# Mathematical Methods

## *Exam Planner*

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

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# Subject: Mathematical Methods

EXAM DATE ----------

GOAL ----------

| Topic: Functions, Relations and Graphs | Do I have it in my notes? | Note-making deadline | Memorising deadline |
|---|---|---|---|
| Graphs of polynomial functions and their key features | | | |
| Graphs of the following functions: power functions, $y = x^n$, $n \in Q$; exponential functions, $y = a^x$, $a \in R^+$, in particular $y = e^x$; logarithmic functions, $y = \log_e(x)$ and $y = \log_{10}(x)$; and circular functions, $y=\sin(x)$, $y=\cos(x)$ and $y=\tan(x)$ and their key features | | | |
| Transformation from $y = f(x)$ to $y = Af(n(x+b)) + c$, where and A,n,b, and $c \in R$, $A,n \neq 0$, and f is one of the functions specified above, and the inverse transformation | | | |
| The relation between the graph of an original function and the graph of a corresponding transformed function (including families of transformed functions for a single transformation parameter) | | | |
| Graphs of sum, difference, product and composite functions involving functions of the types specified above (not including composite functions that result in reciprocal or quotient functions) | | | |
| Modelling of practical situations using polynomial, power, circular, exponential and logarithmic functions, simple transformation and combinations of these functions, including simple piecewise (hybrid) functions. | | | |
| **Topic: Algebra, Number and Structure** | **Do I have it in my notes?** | **Note-making deadline** | **Memorising deadline** |
| Solution of polynomial equations with real coefficients of degree $n$ having up to $n$ real solutions, including numerical solutions | | | |
| Functions and their inverses, including conditions for the existence of an inverse function, and use of inverse functions to solve equations involving exponential, logarithmic, circular and power functions | | | |
| Composition of functions, where f composite $g$, $f \circ g$, is defined by $(f \circ g)(x)=f(g(x))$ given $r_g \subseteq d_f$ | | | |
| Solution of equations of the form $f(x) = g(x)$ over a specified interval, where f and g are functions of the type specified in the 'Functions, relations and graphs' area of study, by graphical, numerical and algebraic methods, as applicable | | | |

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| Solution of literal equations and general solution of equations involving a single parameter | | | |
| Solution of simple systems of simultaneous linear equations, including consideration of cases where no solution or an infinite number of possible solutions exist (geometric interpretation only required for two equations in two variables). | | | |
| **Topic: Calculus** | **Do I have it in my notes?** | **Note-making deadline** | **Memorising deadline** |
| Deducing the graph of the derivative function from the graph of a given function and deducing the graph of an anti-derivative function from the graph of a given function | | | |
| Derivatives of $x^n$ for , $e^x$, $\log_e(x)$, $\sin(x)$, $\cos(x)$ and $\tan(x)$ | | | |
| Derivatives of f(x) $\pm$ g(x), f(x) x g(x), f(x)/g(x) and $(f \circ g)(x)$ where f and g are polynomial functions exponential, circular, logarithmic or power functions and transformations or simple combinations of these functions | | | |
| Application of differentiation to graph sketching and identification of key features of graphs, including stationary points and points of inflection, and intervals over which a function is strictly increasing or strictly decreasing | | | |
| Identification of local maximum/minimum values over an interval and application to solving optimisation problems in context, including identification of interval endpoint maximum and minimum values | | | |
| Anti-derivatives of polynomial functions and functions of the form f(ax + b) where f is $x^n$, for n $\in$ Q, $e^x$, sin(x), cos(x) and linear combinations of these | | | |
| Informal consideration of the definite integral as a limiting value of a sum involving quantities such as area under a curve and approximation of definite integrals using the trapezium rule | | | |
| Anti-differentiation by recognition that F'(x) = f(x) implies $\int$ f(x)dx = F(x) + c and informal treatment of the fundamental theorem of calculus, $\int_a^b f(x)dx = F(b) - F(a)$ | | | |
| Properties of anti-derivatives and definite integrals | | | |
| Application of integration to problems involving finding a function from a known rate of change given a boundary condition, calculation of the area of a region under a curve and simple cases of areas between curves, average value of a function and other situations. | | | |

| Topic: Functions, Relations and Graphs | Do I have it in my notes? | Note-making deadline | Memorising deadline |
|---|---|---|---|
| Random variables, including the concept of a random variable as a real function defined on a sample space and examples of discrete and continuous random variables | | | |
| Discrete random variables:<br>• specification of probability distributions for discrete random variables using graphs, tables and probability mass functions<br>• calculation and interpretation of mean, $\mu$, variance, $\sigma$^2, and standard deviation of a discrete random variable and their use<br>• Bernoulli trials and the binomial distribution, Bi($n$, $p$), as an example of a probability distribution for a discrete random variable<br>• effect of variation in the value(s) of defining parameters on the graph of a given probability mass function for a discrete random variable<br>• calculation of probabilities for specific values of a random variable and intervals defined in terms of a random variable, including conditional probability | | | |
| Continuous random variables:<br>• construction of probability density functions from non-negative functions of a real variable<br>• specification of probability distributions for continuous random variables using probability density functions<br>• calculation and interpretation of mean, $\mu$, variance, $\sigma$^2, and standard deviation of a continuous random variable and their use<br>• standard normal distribution, N(0, 1), and transformed normal distributions, N($\mu$, $\sigma$^2), as examples of a probability distribution for a continuous random variable<br>• effect of variation in the value(s) of defining parameters on the graph of a given probability density function for a continuous random variable<br>• calculation of probabilities for intervals defined in terms of a random variable, including conditional probability (the cumulative distribution function may be used but is not required) | | | |

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| Statistical inference, including definition and distribution of sample proportions, simulations and confidence intervals:<br><br>• distinction between a population parameter and a sample statistic and the use of the sample statistic to estimate the population parameter<br>• simulation of random sampling, for a variety of values of $p$ and a range of sample sizes, to illustrate the distribution of $\hat{P}$ and variations in confidence intervals between samples<br>• concept of the sample proportion $\hat{P} = \frac{X}{n}$ as a random variable whose value varies between samples,<br>• where $X$ is a binomial random variable which is associated with the number of items that have a particular characteristic and $n$ is the sample size<br>• approximate normality of the distribution of $\hat{P}$ for large samples and, for such a situation, the mean<br>• $p$ (the population proportion) and standard deviation, $\sqrt{\frac{p(1-p)}{n}}$<br>• determination and interpretation of, from a large sample, an approximate confidence interval $\left(\hat{p} - z\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}, \hat{p} + z\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}\right)$, for a population proportion where $z$ is the appropriate quantile for the standard normal distribution, in particular the 95% confidence interval as an example of such an interval where $z \approx 1.96$ (the term standard error may be used but is not required). | | | |

## 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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