DECISION 1 SCHEME OF WORK

Topic	Objectives	Notes	Resources	ICT	Formal Homework
Linear programming (7 lessons)	Formulation of problems as linear programs. Graphical solution of two variable problems using ruler and vertex methods. Consideration of problems where solutions must have integer values. The use and meaning of slack variables.	Problems will be restricted to those with a maximum of three variables and three constraints, in addition to non-negativity conditions.			Review Ex 2 Qu 11, 14, 17
Algorithms (3 lessons)	**The general ideas of algorithms. (Using Simplex as an example of an algorithm)** Implementation of an algorithm given by a flow chart or text. Candidates should be familiar with: i. bin packing ii. bubble sort iii. quick sort iv. binary search	The order of algorithm is not expected. When using the quick sort algorithm, the pivot should be chosen as the 'number' at the mid-point of the list.	Bubble Sort Quick Sort	Bubble Sort spreadsheet	Review Ex 1 Qu 1, 4, 7
Review and Test (2 lessons)					

DECISION 1 SCHEME OF WORK

Topic	Objectives	Notes	Resources	ICT	Formal Homework
Algorithms on graphs. (4 lessons) **(See chapter 2 for background to graphs)**	The minimum spanning tree (minimum connector) problem. Prim's and Kruskal's (Greedy) algorithm. Dijkstra's algorithm for finding the shortest path. Planar and non-planar graphs. Planarity algorithm for graphs with a Hamiltonian cycle.	Matrix representation of Prim's algorithm is expected. Candidates will be expected to draw a network from a given matrix and also to write down the matrix associated with a network. Candidates should now that K_5 and $K_{3,3}$ are non-planar. Kuratowski's theorem is not required			Review Ex 1 Qu 8, 10, 11
Matchings (3 lessons) **(See chapter 2 for background to graphs)**	Use of bipartite graphs for modelling matchings. Complete matchings and maximal matchings. Algorithm for obtaining a maximum matching	Candidates will be required to use the maximum matching algorithm to improve a matching by finding alternating paths. No consideration of assignment is required.			Review Ex 3 Qu 1, 7
The route inspection problem. (3 lessons)	Algorithm for finding the shortest route around a network, travelling along every edge at least once and ending at the start vertex. The network will have up to four odd nodes.	Also known as the 'Chinese postman' problem. Candidates will be expected to consider all possible pairings of odd nodes. The application of Floyd's algorithm to the odd nodes is not required.			Review Ex 2 Qu 3 Ex 3D Qu 2
Review and Test (2 lessons)					

DECISION 1 SCHEME OF WORK

Topic	Objectives	Notes	Resources	ICT	Formal Homework
Critical Path Analysis (7 lessons)	Modelling of a project by an activity network, including the use of dummies. Algorithm for finding the critical path. Earliest and latest event times. Earliest and latest start and finish times for activities. Total float. Gantt (cascade) charts. Scheduling	A precedence table will be given. Activity on edge will be used.			Review Ex 2 Qu 6, 9, 10
Review and Test (2 lessons)					

C4 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
C4 Mindmap					
Algebra and Functions	**Prior Knowledge:** ☺ *Simplification of rational expressions including factorising and cancelling (C3)*				
	Rational functions. Partial fractions (denominators not more complicated than repeated linear terms).	*BOTM* Identifying partial fractions Finding partial fractions Improper partial fractions The mixed bag		On Target True, Never, Sometimes; Teacher Notes Mathsnet Exam Questions	**NRich** Complex Partial Fractions (first part of this problem)
Things to make you go hmmmmmm…….					

C4 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
Coordinate Geometry	**Prior Knowledge:** ☺ *Plot graphs of linear, quadratic, cubic functions, the reciprocal function $y = 1/x$, $x \neq 0$, the exponential function $y = k^x$ for integer values of x and simple positive values of k, the trigonometrical functions, using a spreadsheet of graph plotter as well as pencil and paper; recognise the characteristic shapes of all these functions (C1)* ☺***Solution of simultaneous equations. Analytical solution by substitution (C1)***				
	Cartesian and parametric equations of curves and conversion between the two forms.	*BOTM* Cartesian or parametric Points on parametrics Parametric pictures		On Target True, Never, Sometimes; Teacher Notes Mathsnet Exam Questions	A14 EXPLORING EQUATIONS IN PARAMETRIC FORM RISP 27 RISP 29 **NRich** Folium of Descartes
	Things to make you go hmmmmmm…….				

