

A2 Further Maths Checklists for FP2, D2 and S2

FP2

Skills/ Knowledge/ Specification	R	A	G
INEQUALITIES			
Solve algebraic fractional inequalities using manipulation			
Solve algebraic fractional inequalities using graphs			
Solve algebraic inequalities which include modulus functions			
SERIES			
Use the method of differences to sum simple finite series			
COMPLEX NUMBERS			
Express a complex number in the form $r(\cos\theta + i\sin\theta)$			
Express a complex number in the form $re^{i\theta}$			
Convert a complex number in modulus argument or exponential form into the form $x + iy$			
Find the modulus of two complex numbers that have been multiplied or divided			
Find the argument of two complex numbers that have been multiplied or divided			
Prove de Moivre's theorem: $[r(\cos\theta + i\sin\theta)]^n = r^n (\cos(n\theta) + i\sin(n\theta))$			
Apply de Moivre's theorem to find powers of complex numbers			
Apply de Moivre's theorem to trigonometric identities			
Use de Moivre's theorem to find n th roots of a complex number			
Use complex numbers to represent a locus of points on an Argand diagram			
Use algebraic methods to find the Cartesian equations of locus of complex numbers			
Use complex numbers to represent regions on an Argand diagram			
Map points on the z -plane to points on the w -plane by applying a given formula			
FIRST ORDER DIFFERENTIAL EQUATIONS			
Find general solutions to first order differential equations using separation of variables			
Solve exact diff. eqs. where one side is the derivative of a product of the other side			
Solve first order differential equations where $dy/dx + Py = Q$			
Use a given substitution to reduce a diff. eq. into an equation you can solve			
SECOND ORDER DIFFERENTIAL EQUATIONS			
Find the general solution of a $d^2 y/dx^2 + b dy/dx + cy = 0$ where $b^2 - 4ac > 0$			
Find the general solution of a $d^2 y/dx^2 + b dy/dx + cy = 0$ where $b^2 - 4ac = 0$			
Find the general solution of a $d^2 y/dx^2 + b dy/dx + cy = 0$ where $b^2 - 4ac < 0$			

Find the general solution of a $d^2 y/dx^2 + b dy/dx + cy = f(x)$			
Find the specific solution of a $d^2 y/dx^2 + b dy/dx + cy = f(x)$ given boundary conditions			
Use a given substitution to transform a 2nd order diff eq into one you can solve			
MACLAURIN AND TAYLOR SERIES			
Find high derivatives			
Use Maclaurin expansion to express trigonometric, logarithmic and exponential functions			
Use Maclaurin expansion to express composite functions			
To find an approximation to a function of x close to $x = a$ using Taylor's expansion			
Find the solution, in the form of a series to a differential equation using Taylor series			
POLAR COORDINATES			
Switch between polar and Cartesian coordinates			
Switch between polar and Cartesian equations			
Sketch curves given their polar equations			
Use integration to find areas of sectors of curves given their polar equations			
Use polar equations to find tangents to a curve that are parallel or perpendicular to the initial line			

D2

Skills/ Knowledge/ Specification	R	A	G
Transportation problem			
Find an initial allocation using the north west corner method			
Adapt the algorithm for unbalanced solutions			
Identify a degenerate solution			
Find shadow costs for an allocation			
Find improvement indices			
Use improvement indices to improve an allocation			
Use improvement indices for unbalanced problems			
Use improvement indices for degenerate problems			
Formulate a transportation problem as a linear programming problem			
Allocation problem			
Reduces cost matrices			
Use the Hungarian algorithm to find a least cost allocation			
Adapt the algorithm to use a dummy location			

