Specialist Mathematics

Exam Planner

*Your guide for exam goal-setting,
preparation and success.*

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Subject: Specialist Mathematics

EXAM DATE --

GOAL --

Topic: Logic and Proof	Do I have it in my notes?	Note-making deadline	Memorising deadline
Conjecture – making a statement to be proved or disproved			
Implications, equivalences and if and only if statements (necessary and sufficient conditions)			
Natural deduction and proof techniques: direct proofs using a sequence of direct implications, proof by cases, proof by contradiction, and proof by contrapositive			
Quantifiers 'for all' and 'there exists', examples and counter-examples			
Proof by mathematical induction.			
Topic: Functions, Relations and Graphs	**Do I have it in my notes?**	**Note-making deadline**	**Memorising deadline**
Rational functions and the expression of rational functions of low degree as sums of partial fractions			
Graphs of rational functions of low degree, their asymptotic behaviour, and the nature and location of stationary points and points of inflection			
Graphs of simple quotient functions, their asymptotic behaviour, and the nature and location of stationary points and points of inflection.			
Topic: Complex Numbers	**Do I have it in my notes?**	**Note-making deadline**	**Memorising deadline**
De Moivre's theorem, proof for integral powers, powers and roots of complex numbers in polar form, and their geometric representation and interpretation			
The n th roots of unity and other complex numbers and their location in the complex plane			
Factors over C, of polynomials; and introduction to the fundamental theorem of algebra, including its application to factorisation of polynomial functions of a single variable over C, for example, $z8+1$, z^2-i or $z^3-(2-i)\ z^2+z-2+i$			
Solution over C of polynomial equations by completing the square, use of the quadratic factorisation and the conjugate root theorem.			

Topic: Calculus	Do I have it in my notes?	Note-making deadline	Memorising deadline
The relationship between the graph of a function and the graphs of its anti-derivative functions			
Derivatives of inverse circular functions			
Second derivatives, use of notations $f''(x)$ and $\frac{d^2y}{dx^2}$, and their application to the analysis of graphs of functions, including points of inflection and concavity			
Applications of chain rule to related rates of change and implicit differentiation; for example, implicit differentiation of the relations $x^2+y^2=9$, $3xy^2=x+y$ and $x\sin(y)+x^2\cos(y)=1$			
Techniques of anti-differentiation and for the evaluation of definite integrals: • anti-differentiation of $1/x$ to obtain $\log_e \lvert x \rvert$ • anti-differentiation of $\frac{1}{\sqrt{a^2-x^2}}$ and $\frac{a}{a^2+x^2}$ for $a > 0$ by recognition that they are derivatives of corresponding inverse circular functions • use of the substitution $u=g(x)$ to anti-differentiate expressions • use of the trigonometric identities $\sin^2(ax) = \frac{1}{2}(1-\cos(2ax)$ and $\cos^2(ax) = \frac{1}{2}(1+\cos(2ax)$ in anti-differentiation techniques • anti-differentiation using partial fractions of rational functions • integration by parts			
Numerical and symbolic integration using technology			
Application of integration, areas of regions bounded by curves, arc lengths for parametrically determined curves, surface area of solids of revolution, volumes of solids of revolution of a region about either coordinate axis.			

Formulation of differential equations from contexts in, for example, chemistry, biology and economics, in situations where rates are involved (including some differential equations whose analytic solutions are not required, but can be solved numerically using technology)			
The logistic differential equation			
Verification of solutions of differential equations and their representation using direction (slope) fields			
Solution of simple differential equations of the form $\frac{dy}{dx} = f(x), \frac{dy}{dx} = g(y)$ and in general differential equations of the form $\frac{dy}{dx} = f(x)g(y)$ using separation of variables and differential equations of the form $\frac{d^2y}{dx^2} = f(x)$			
Numerical solution by Euler's method (first order approximation)			
Use of velocity–time graphs to describe and analyse rectilinear motion			
Application of differentiation, anti-differentiation and solution of differential equations to rectilinear motion of a single particle, including the different derivative forms for acceleration $a = \frac{d^2x}{dt^2} = \frac{dv}{dt} = v\frac{dv}{dx} = \frac{d}{dx}\left(\frac{1}{2}v^2\right)$			

Topic: Space and measurement	**Do I have it in my notes?**	**Note-making deadline**	**Memorising deadline**
Addition and subtraction of vectors and their multiplication by a scalar, position vectors			
Linear dependence and independence of a set of vectors and geometric interpretation			
Magnitude of a vector, unit vector, the orthogonal unit vectors **i**, **j** and **k**			
Resolution of a vector into rectangular components			
Scalar (dot) product of two vectors, deduction of dot product for the **i**, **j** and **k** vector system and its use to find scalar resolute and vector resolute			