C4 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
Sequences and Series	**Prior Knowledge:** ☺ *Binomial expansion of $(1+x)^n$ for a positive integer n (C2)* ☺ *The notations n! and $\binom{n}{r}$ (C2)* ☺ *Multiplying fractions and integers*				
	Binomial series for any rational n.	*BOTM* Valid expansions Rational powers Binomial with a twist Partial binomials		On Target True, Never, Sometimes; Teacher Notes Mathsnet Exam Questions	RISP 19 RISP 22 **NRich** Discrete Trends
	Things to make you go hmmmmmm…….				

C4 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
Differentiation	**Prior Knowledge:** ☺ *Cartesian and parametric equations of curves and conversion between the two forms.* ☺ *$y = a^x$ and its graph (C2)* ☺ *Indefinite integration as the reverse of differentiation (C1)* ☺ *Integration of x^n (C1)*				
	Differentiation of simple functions defined implicitly or parametrically.	*BOTM* Implicit functions Implicit differentiation Parametric differentiation Parametric areas Areas with a twist		On Target	**NRich** Squareness Folium of Descartes
	Exponential growth and decay			True, Never, Sometimes; Teacher Notes	
	Formation of simple differential equations	*BOTM* Differential equations		Mathsnet Exam Questions	RISP 28 RISP 30 **NRich** Integral Equation
Things to make you go hmmmmmm…….					

C4 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
Integration	**Prior Knowledge:** ☺ *Indefinite integration as the reverse of differentiation (C1)* ☺ *Integration of x^n (C1)* ☺ *Evaluation of definite integrals (C2)* ☺ *Interpretation of the definite integral as the area under a curve (C2)* ☺ *Approximation of area under a curve using the trapezium rule (C2)* ☺ *Differentiation of e^x, lnx, sinx, cosx and tanx and their sums and differences (C3)* ☺ *Differentiation using the product rule, the quotient rule, the chain rule (C3)* ☺ *The use of $\frac{dy}{dx} = 1/\frac{dy}{dx}$ (C3)* ☺ *Simplification of rational expressions including factorising and cancelling (C3)* ☺ *Partial fractions (C4)* ☺ *Formation of simple differential equations (C4)* ☺ *Solve problems involving volumes of right prisms, cylinders, cones and spheres*				
	Integration of e^x, $\frac{1}{x}$, sinx, cosx	*BOTM* Standard functions Logarithms	Log cabin or beachhut? Maths poetry E Jokes SIC is negative Find your buddy	On Target	

C4 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
	Simple cases of integration by i) substitution and ii) integration by parts. These methods as the reverse process of the chain and product rules respectively.	BOTM Simple substitution Definite substitution Harder substitution Integrating tanx Integrating lnx Trigonometry Definite Integration Making decisions	i) Where does $y = \int f(x)\frac{dx}{du}du$ come from?; Unjumble with a twist; Teacher Notes ii) Unjumble cyclic; Teacher Notes *Gotta be, could be, can't be*; Teacher Notes Fifty ways to do an integral	Standard, substitution or parts*; Teacher Notes True, Never, Sometimes; Teacher Notes	
	Simple cases of integration using partial fractions	BOTM Harder Logarithms			
	Evaluation of volume of revolution.	BOTM Volumes Parametric volumes	Deriving $V = \pi \int y^2 dx$ *Trio*; Teacher Notes Cone Unjumble; Teacher Notes Sphere Unjumble; Teacher Notes	Mathsnet Exam Questions	RISP 25

C4 (EDEXCEL)					
Topic	**Objectives**	**ICT Resources** including Bring on the Maths (BOTM) Match Up Maths (MUM)	**GlosMaths Resources**	**Assessment**	**Success For All and other resources**
	Analytical solution of simple first order differential equations with separable variables. Numerical integration of functions.		*Differential equation buddies*; Teacher Notes		RISP 30 **NRich** Out in Space Mechanical Integration
			Things to make you go hmmmmmm…….		

