

## A Level Preparation: Mathematics

Module Code: DLAPMAT

<b>Module Type</b> see curriculum	<b>Admission Requirements</b> DLFSWE01_E	<b>Study Level</b>	<b>CP</b> 10	<b>Student Workload</b> 300 h
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<b>Semester / Term</b> see curriculum	<b>Duration</b> Minimum 1 semester	<b>Regularly offered in</b> WiSe/SoSe	<b>Language of Instruction and Examination</b> English
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### Module Coordinator

Prof. Dr. Veronica Mas (A Level Preparation: Mathematics AS) / Prof. Dr. Veronica Mas (A Level Preparation: Mathematics A)

### Contributing Courses to Module

- A Level Preparation: Mathematics AS (DLAPMAT01)
- A Level Preparation: Mathematics A (DLAPMAT02)

### Module Exam Type

#### Module Exam

#### Split Exam

A Level Preparation: Mathematics AS

- Study Format "Distance Learning": Exam

A Level Preparation: Mathematics A

- Study Format "Distance Learning": Exam

### Weight of Module

see curriculum

**Module Contents****A Level Preparation: Mathematics AS**

- Quadratic
- Functions
- Coordinate geometry
- Circular measure
- Trigonometry
- Series
- Differentiation
- Integration
- Representation of data
- Permutations and combinations
- Probability
- Discrete random variables
- The normal distribution

**A Level Preparation: Mathematics A**

- Algebra
- Logarithmic and exponential functions
- Trigonometry
- Differentiation
- Integration
- Numerical solution of equations
- Vectors
- Differential equations
- Complex numbers
- The Poisson distribution
- Linear combinations of random variables
- Continuous random variables
- Sampling and estimation
- Hypothesis tests

### Learning Outcomes

#### A Level Preparation: Mathematics AS

On successful completion, students will be able to

- be confident at solving mathematical equations, manipulating functions and data.
- understand mathematical as well as probability principles.
- develop a range of skills associated to the use of mathematics to solve real everyday situations.
- skilfully analyse problems logically.
- formulate, interpret and solve problems using mathematical terms and language.
- acquire the mathematical and probability background require to study further related courses.

#### A Level Preparation: Mathematics A

On successful completion, students will be able to

- be confident at solving mathematical differential equations, manipulating functions, vectors and complex numbers.
- understand mathematical and probability principles.
- develop a range of skills associated to the use of mathematics to solve real everyday situations.
- skilfully analyse problems logically.
- formulate, interpret and solve problems using mathematical and statistic terms and language.
- acquire the mathematical as well as probability and statistic background require to study further related courses.

#### Links to other Modules within the Study Program

This module is similar to other modules in the field of Methods

#### Links to other Study Programs of the University

All Bachelor Programs in the Business & Management field

## A Level Preparation: Mathematics AS

Course Code: DLAPMAT01

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
	English		5	DLFSWE01_E

### Course Description

Mathematics, probability and statistics provide the foundations for solving real world engineering and IT problems. This course provides all elements and worked examples important to succeed in the mathematics AS level Cambridge exam by introducing important mathematical terms and concepts as well as the foundations of probability and statistics. The theory and example exercises are carefully selected starting from a basic level and gradually increasing to the exam level from functions, geometry and trigonometry to differentiation and integrations.

### Course Outcomes

On successful completion, students will be able to

- be confident at solving mathematical equations, manipulating functions and data.
- understand mathematical as well as probability principles.
- develop a range of skills associated to the use of mathematics to solve real everyday situations.
- skilfully analyse problems logically.
- formulate, interpret and solve problems using mathematical terms and language.
- acquire the mathematical and probability background require to study further related courses.

