Park House School - Year 13 Feb/March Mocks

Further Maths Assessment Manifest

- You will have 4 Further Maths papers, paper 1 will be pure paper, paper 2 will be a pure paper, paper 3 will be mechanics and paper 4 will be statistics
- Each paper will be 75 marks
- Each paper will be 90 minutes
- You are expected to spend 1 minute on each mark and then 15 minutes checking your answers.

Core Pure

Topics	Red	Amber	Green
I can construct proofs using mathematical induction with contexts to include sums of series, divisibility and powers of matrices			
I can solve any quadratic equation with real coefficients			
I can solve cubic or quartic equations with real coefficients			
I can add, subtract, multiply and divide complex numbers in the form x+iy with x and y real			
I understand and use the terms 'real part' and 'imaginary part'			
I understand and use the complex conjugate			
I know that non-real roots of polynomial equations with real coefficients occur in conjugate pairs			
I can use and interpret Argand diagrams			
I can convert between Cartesian form and the modulus-argument form of a complex numbers			
I can multiply and divide complex numbers in modulus-argument form			
I can construct and interpret simple loci in the Argand diagram such as $\|z-a\|>r$ and $\arg(z-a)=\theta$			
I can understand de Moivre's theorem and use it to find multiple angle formula and sums of series			
I know and use the definition $e^{i\theta} = \cos(\theta) + i\sin(\theta)$ and the form $z=re^{i\theta}$			
I can find the n distinct nth roots of $re^{i\theta}$ for $r\neq0$ and know that they form the vertices of a regular n-gon in the Argand diagram			
I can use complex roots of unity to solve geometric problems			
I can add, subtract and multiply conformable matrices			
I can multiply a matrix by a scalar			
I understand and use zero and identity matrices			
I use matrices to represent linear transformations in 2-D			
I can perform successive matrix transformations			
I can perform and describe a single transformation in 3-D			
I can find invariant points and lines for linear transformations			
I can calculate determinants of 2x2 and 3x3 matrices and interpret as scale factors, including the effect on orientation			
I understand and use singular and non-singular matrices			
I understand the properties of inverse matrices			
I can calculate and use the inverse of non-singular 2x2 and 3x3 matrices			
I can solve three linear simultaneous equations in three variables by use of the inverse matrix			

I can interpret geometrically the solution and failure of solution of three simultaneous linear equations			
I understand and use the relationship between roots and coefficients of polynomial equations up to quartic equations			
I can form a polynomial equation whose roots are a linear transformation of the roots of a given polynomial equation (of at least cubic degree)			
I understand and use formulae for the sum of integers, squares and cubes and use these to sum other series			
I understand and use the method of differences for summation of series including use of partial fractions			
I can find the Maclaurin series of a function including the general term			
I recognise and use the Maclaurin series for e^x, ln(1+x), sinx, cosx and $(1+x)^n$, and be aware of the range of value of x for which they are valid			
I can derive formulae for and calculate volumes of revolution			
I can evaluate improper integrals where either the integrand is undefined at a value in the range of integration or the range of integration extends to infinity			
I understand and evaluate the mean value of a function			
I can integrate using partial fractions			
I can differentiate inverse trigonometric functions			
I can integrate functions of the form $(a^2-x^2)^{-½}$ and $(a^2-x^2)^{-1}$ and be able to choose trigonometric substitutions to integrate associated functions			
I can derive formulae for and calculate volumes of revolution			
I understand and use the vector and Cartesian forms of an equation of a straight line in 3-D			
I understand and use the vector and Cartesian forms of the equation of a plane			
I can calculate the scalar product and use it to express the equation of a plane, and to calculate the angle between two lines, the angle between two planes and the angle between a line and a plane			
I can check whether vectors are perpendicular by using the scalar product			
I can find the intersection of a line and a plane			
I can calculate the perpendicular distance between two lines, from a point to a line and from a point to a plane			
I understand and use polar coordinates and am able to convert between polar and Cartesian coordinates			
I can sketch curves r given as a function of theta, including use of trigonometric functions			
I can find the area enclosed by a polar curve			
I can find tangents parallel to, or perpendicular to the initial line			
I understand the definitions of hyperbolic functions sinhx, coshx and tanhx, including their domains and ranges, and am able to sketch their graphs			
I can differentiate and integrate hyperbolic functions			
I understand and am able to use the definitions of the inverse hyperbolic functions and their domains and ranges			