C4 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
Vectors	**Prior Knowledge:** ☺ *Understand and use vector notation;* ☺ *Calculate and represent graphically the sum of two vectors, the difference of two vectors and a scalar multiple of a vector;* ☺ *Calculate the resultant of two vectors;* ☺ *Understand and use the commutative and associative properties of vector addition;* ☺ *Solve simple geometrical problems in 2-D using vector methods* ☺ *Multiplication of integers* ☺ *Find the gradient of lines given by equations of the form y = mx + c (when values are given for m and c)* ☺ *Understand that the form y = mx + c represents a straight line and that m is the gradient of the line, and c is the value of the y intercept* ☺ *The sine and cosine rules* ☺ *Area of a triangle = ½absinC*				
	Vectors in 2 and 3 dimensions. Magnitude of a vector . Algebraic operations of vector addition, subtraction and multiplication by a scalar, and their geometrical interpretations Position vectors. The distance between two points. The orthogonal unit vectors.	BOTM Basic skills Position vectors A mixed bag	Vector Song Quick History *Trio*; Teacher Notes *Vector terminology loop*; Teacher Notes *Vector intro loop*; Teacher Notes *Position vector buddies*; Teacher Notes	On Target *Treasure Hunt (Easy)* Treasure Hunt (Hard)	**NRich** Article: Vectors – What Are They?
	The scalar product. Its use for calculating the angle between two lines.	*BOTM* Dot Product	Deriving the formula; Student version World problem		**NRich** Article: Multiplication of Vectors Cubestick Flexi Quads Tetra Perp

C4 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
	Vector equations of lines.	BOTM Equations of lines Intersecting lines	Cartesian link *Unjumble*; Teacher Notes *Trio Vector Equation*; Teacher Notes *Trio Vector link with Cartesian*; Teacher Notes *Trio Perpendicular and Intersecting lines*; Teacher Notes	True, Never, Sometimes; Teacher Notes Mathsnet Exam Questions	RISP 29
Things to make you go hmmmmmm…….					

Formulae that students are expected to remember and that may not be included in formulae booklets.

Integration

Function	Integral
$\cos kx$	$\frac{1}{k}\sin kx + c$
$\sin kx$	$-\frac{1}{k}\cos kx + c$
e^{kx}	$\frac{1}{k}e^{kx} + c$
$\frac{1}{x}$	$\ln\lvert x\rvert + c,\ x \neq 0$
$f'(x) + g'(x)$	$f(x) + g(x) + c$
$f'(g(x))\,g'(x)$	$f(x) + g(x) + c$

Vectors

$$\begin{pmatrix} x \\ y \\ z \end{pmatrix} \bullet \begin{pmatrix} a \\ b \\ c \end{pmatrix} = xa + yb + zc$$

C3 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
Algebra and Functions	**Prior Knowledge:** ☺ *Understand equivalent fractions, simplifying a fraction by cancelling all common factors;* ☺ *Add and subtract fractions by writing them with a common denominator;* ☺ *Multiply and divide a given fraction by an integer, by a unit fraction and by a general fraction* ☺ *Understand that the transformation of algebraic entities obeys and generalises the well-defined rules of generalised arithmetic;* ☺ *Simplify simple algebraic fractions to produce linear expressions* ☺ *Solve equations involving simple algebraic fractions including compound expressions as numerators and/or denominators* ☺ *Substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$* ☺ *Solve linear equations that require prior simplification of brackets, including those that have negative signs occurring anywhere in the equation, and those with a negative (or fractional) solution* ☺ *Manipulate algebraic expressions by collecting like terms, multiplying a single term over a bracket, taking out common factors, expand the product of two linear expressions eg $(ax \pm p)(bx \pm q)$; factorising quadratic expressions including the difference of two squares and cancelling common factors in rational expressions* ☺ *Plot graphs of linear, quadratic, cubic functions, the reciprocal function $y = 1/x$, $x \neq 0$, the exponential function $y = k^x$ for integer values of x and simple positive values of k, the trigonometrical functions, using a spreadsheet of graph plotter as well as pencil and paper; recognise the characteristic shapes of all these functions (C1)* ☺ *Knowledge of the effect of simple transformations on the graph of $y = f(x)$ as represented by $y = af(x)$, $y = f(x) + a$, $y = f(x+a)$, $y = f(ax)$(C1)*				
	Simplification of rational expressions including factorising and cancelling.	*BOTM* Simplifying fractions Manipulating algebra		On Target True, Never, Sometimes; Teacher Notes	RISP 21 **NRich** Problem and article – Telescoping Functions