Vector (cross) product of two vectors in three dimensions, including the determinant form			
Vector proofs of simple geometric results, such as ‘the diagonals of a rhombus are perpendicular’, ‘the medians of a triangle are concurrent’ and ‘the angle subtended by a diameter in a circle is a right angle’			
Parallel and perpendicular vectors			
Vector equations and parametric equations of curves in two or three dimensions involving a parameter (and the corresponding Cartesian equation in the two-dimensional case)			
Vector equation of a straight line, given the position of two points, or equivalent information, in both two and three dimensions			
Vector cross product, normal to a plane and vector, parametric and Cartesian equations of a plane			
Position vector as a function of time and sketching the corresponding path given the function, including circles, ellipses and hyperbolas in Cartesian or parametric forms			
The positions of two particles each described as a vector function of time, and whether their paths cross or if the particles meet			
Differentiation and anti-differentiation of a vector function with respect to time and applying vector calculus to motion in a plane and in three dimensions			

Topic: Data Analysis, Probability and Statistics	**Do I have it in my notes?**	**Note-making deadline**	**Memorising deadline**
For n independent identically distributed random variables $X_1, X_2 \ldots X_n$ each with mean μ and variance σ^2: • $\mathrm{E}(X_1 + X_2 + \cdots + X_n) = n\mu$ • $\mathrm{Var}(X_1 + X_2 + \cdots + X_n) = n\sigma^2$			
For n independent random variables $X_1, X_2 \ldots X_n$ and real numbers $a_1, a_2 \ldots a_n$: • $\mathrm{E}(a_1X_1 + a_2X_2 + \cdots + a_nX_n) = a_1\mathrm{E}(X_1) + a_2\mathrm{E}(X_2) + \cdots + a_n\mathrm{E}(X_n)$ • $\mathrm{Var}(a_1X_1 + a_2X_2 + \cdots + a_nX_n) = a_1{}^2\mathrm{Var}(X_1) + a_2{}^2\mathrm{Var}(X_2) + \cdots + a_n{}^2\mathrm{Var}(X_n)$			
For n normally distributed independent random variables $X_1, X_2 \ldots X_n$ and real numbers $a_1, a_2 \ldots a_n$ the random variable $a_1X_1 + a_2X_2 + \cdots + a_nX_n$ is also normally distributed			

The concept of the sample mean $\bar{X}$ as a random variable whose value varies between samples where X is a random variable with mean μ and the standard deviation σ			
Simulation of repeated random sampling, from a variety of distributions and a range of sample sizes, to illustrate properties of the distribution of $\bar{X}$ across samples of a fixed size n including its mean μ its standard deviation $\frac{\sigma}{\sqrt{n}}$ (where μ and σ are the mean and standard deviation of X respectively) and its approximate normality if n is large			
Determination of confidence intervals for means and the use of simulation to illustrate variations in confidence intervals between samples and to show that the likelihood of a confidence interval containing μ depends on the level of confidence chosen in the determination of the interval			
Construction of an approximate confidence interval, $(\bar{x} - z\frac{\sigma}{\sqrt{n}}, \bar{x} + z\frac{\sigma}{\sqrt{n}})$ where σ is the population standard deviation and z is the appropriate quantile for the standard normal distribution or construction of an approximate confidence interval $(\bar{x} - z\frac{s}{\sqrt{n}}, \bar{x} + z\frac{s}{\sqrt{n}})$ where s is the sample standard deviation and z is the appropriate quantile for the standard normal distribution, and n is large ($n \geq 30$ in many practical contexts)			
Concepts of null hypothesis, H_0, and alternative hypotheses, H_1, test statistic			
Level of significance and p-value			
Formulation of hypotheses and making a decision concerning a population mean based on: • a random sample from a normal population of known variance • a large random sample from any population			
1-tail and 2-tail tests			
Interpretation of the results of a hypothesis test in the context of the problem			
Hypothesis test, relating the formulation, conduct, errors and results in terms of conditional probability			

Practice Schedule

PRACTICE EXAM	DEADLINE
Practice Exam 1	
Practice Exam 2	
Practice Exam 3	
Practice Exam 4	
Practice Exam 5	
EXAM DATE:	

Congratulations!

You're ready! Now relax and think about how good it will feel leaving the exam room knowing the hard work has paid off. Congratulations and good luck (not that you need it)!

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