I can derive and use the logarithmic forms of the inverse hyperbolic functions			
I can integrate functions of the form $(x^2+a^2)^{½}$ and $(x^2-a^2)^{½}$ and am able to choose substitutions to integrate associated functions			
I can find and use an integrating factor to solve first order differential equations and recognise when it is appropriate to do so			
I can find both general and particular solutions to differential equations			
I can use differential equations in modelling in kinematics and in other contexts			
I can solve differential equations of the form $y'' + ay' + by = 0$ where a and b are constants by using the auxiliary equation			
I can solve differential equations of the form $y'' + ay' + by = f(x)$ where a and b are constants by solving the homogeneous case and adding a particular integral to the complementary function			
I can understand and use the relationship between the cases when the discriminant of the auxiliary equation is positive, zero and negative and the form of the solution of the differential equation			
I can solve the equation for simple harmonic motion and relate the solution to the motion			
I can model damped oscillations using second order differential equations and interpret their solutions			
I can analyse and interpret models of situations with one independent variable and two dependent variables as a pair of coupled first order simultaneous equations and be able to solve them, for example predator-prey models			

Statistics

Topics	Red	Amber	Green
I can calculate the mean and variance of discrete probability distributions			
I can extend this to find the expected value function to include E(g(x))			
I can understand and use the Poisson distribution			
I can use the additive property of Poisson distributions			
I can find the mean and variance of the binomial distribution and the Poisson distribution			
I can use the Poisson distribution as an approximation to the binomial distribution			
I can understand and use geometric and negative binomial distributions			
I can find the mean and variance of a geometric distribution with parameter p			
I can find the mean and variance of negative binomial distribution			
I can extend the ideas of hypothesis tests to test for the mean of a Poisson distribution			
I can extend hypothesis testing to test for the parameter p of a geometric distribution			
I can apply the Central Limit Theorem to other distributions			
I can use the goodness of fit tests and contigency tables			
I can state and test the null and alternative hypotheses			

I can work out the degrees of freedom and use this to find critical values			
I can define and derive probability generating functions			
I can use probability generating functions for the negative binomial, geometric, binomial and Poisson distributions			
I can use probability generating functions to find the mean and variance			
I can use probability generating functions of the sum of independent random variables			
I can understand Type I and Type II errors			
I can use Type I and Type II errors and the power function to indicate the effectiveness of statistical tests			

Mechanics

Topics	Red	Amber	Green
I can calculate the momentum and impulse			
I can use the impulse-momentum principle			
I can use the principle of the conservation of momentum applied to two spheres colliding directly			
I can calculate the momentum as a vector and use the impulse-momentum principle in vector form			
I can calculate kinetic energy, potential energy, work done and power			
I can use the work-energy principle and the principle of conservation of mechanical energy			
I can use Hooke's law in elastic springs and strings			
I can find the energy stored in an elastic string or spring			
I can use the work-energy principle involving kinetic energy, potential energy and elastic energy			
I can understand and use Newton's law of restitution for the direct impact of elastic spheres			
I can answer problems involving the loss of kinetic energy due to an impact			
I can answer problems involving successive direct impact of spheres and/or a sphere with a smooth plane surface			
I can answer problems involving oblique impact of smooth elastic spheres and a smooth sphere with a fixed surface			
I can answer problems involving the loss of kinetic energy due to an oblique impact			
I can answer problems involving successive oblique impacts of a sphere with smooth plane surfaces			