Year 12 Further Mathematics – Key vocabulary list

Appendix 1: Term 1

Unit 1CP1: Complex numbers

"Belonging to" $\in$	Complex number z	Integer	Real
$\mathbb{C}$ set of complex numbers	Conjugate pair	Polynomial	Root
Coefficient	Cubic	Quadratic	Simplify
Complex	Discriminant	Quartic	$\mathbb{Z}$ set of integers
Complex conjugate z^*	Imaginary	$\mathbb{R}$ set of real numbers	i

Unit 1CP2: Argand Diagrams

Angle bisector	Complex conjugate	Locus/Loci	Radians
Anticlockwise	Diameter	Max $\|z\|$	Radius
Argand Diagram	Gradient	Min $\|z\|$	Real axis
Argument $\arg(z)$	Half-line	Modulus $\|z\|$	Region
Bisects	Hence	Modulus-argument form	Set notation { ...}
Cartesian form	Imaginary axis	Perpendicular bisector	Tangent
Centre	Intersection $\cap$	Positive real axis	Union $\cup$
Circle	Line segment	Quadrant	Vector

Unit 1CP3: Series

Evaluate	$\mathbb{N}$ Set of natural numbers	Series	Sum of r $\sum r$
General result	Natural number	Show that	Sum of cubes $\sum r^3$
Hence	Polynomial	Sigma notation $\sum f(x)$	Sum of squares $\sum r^2$
Integer	Satisfies	Standard results	Verify
Limits	Sequence	Sum of 1 $\sum 1$	

Unit D1-1: Algorithms

Algorithm	First-fit	Lower bound	Run time
Bin-packing algorithm	First-fit decreasing	Optimal solution	Sequence
Bubble sort	Flow-chart	Order	Size
Cubic order	Full-bin	Pass	Sorted list
Decision	Implement	Pivot	Start/End
Factor	Instruction	Quadratic order	Sub-list
Finite	Linear order	Quick sort	Working list

Unit D1-2: Graphs and networks

Adjacency matrix	Euler's handshaking lemma	Node	Trail
Arc	Even degree	Non-planar	Tree
Complete graph	Graph	Odd degree	Undirected graph
Connected	Graph theory	Order of vertex	Valency of vertex
Cycle	Hamiltonian cycle	Path	Vertex set
Degree of vertex	Isomorphic graph	Planar	Vertex/vertices
Directed edge	Lemma	Planar graph	Walk
Directed graph(digraph)	Line segment	Planarity algorithm	Weight
Distance matrix	Loop	Simple graph	Weighted graph
Edge	Matrix	Spanning tree	
Edge set	Network	Subgraph	

Year 12 Further Mathematics – Key vocabulary list

Appendix 1: Term 2

Unit 1CP4: Roots of polynomials

Argand diagram	Cubic	$\mathbb{R}$ set of real numbers	Sums of squares
Belonging to $\in$	Linear transformation	Real	Symmetry
$\mathbb{C}$ set of complex numbers	Product	Reciprocal	$Im(\alpha)$ Imaginary component
Coefficient	Product of roots	Roots $\alpha, \beta, \gamma, \delta$	$Re(\alpha)$ Real component
Complex	Quadratic	Sum of roots	
Conjugate	Quartic	Sums of cubes	

Unit 1CP6: Matrices

Additively conformable	Exists	Parallel	Sheaf
Array	Identity matrix **I**	Plane	Singular matrix
Associative	Inconsistent	Point	Size
Cofactor matrix C	Infinitely many	Post-multiply	Square matrix
Columns	Inverse	Pre-multiply	System of equations
Commutative	Leading diagonal	Prism	Transpose
Consistent	Matrix	Product	Transpose matrix M^T
Corresponding	Matrix of minors	Rows	Unique solution
Determinant det M	Minor	Scalar	Vector
Determinant |M|	Multiplicatively conformable	Scalar multiplication	Zero matrix
Element	Non-singular matrix	Self-inverse	

Unit D1-3: Algorithms on graphs

Algorithm	Edge	Network	Route table
Arc	Final label	Node	Shortest path
Dijkstra's algorithm	Floyd's algorithm	Order	Vertex/vertices
Directed arc	Kruskal's algorithm	Order of labelling	Weight
Directly connected	Minimum connector	Prim's algorithm	
Distance matrix	Minimum spanning tree MST	Route	

Unit D1-4: Route inspection

Algorithm	Edge	Network	Route table
Arc	Final label	Node	Shortest path
Dijkstra's algorithm	Floyd's algorithm	Order	Vertex/vertices
Directed arc	Kruskal's algorithm	Order of labelling	Weight
Directly connected	Minimum connector	Prim's algorithm	
Distance matrix	Minimum spanning tree MST	Route	

Year 12 Further Maths – Key vocabulary list

Appendix 1: Term 3

Unit 1CP7: Linear transformations

Angle of rotation	Line of invariant points	Origin	Stretch
Anticlockwise	Line of reflection	Parallel to …	Successive transformations
Area scale factor	Linear	Plane of symmetry	Transformation
Determinant	Linear transformation	Positive x-axis	Transformation matrix
Image	Map	Reflection	Two-way stretch
Invariant line	Matrix	Reflection matrix	Unit vectors
Invariant point	Object	Rotation	Vertex/vertices
Inverse matrix M^{-1}	Order of application	Rotation matrix	

