FP020-30 Pure Mathematics

23/24

Department
Warwick Foundation Studies
Level
Foundation
Module leader
Chris Jones
Credit value
30
Module duration
25 weeks
Assessment
50% coursework, 50% exam
Study location
University of Warwick main campus, Coventry

Description

Introductory description

FP020-30 Pure Mathematics

Module aims

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

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.

- Fundamentals (number systems such as real/rational/irrational/integers ; notation for real intervals ; algebraic fluency including factorising, equations and graphs, straight lines, quadratics, indices and surds ; one-to-one and many-to-one functions ; composite and inverse functions)
- Polynomials 1 (factor theorem and remainder theorem ; solving cubics ; graph transformations ; sketching graphs involving the modulus function)
- Polynomials 2 (sketching rational functions ; solving inequalities involving rational functions and/or the modulus function)

- Polynomials 3 (decomposing proper and improper rational functions into partial fractions ; binomial expansions with positive integer power)
- Sequences and Series (arithmetic and geometric series ; infinite power series version of the binomial expansion)
- Exponentials and Logarithms (behaviour of general exponential functions ; logarithm simplification laws and using logarithms to solve exponential equations ; the exponential function and natural logarithm)
- Trigonometry 1 (behaviour of the sine, cosine and tangent functions and their reciprocals ; use standard trigonometric identities to prove unseen trigonometric identities ; radian angle measure)
- Trigonometry 2 (determine solutions to trigonometric equations within any given interval ; use of sum and difference formulae, double-angle identities, sum-to-product and product-to-sum formulae)
- Trigonometry 3 (finding and using the harmonic form ; solving equations and proving identities involving the inverse trigonometric functions)
- Conic Sections (the geometric properties of circles, parabolas, ellipses and hyperbolas, and the standard forms of their equations ; finding tangent lines to graphs of conic sections)
- Coordinate Geometry (vector notation and arithmetic, including magnitude and dot product ; vector equations for straight lines in two- and three-dimensional space ; determining intersection of two lines in three-dimensional space ; shortest distance problems)
- Differentiation 1 (finding derivatives of polynomials, exponential functions, logarithm functions and trigonometric functions ; using the chain rule, product rule and quotient rule ; using derivatives to find gradients of curves and tangent and normal line equations ; finding and classifying stationary points of curves)
- Differentiation 2 (implicit differentiation ; finding the derivative of a curve described by a pair of parametric equations ; use both implicit differentiation and parametric differentiation to find stationary points and classify them using the second derivative)
- Integration 1 (find indefinite integrals of polynomial, exponential, reciprocal and trigonometric functions, applying the chain rule in reverse when required ; evaluate definite integrals and use them to find areas bounded between curves and the coordinate axes ; volumes of revolution)
- Integration 2 (integration by substitution ; integration by parts ; finding general and particular solutions to separable differential equations)
- Complex Numbers 1 (the imaginary unit and its powers ; arithmetic of complex numbers ; finding complex solutions to polynomial equations ; visualising complex numbers as points in the complex plane ; finding the modulus and argument of a complex number ; representing complex numbers using polar/modulus-argument form and Euler/exponential form)
- Complex Numbers 2 (using De Moivre's Theorem to prove various real-valued trigonometric identities ; finding complex solutions to power equations, including roots of unity)
- Mathematical Logic (use truth tables and truth functions to explore properties of compound propositions, including to determine whether or not a compound proposition is a tautology, contingency or contradiction, and whether or not two compound propositions are logically equivalent)
- Systems of Proof (construct rigorous logical proofs of statements by an appropriate method, including direct proof, proof by exhaustion, disproof by counterexample, proof by contrapositive, proof by contradiction, proof by induction)

- Sets (further set notation including complement and the difference between two sets ; using De Morgan's Laws and the distribution laws to simplify expressions involving sets ; construct proofs that a given set is a subset of another, or that two given sets are equal)
- Functions (formally prove whether or not a given function is injective, surjective, and bijective ; prove statements involving composite functions, image sets and pre-image sets)

Learning outcomes

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

- Construct mathematical proofs, and in so doing use relevant mathematical principles and processes to enable progression onto an undergraduate degree course.
- Identify, formulate, abstract, and solve mathematical problems that use tools from a variety of mathematical areas, including algebra, analysis, Calculus, and Geometry.
- Construct and present mathematical arguments through appropriate use of logical deduction and precise statements involving correct use of symbols and appropriate mathematical language.
- Use mathematical techniques e.g. differential equations, that are applicable to solution of real- world problems in applied sciences.

Indicative reading list

View reading list on Talis Aspire

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.

Study

Study time

Type	Required
Lectures	25 sessions of 1 hour (8%)
Seminars	75 sessions of 1 hour (25%)
Private study	140 hours (47%)
Total	300 hours

Type	Required
Assessment	60 hours (20%)
Total	300 hours

Private study description

No private study requirements defined for this module.

Costs

No further costs have been identified for this module.

Assessment

You must pass all assessment components to pass the module.

Assessment group C

	Weighting	Study time
Class Test 1	25%	15 hours
Students complete short-answer questions covering the topics from the first section of the module, in timed test conditions.		
Class Test 2	25%	15 hours
Students complete short-answer questions covering the topics from the second section of the module, in timed test conditions.		
In-person Examination	50%	30 hours
Students complete longer examination questions across all topics of the module, including some which may require them to link multiple topics together.		

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

Feedback on assessment

Students will be given the opportunity to view their marked scripts and receive further verbal feedback in seminars

Past exam papers for FP020

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