C3 Mindmap

C3 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
	Definition of a function. Domain and range of functions.	***BOTM*** Range and domain	Introduction to the history and language of functions Identifying mappings; Teacher notes A graph or not a graph; Teacher Notes When odd is even? Partners Please; Teacher Notes	*Function Summary Loop* Function True, Never, Sometimes; Teacher Notes	RISP 4 RISP 16 RISP 18
	Composition of functions.	***BOTM*** Composite functions AUTOGRAPH Composite Snap	*We will, we will combine you; Teacher Notes* Composite Song	*Treasure Hunt; Teacher Notes*	
	Inverse functions and their graphs.	*BOTM Inverse functions* AUTOGRAPH Inverse Snap	Can we always reverse? Teacher Notes *Inverse loop; Teacher Notes* Why is the inverse a reflection on the line y=x? Student sheet		A7 INTERPRETING FUNCTIONS,

C3 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
	The modulus function	BOTM Modulus functions Solving functions AUTOGRAPH Modulus	Intro to modulus loop; Teacher Notes Solving Modulus equations tutorial *TRIO*; Teacher Notes *Modulus challenge*; Teacher Notes	Mathsnet Exam Questions	**NRich** Slide
	Combinations of the transformations y = f(x) as represented by y = af(x), y = f(x) + a, y = f(x+a), y = f(ax).	*BOTM* Transforming graphs			A12 EXPLORING TRIGONOMETRICAL GRAPHS **NRich** Parabolas Again
Things to make you go hmmmmmm…….					

C3 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
Exponentials and Logarithms	**Prior Knowledge:** ☺ *$y = a^x$ and its graph (C2)* ☺ *The laws of logarithms (C2)* ☺ *The solution of equations of the form $a^x = b$ (C2)* ☺ *Inverse functions and their graphs.(C3)*				
	The function e^x and its graph. (Link with 'Differentiation' section - Differentiation of $y=a^x$)	*BOTM* Exponential graphs AUTOGRAPH Differentiating $y=a^x$	Who is e? The Enigmatic number e Who's best - E or Pi ?	On Target	RISP 13
	ln x as the inverse function of e^x	*BOTM* Solving equations I Solving equations II		True, Never, Sometimes; Teacher Notes	RISP 29
	The function ln x and its graph	*BOTM* Natural logarithms		Mathsnet Exam Questions	
Things to make you go hmmmmmm…….					

C3 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
Trigonometry	**Prior Knowledge:** ☺ *Sine, cosine and tangent functions. Their graphs, symmetries and periodicity. (C2)* ☺ *The sine and cosine rules; Area of a triangle = ½absinC* ☺ *Radian measure (C2)* ☺ *Knowledge and use of tanx = sinx/cosx and $\sin^2\theta + \cos^2\theta = 1$. (C2)* ☺ *Solution of simple trigonometric equations in a given interval. (C2)* ☺ *Inverse functions and their graphs.(C3)*				
	Knowledge of secant, cosecant and cotangent and of arcsin, arccos and arctan. Their relationships to sine, cosine and tangent. Understanding of their graphs and appropriate restricted domains.	*BOTM* Trigonometrical graphs GSP Back to the unit circle AUTOGRAPH Inverse Sine	0=1? A brief history The Trig Family Song Drawing the graph of inverse sine; Teacher Notes *Special Angles*; Teacher Notes	On Target True, Never, Sometimes; Teacher Notes	
	Knowledge and use of $1 + \tan^2\theta = \sec^2\theta$ $1 + \cot^2\theta = \operatorname{cosec}^2\theta$	BOTM Identities I MUM Trig Identities GSP Back to the unit circle	*Identity match* *Trio*; Teacher Notes	*Treasure Hunt Identities*; Teacher Notes	**NRich** t for Tan Octa Flower

C3 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
	Knowledge and use of formulae for sin (A ± B), cos (A ± B) and tan (A ± B); Knowledge and use of double angle formulae	*BOTM* Identities II Compound Angles	Proof; Teacher Notes Sin75° > 1 Back to Malta! Unjumble proof 1 Unjumble proof 2 Unjumble proof 3 Unjumble proof 4 Teacher Notes		RISP 26 RISP 29 **NRich** Shape and Territory
	Knowledge and use of the expressions for $a\cos\theta + b\sin\theta$ in the equivalent forms of $r\cos(\theta \pm \alpha)$ or $r\sin(\theta \pm \alpha)$	BOTM Further Compound Angles problems	*Trio*; Teacher Notes Equation hierachy	*Treasure Hunt rcos/rsin*; Teacher Notes Mathsnet Exam Questions	**NRich** Loch Ness (Involves modulus function & differentiation)
Things to make you go hmmmmmm…….					