### Contents

1. Quadratics
  - 1.1 Solving quadratic functions by factoring and inequalities
  - 1.2 Completing the square
  - 1.3 Discriminant
  - 1.4 Simultaneous equations
  - 1.5 Graphs of functions
2. Functions
  - 2.1 Mapping
  - 2.2 Composite functions
  - 2.3 Inverse functions
  - 2.4 Transformations

3. Coordinate geometry
  - 3.1 Line segment
  - 3.2 Parallels and perpendicular lines
  - 3.3 Straight line and circles equation
  - 3.4 Points of intersection
4. Circular measure
  - 4.1 Radians and arc length
  - 4.2 Sector area
  - 4.3 Problems
5. Trigonometry
  - 5.1 Trigonometric functions and graphs
  - 5.2 Inverse trigonometric functions
  - 5.3 Trigonometric equations and identities
6. Series
  - 6.1 Pascal's triangle
  - 6.2 Binomial notation and expansion
  - 6.3 More complicated expansions
  - 6.4 Sequences
  - 6.5 Arithmetic and geometric progressions
7. Differentiation
  - 7.1 Differentiation from Definition
  - 7.2 Differentiation rules
  - 7.3 Equation of a Tangent
  - 7.4 Second derivative
  - 7.5 Equation of the tangent
  - 7.6 Stationary Points and Concavity
8. Integration
  - 8.1 Integration
  - 8.2 Antidifferentiation and the Indefinite Integral
  - 8.3 The definite integral
  - 8.4 Finding area using integration
  - 8.5 Improper integrals
  - 8.6 Volumes of revolution

9. Representation of data
  - 9.1 Stem and leaf diagrams
  - 9.2 Categorical and numerical data
  - 9.3 Measures of central tendency
  - 9.4 Distributions
  - 9.5 Variance
10. Permutations and combinations
  - 10.1 Factorials
  - 10.2 Permutations
  - 10.3 Combinations and the binomial coefficient
11. Probability
  - 11.1 Events and their outcomes
  - 11.2 The Addition Law
  - 11.3 The Multiplication Law
  - 11.4 Conditional Probability
12. Discrete random variables
  - 12.1 Probability Distribution
  - 12.2 Expectation and variance of a discrete random variable
  - 12.3 The binomial distribution
  - 12.4 The geometric distribution
13. The normal distribution
  - 13.1 Continuous random variables
  - 13.2 Normal curves and the normal distribution
  - 13.3 Modelling discrete situations
  - 13.4 Using the normal distribution to approximate binomial

**Literature****Compulsory Reading****Further Reading**

- Linsky, J., Nicholson, J. & Western, B. (2012). Pure Mathematics 1 for Cambridge International AS & A level (Second Edition). Oxford University Press.
- Nicholson, J. (2018). Complete Probability & Statistics for Cambridge International AS & A level (Second Edition). Oxford University Press.
- Goldie, S. & Nicholson (2018). Complete Pure Mathematics 1 for Cambridge International AS & A level (Second Edition). Hodder education and Hachette UK company

**Study Format Distance Learning**

<b>Study Format</b> Distance Learning	<b>Course Type</b> Online Lecture
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<b>Information about the examination</b>	
<b>Examination Admission Requirements</b>	<b>BOLK:</b> yes <b>Course Evaluation:</b> no
<b>Type of Exam</b>	Exam

<b>Student Workload</b>					
<b>Self Study</b>	<b>Contact Hours</b>	<b>Tutorial</b>	<b>Self Test</b>	<b>Independent Study</b>	<b>Hours Total</b>
90 h	0 h	30 h	30 h	0 h	150 h

<b>Instructional Methods</b>	
<input type="checkbox"/> Learning Sprints® <input checked="" type="checkbox"/> Course Book <input type="checkbox"/> Vodcast <input checked="" type="checkbox"/> Shortcast <input checked="" type="checkbox"/> Audio <input checked="" type="checkbox"/> Exam Template	<input type="checkbox"/> Review Book <input type="checkbox"/> Creative Lab <input type="checkbox"/> Guideline <input checked="" type="checkbox"/> Live Tutorium/Course Feed <input type="checkbox"/> Reader <input checked="" type="checkbox"/> Slides

## A Level Preparation: Mathematics A

Course Code: DLAPMAT02

Study Level	Language of Instruction and Examination	Contact Hours	CP	Admission Requirements
	English		5	DLFSWE01_E

### Course Description

Mathematic, probability and statistics provide the foundations for solving real world engineering and IT problems. This course provides all elements and worked examples important to succeed in the mathematics A level Cambridge exam by introducing important mathematical terms and concepts as well as the foundations of advance statistics. The theory and example exercises are carefully selected starting from A level and gradually increasing to the exam level. The course covers topics of algebra, functions, trigonometry as well as differentiation, integrations and differential equations, complex numbers, vectors, numerical methods and statistics.

