

## AS Further Maths Checklists fro FP1, M1 and S2

### FP1

Skills/ Knowledge/ Specification	R	A	G
<b>Complex Numbers</b>			
Add or subtract complex numbers			
Multiply complex numbers			
Finding the complex conjugate of a complex number			
Simplifying fractions with a complex denominator			
Representing complex numbers on an Argand diagram			
Finding the modulus and argument of complex numbers			
Solve Quadratic equations with complex roots			
Solve polynomials with complex roots			
<b>Numerical solutions to equations</b>			
Proving a root exists between two points			
Using interval bisection to find roots to a given degree of accuracy			
Using linear interpolation to find roots to a given degree of accuracy			
Using a the Newton-Raphson formula to find approximations of roots			
<b>Parametric Equations</b>			
To know the general equation of a parabola in Cartesian and parametric form			
To use the general equation of a parabola to state the focus, directrix and vertex			
To write the equation of a parabola from a given focus and directrix			
Proving that a locus of a point and a line $x = a$ can be written as a parabola			
Finding where parabola and a straight line intersect			
To know the general equation of a rectangular hyperbola in Cartesian and parametric form			
To use differentiation to find tangents and normals of rectangular hyperbolas			
Finding where tangents and normals to rectangular hyperbolas intersect each other and lines			
<b>Matrix Algebra</b>			
Add or subtract matrices			
Multiply a matrix by a scalar			
Multiply two matrices together			
Find where a point is transformed to given a linear transformation in matrix form			
To prove if a transformation is linear			
Describe a rotation, reflection or enlargement as a $2 \times 2$ matrix			
Find the matrix of a given rotation, reflection or enlargement			
To solve problems involving multiple transformations			

Find the inverse of a 2x2 matrix			
Use and inverse matrix to reverse the effect of a linear transformation			
Use the determinant of a matrix to find the area of an enlarge shape and vice versa			
Use a matrix to solve linear simultaneous equations			
<b>Series</b>			
Use Sigma notation for writing the sum of a series			
Finding the sum of the natural (integer) numbers using a remembered formula			
Using the given formulae for the sum of series for x squared and x cubed			
To find the sum of a cubic or quadratic series using the formulae			
To show the sum of the first n terms of a series can be written in a given form			
<b>Proof</b>			
To prove by induction the summation of a series			
To prove by induction that an expression is divisible by a certain integer			
To prove by induction a general rule for a given recurrence relation			

## M1

Skills/ Knowledge/ Specification	R	A	G
<b>KINEMATICS OF A PARTICLE MOVING IN A STRAIGHT LINE WITH CONSTANT ACCELERATION</b>			
Know and use $v = u + at$			
Know and use $v^2 = u^2 + 2as$			
Know and use $s = ut + \frac{1}{2} at^2$			
Know and use $s = vt - \frac{1}{2} at^2$			
Know and use $s = \frac{(u + v)t}{2}$			
Apply the above equations to vertical motion under gravity using $g = 9.8ms^{-2}$			
Sketch velocity/time graphs from given information			
Use the gradient of a section of a velocity/time graph to calculate acceleration			
Use the area under a velocity/time graph to calculate/equate to total distance			
<b>DYNAMICS OF A PARTICLE MOVING IN A STRAIGHT LINE WITH CONSTANT ACCELERATION</b>			
Know and use $F = ma$			
Resolve forces into horizontal and vertical components and use with $F = ma$			
Resolve forces into perpendicular and parallel components on a slope and use with $F = ma$			
Use friction = $\mu R$ in problems involving $F = ma$ in any of the above contexts			
Understand tension and thrust and how to represent them on a force diagram			
Solve connected particle problems involving pulleys, including particles on slopes			

Solve connected particle problems involving a car and trailer including on a slope			
Use conservation of momentum with colliding particles			
Use conservation of momentum with exploding shells and bullets/guns			
Use conservation of momentum with exploding shells and bullets/guns			
Use conservation of momentum with jerk in a string on connected particles			
Use $\text{IMPULSE} = \text{CHANGE IN MOMENTUM}$			
<b>STATICS OF A PARTICLE</b>			
Use the cos and sin rules to find the magnitude and direction of a resultant force			
Use resolving and trig/pythagoras to find the mag and direction of a resultant force			
Use resolving to find an unknown force in equilibrium situations			
Use friction = $\mu R$ in equilibrium problems, including on slopes			
Resolve forces into horizontal and vertical components in equilibrium problems			
Resolve forces into perp'lar and par'l components on a slope in equilibrium problems			
<b>MOMENTS</b>			
Use $Fd$ and $Fd \sin \theta$ to calculate the moment of a force about a point			
Understand that clockwise = anticlockwise in equilibrium situations			
Calculate with moments when forces are given as vectors and points as co-ordinates			
Solve balance problems for uniform rods			
Solve balance problems for non-uniform rods			
Solve balance problems when on the point of tilting about one pivot			
<b>VECTORS</b>			
Understand that vectors can represent any quantity with magnitude and direction			
Calculate the magnitude and direction of a given vector and interpret the magnitude			
Understand how to calculate and use unit vectors			
Use $\mathbf{F} = m\mathbf{a}$ and $\mathbf{v} = \mathbf{u} + \mathbf{at}$ as vector equations for 2-D acceleration problems			
Use $\mathbf{r} = \mathbf{r0} + \mathbf{tv}$ to find the position of a particle moving in 2-D at time $t$			
Use $\mathbf{ArB} = \mathbf{rA} - \mathbf{rB}$ to find the position vector of A relative to B			

## S2

<b>Skills/ Knowledge/ Specification</b>	R	A	G
<b>BINOMIAL &amp; POISSON DISTRIBUTIONS</b>			
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			
<b>CONTINUOUS RANDOM VARIABLES</b>			
Use the properties of a c.r.v to sketch it's 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			
<b>CONTINUOUS UNIFORM DISTRIBUTION</b>			
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			
<b>NORMAL APPROXIMATIONS</b>			
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			
<b>POPULATIONS AND SAMPLES</b>			
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			
<b>HYPOTHESIS TESTING</b>			
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			