C3 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
Differentiation	**Prior Knowledge:** ☺ *The derivative of f(x) as the gradient of the tangent to the graph of y = f (x) at a point; the gradient of the tangent as a limit; interpretation as a rate of change. Second order derivatives.* ☺ *Differentiation of x^n and related sums and differences.* ☺ *Applications of differentiation to gradients, tangents and normals.* ☺ *Applications of differentiating to maxima and minima and stationary points, increasing and decreasing functions* ☺ *ln x as the inverse function of e^x*				
	Differentiation of i) e^x ii) sinx,cosx iii) and their sums and differences.	*BOTM* Trigonometrical functions I Trigonometrical functions II Further Differentiation Second derivatives Even further differentiation MUM Harder Differentiation Trig Differentiation AUTOGRAPH Differentiating sine and cosine Differentiating $y=a^x$ EXCEL Discovering e by differentiating $y=a^x$ from first principles	i) Discovering e by differentiating $y=a^x$ from first principles Unjumble differentiating a^x E jokes ii) Small angles; Teacher Notes First principles; Teacher Notes Trig First Principles Game; Teacher Notes *Find your 'standard' buddy*; Teacher Notes	On Target True, Never, Sometimes; Teacher Notes Differentiation 3 in a line; Teacher Notes	

C3 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
	Differentiation using the product rule, the quotient rule, the chain rule. Differentiation of tanx	BOTM Tangent and cosecant Cotangent and secant Product rule Quotient Rule Chain Rule MUM Finding gradients using any method	Deriving the rules for: Product Quotient Chain Which method? Teacher Notes *Product loop*; Teacher Notes **Quotient Treasure Hunt**; Teacher Notes Quotient Song Differentiating tanx	Mathsnet Exam Questions	RISP 21
	The use of $\frac{dy}{dx} = 1/\frac{dy}{dx}$ Differentation of lnx	*BOTM* Even further differentiation (Differentiation of y=lnx)	*Trio*; Teacher Notes		**NRich** Exponential Trend Quick Route
			Things to make you go hmmmmmm…….		

C3 (EDEXCEL)

Topic	Objectives	ICT Resources including Bring on the Maths (BOTM) Match Up Maths (MUM)	GlosMaths Resources	Assessment	Success For All and other resources
Numerical Methods	**Prior Knowledge:** ☺ *Substitute positive and negative numbers into expressions such as $3x^2 + 4$ and $2x^3$* ☺ *Sequences, including those given by a formula for the nth term and those generated by a simple relation in the form $x_{n+1} = f(x_n)$ (C1)*				
	Location of the roots of f(x)=0 by considering changes of sign of f(x) in an interval of x in which f(x) is continuous.	*BOTM* Roots in a range		On Target Mathsnet Exam Questions True, Never, Sometimes; Teacher Notes	**NRich** Spokes
	Approximate solutions of equations using simple iterative methods, including recurrence relations of the form $x_{n+1} = f(x_n)$.	*BOTM* Iteration I Iteration II			**NRich** Equation Attack Two Trees
	Things to make you go hmmmmmm…….				

Formulae that students are expected to remember and that may not be included in formulae booklets.

Trigonometry

$\cos^2 A + \sin^2 A \equiv 1$

$\sec^2 A \equiv 1 + \tan^2 A$

$\operatorname{cosec}^2 A \equiv 1 + \cot^2 A$

$\sin 2A \equiv 2 \sin A \cos A$

$\cos 2A \equiv \cos^2 A - \sin^2 A$

$\tan 2A \equiv \dfrac{2 \tan A}{1 - \tan^2 A}$

Differentiation

Function	Derivative
$\sin kx$	$k \cos kx$
$\cos kx$	$-k \sin kx$
e^{kx}	ke^{kx}
$\ln x$	$\dfrac{1}{x}$
$f(x) + g(x)$	$f'(x) + g'(x)$
$f(x)g(x)$	$f'(x)g(x) + f(x)g'(x)$
$f(g(x))$	$f'(g(x))g'(x)$