### Course Outcomes

On successful completion, students will be able to

- be confident at solving mathematical differential equations, manipulating functions, vectors and complex numbers.
- understand mathematical and probability principles.
- develop a range of skills associated to the use of mathematics to solve real everyday situations.
- skilfully analyse problems logically.
- formulate, interpret and solve problems using mathematical and statistic terms and language.
- acquire the mathematical as well as probability and statistic background require to study further related courses.

### Contents

1. Algebra
  - 1.1 The modulus function and sketching
  - 1.2 Solving Equations and Inequalities
  - 1.3 Division of polynomials
  - 1.4 The remainder and factor theorem
2. Logarithmic and exponential functions
  - 2.1 Exponential and logarithmic function
  - 2.2 Equations and inequalities
  - 2.3 Transforming a relationship to linear form

3. Trigonometry
  - 3.1 Trigonometric functions
  - 3.2 Trigonometric identities
  - 3.3 Double angle formulae
  - 3.4 Other trigonometric identities with angles
4. Differentiation
  - 4.1 The product and the quotient rule
  - 4.2 Differentiation of further functions
  - 4.3 Implicit and parametric differentiation
5. Integration
  - 5.1 Integration
  - 5.2 Binomial expansions and partial fractions
  - 5.3 Integration using partial fraction, by parts and substitution
  - 5.4 Numerical integration using trapezium
6. Numerical solution of equations
  - 6.1 Finding approximate roots
  - 6.2 Finding roots using iterative relationships
  - 6.3 Applications of iterative processes
7. Vectors
  - 7.1 Vector notation and operating with vectors
  - 7.2 Position vectors and graphical interpretations
  - 7.3 Vector equations of straight lines
  - 7.4 The scalar product
8. Differential equations
  - 8.1 Understanding simple DEs
  - 8.2 Solving First order DEs
  - 8.3 Finding particular solutions
  - 8.4 DEs models

9. Complex numbers
  - 9.1 Introduction to complex numbers
  - 9.2 Calculations with complex numbers
  - 9.3 Solving equations
  - 9.4 Polar and exponential forms
  - 9.5 Loci and Argand diagrams
10. The Poisson distribution
  - 10.1 The Poisson distribution
  - 10.2 Modelling with Poisson distribution
  - 10.3 The sum of Poisson distributions
  - 10.4 Poisson approximation to binomial
11. Linear combinations of random variables
  - 11.1 Expectation of a distribution
  - 11.2 Sum and differences of independent random variables
12. Continuous random variables
  - 12.1 Probability density function
  - 12.2 Mean and variance
  - 12.3 The median and the mode
  - 12.4 Uniform distribution
13. Sampling and estimation
  - 13.1 Terms and notation
  - 13.2 The sample mean
  - 13.3 The Central Limit Theorem
  - 13.4 Point and interval estimators
14. Hypothesis tests
  - 14.1 Basic concepts
  - 14.2 Hypothesis tests for different distributions
  - 14.3 Type I and type II errors

**Literature****Compulsory Reading****Further Reading**

- Linsky, J., Nicholson, J. & Western, B. (2012). Pure Mathematics 2 & 3 for Cambridge International AS & A level (Second Edition). Oxford University Press.
- Nicholson, J. (2018). Complete Probability & Statistics for Cambridge International AS & A level (Second Edition). Oxford University Press.
- Pemberton, S & Hughes, J. (2018). Complete Pure Mathematics 2 & 3 for Cambridge International AS & A level (Second Edition). Cambridge University Press.

**Study Format Distance Learning**

<b>Study Format</b> Distance Learning	<b>Course Type</b> Online Lecture
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<b>Information about the examination</b>	
<b>Examination Admission Requirements</b>	<b>BOLK:</b> yes <b>Course Evaluation:</b> no
<b>Type of Exam</b>	Exam

<b>Student Workload</b>					
<b>Self Study</b>	<b>Contact Hours</b>	<b>Tutorial</b>	<b>Self Test</b>	<b>Independent Study</b>	<b>Hours Total</b>
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