Adapt the algorithm to manage incomplete data			
Modify the algorithm to deal with a maximum profit allocation			
Formulate the allocation problem as linear programming problems			
Travelling salesman problem (TSP)			
Know the differences between the classical and practical problems			
Convert a network into a table of minimum distances			
Find a minimum spanning tree using Prims or Kruskals algorithms			
Find an initial upper bound for the TSP			
Use short cuts to improve upper bounds			
Use a minimum spanning tree to find a lower bound			
Use nearest neighbour algorithm to find an upper bound			
Linear Programming			
Formulate problems as linear programming problems using slack variables			
Use a simplex tableaux to solve a linear programming problem			
Use a simplex tableaux to solve a linear programming problem which require integer solutions			
Game Theory			
Determine play safe strategies for both players in a two person game			
Find a saddle point for a zero-sum game, if one exists			
Reduce a pay-off matrix using dominance			
Determine the optimal mixed strategy for a 2x2 game with no stable solution			
Determine the optimal mixed strategy for a 2x3 or 3x2 game with no stable solution			
Convert a 2x3 or 3x2 game into a linear programming problem			
Convert a 2x3 or 3x2 game into a linear programming problem and solve it			
Flows in networks			
Be familiar with the terminology of flows in networks, e.g. capacity, source, sink and cut			
Find given cuts			
Find initial flow through a capacitated directed network			
Find flow augmenting routes to increase the flow through a network			
Confirm a flow is maximal			
Adapt the algorithm to deal with multiple sources and/or sinks			
Dynamic Programming			
Understand the terminology of dynamic programming			
Use dynamic programming to solve maximum and minimum problems presented in network form			
Use dynamic programming to solve minimax and maximin problems presented in network form.			
Use dynamic programming to solve maximum and minimum problems presented in table form.			
Use dynamic programming to solve minimax and maximin problems presented in table form			

S2

Skills/ Knowledge/ Specification	R	A	G
BINOMIAL & POISSON DISTRIBUTIONS			
Use factorial notation to find the number of arrangements of objects			
Use the binomial theorem to find probabilities			
Know when the binomial distribution is a suitable model			
Find cumulative distribution functions of the binomial distribution from the table			
Find the mean and variance of the binomial distribution using the formulae			
Solve worded binomial distribution problems			
Use the Poisson distribution formula in finding probabilities			
Use the tables of Poisson cumulative distribution functions to find probabilities			
Know when the Poisson distribution is a suitable model			
Approximate a binomial distribution to a Poisson distribution			
Decide which distribution is an appropriate model			
CONTINUOUS RANDOM VARIABLES			
Use the properties of a c.r.v to sketch its probability density function			
Sketch a cumulative distribution function for a given c.r.v			
Use given formulae to find the mean and variance for a given p.d.f			
Find the mode, median and quartiles of a c.r.v			
CONTINUOUS UNIFORM DISTRIBUTION			
Sketch a continuous uniform distribution from given information			
Find the expectation and variance for a given continuous uniform distribution			
Find the cumulative distribution function for a continuous uniform distribution			
Choosing the correct model for a given scenario			
NORMAL APPROXIMATIONS			
Use continuity correction to go from a discrete distribution to a continuous one			
Approximate a binomial distribution by a normal distribution			
Approximate a Poisson distribution by a normal distribution			
Choose the correct approximation of the normal distribution for a given problem			
POPULATIONS AND SAMPLES			
Understand the difference between populations, censuses and samples			
To explain the advantages and disadvantages of taking a census			
To explain the advantages and disadvantages of sampling			
To understand the concept of a simple random sample			
To understand the concept of a statistic			
To express the sampling distribution for a given population			

HYPOTHESIS TESTING			
State the null and alternative hypothesis			
Use given significance levels			
Decide if a hypothesis test is a one or two tailed test			
Use a hypothesis test for the Poisson distribution for a given level of significance			
Use a hypothesis test for the binomial distribution for a given level of significance			
Find critical regions for a hypothesis test for the Poisson distribution			
Find critical regions for a hypothesis test for the binomial distribution			
Find the actual level of significance of a hypothesis test			
Approximate the Poisson distribution as a normal distribution in hypothesis testing			
Approximate the binomial distribution as a normal distribution in hypothesis testing			
Approximate the binomial distribution as a Poisson distribution in hypothesis testing			
Know when to use each approximation			