variety of mathematical areas, including algebra, analysis, Calculus, and differential and Geometry.
- Use mathematical principles in the analysis and solution of real- world problems in the sciences and engineering.

## Indicative reading list

1. Calculus Concepts and Methods. Authors: Ken Binmore and Joan Davies. Cambridge University Press 2001.

2. Introducing Pure Mathematics. Author: Robert Smedley  
Oxford University Press 2001.

### **Subject specific skills**

Develop students ability to propound correct logical mathematical arguments and to be able to identify valid and invalid propositions.

### **Transferable skills**

Mathematics for use in IRS, Economics, Computer Science.  
Basics of logic for use in SPAMM, Computer Science.

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## **Study**

### **Study time**

<b>Type</b>	<b>Required</b>
Lectures	25 sessions of 1 hour (25%)
Seminars	75 sessions of 1 hour (75%)
Total	100 hours

### **Private study description**

Private Study, practice of topic, revising of lecture materials.

## **Costs**

No further costs have been identified for this module.

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## **Assessment**

You must pass all assessment components to pass the module.

### **Assessment group D2**

	<b>Weighting</b>	<b>Study time</b>
Short answer and MCQs 3	15%	10 hours
Short answer and MCQs 1	10%	5 hours
Short answer and MCQs 2	15%	10 hours
In-person Examination	60%	15 hours

hand-written examination

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- Answerbook Pink (12 page)
- Students may use a calculator

### **Feedback on assessment**

- (i) Written feedback delivered via tabula.
- (ii) Generic feedback in a seminar.
- (iii) Face to face feedback.

[Past exam papers for FP020](#)

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## **Availability**

### **Courses**

This module is Core for:

- FIOE Warwick International Foundation Programme
  - Year 1 of FP18 Warwick International Foundation Programme - Computer Science
  - Year 1 of FP17 Warwick International Foundation Programme - Economics
  - Year 1 of FP13 Warwick International Foundation Programme - Mathematics and Economics
  - Year 1 of FP16 Warwick International Foundation Programme - Mathematics and Statistics