Unit D1-5: Travelling salesman

Algorithm	Eulerian cycle	Odd	Semi-Eulerian graph
Chinese postman	Eulerian graph	Order of node	Shortest route
Connected graph	Even	Pairing vertices	Trail
Degree of vertex	Network	Route	Vertex/vertices
Edge	Node	Route inspection	Weight

Unit D1-6: Linear programming

Arc	Initial upper bound	Practical problem	Travelling salesman
Classical problem	Interval	Prim's algorithm	Triangle inequality
Distinct	Kruskal's algorithm	Reconnect	Undirected network
Edge	Lower bound	Residual minimum spanning tree RMST	Upper bound
Finite sequence	Minimum spanning tree MST	Shortest distinct arc	Vertex/vertices
Hamiltonian cycle	Nearest neighbour algorithm	Table of least distances	Walk
Hamiltonian cycle	Optimal solution	Tour	

Year 12 Further Mathematics – Key vocabulary list

Appendix 1: Term 4

Unit 1CP8: Proof by induction

$\mathbb{Z}^+$ set of positive integers	Divisibility	Matrix	RHS right hand side
Assume true	Inductive	Positive integers	Show true
Assumption	Iterative	Proof by induction	Summation
Belonging to $\in$	LHS left hand side	Prove	Sums of series
Conclusion	Mathematical induction	Recursive	

Unit 1CP5: Volume of revolution

Bounded	Function	Model	Substitute
Cone	Generated	Radians	Summation
Cylinder	Integral	Region	Verify
Definite integration	Intersection	Rotated 2π about …	Volume
Exact	Limits	Solid of revolution	Volume of revolution

Unit 1CP9: Vectors (part 1)

Cartesian form	Length	Perpendicular	Unit vector $\hat{\boldsymbol{a}}$
Column vector	Line segment	Plane	Vector
Coplanar	Modulus	Point	Vector equation of a line **r**
Cross product $\boldsymbol{a} \times \boldsymbol{b}$	Normal to	Position vector	Vector equation of a plane π
Determinant of matrix	Normal vector	Scalar	Vector product $\boldsymbol{a} \times \boldsymbol{b}$
Direction vector	Origin O	Scalar product $\boldsymbol{a} \cdot \boldsymbol{b}$	ijk notation
Dot product $\boldsymbol{a} \cdot \boldsymbol{b}$	Parallel	Shortest distance	
Intersection	Parameter	Skew	

Unit D1-7: Simplex algorithm

“fail to satisfy”	Inequality	Minimum point	Ruler method
Constraints	Integer only solution	Objective function	Satisfy
Decision variables	Linear programming	Objective line method	Vertex testing
Define variables	Maximise	Optimal solution	
Feasible region	Maximum point	Optimal vertex	
Illustrate graphically	Minimise	Region	

Year 12 Further Mathematics – Key vocabulary list

Appendix 1: Term 5

Unit 1CP9: Vectors (part 2)

Cartesian form	Length	Perpendicular	Unit vector $\hat{\boldsymbol{a}}$
Column vector	Line segment	Plane	Vector
Coplanar	Modulus	Point	Vector equation of a line **r**
Cross product $\boldsymbol{a} \times \boldsymbol{b}$	Normal to	Position vector	Vector equation of a plane π
Determinant of matrix	Normal vector	Scalar	Vector product $\boldsymbol{a} \times \boldsymbol{b}$
Direction vector	Origin O	Scalar product $\boldsymbol{a} \cdot \boldsymbol{b}$	ijk notation
Dot product $\boldsymbol{a} \cdot \boldsymbol{b}$	Parallel	Shortest distance	
Intersection	Parameter	Skew	

Unit D1-8: Critical path analysis

Arbitrarily large number	Linear programming	Optimal vertex	Slack variable
Artificial variable	Maximise	Pivot	Surplus variable
Basic feasible solution	Minimise	Pivot column	Two-stage Simplex method
Basic variable	Non-basic variables	Pivot row	θ value
Big-M method	Non-negativity constraints	Row operations	
Constraints	Objective	Simplex algorithm	
Decision variable	Objective function	Simplex tableau	

Year 12 Further Mathematics – Key vocabulary list

Appendix 1: Term 6

Unit 2CP1: Complex numbers

Argand diagram	Exponential form	n^{th} root	Root
Argument $\arg(z)$	Geometric series	Origin O	Roots of unity
Complex number z	Identity	Proof by induction	Sum of geometric series
Converge	Imaginary axis $Im(z)$	Radians	Vertex/vertices
Cube roots of unity $1, \omega, \omega^2$	Imaginary component	Real axis $Re(z)$	
De Moivre's theorem	Modulus $\|z\|$	Real component	
Euler's relation	Modulus-argument form	Regular polygon/n-gon	

Unit D2-1: Transportation

Balanced	Dummy supply point	North-west corner method	Supply point
Capacity	Entering cell	Objective function	Total demand
Constraints	Entering route	Optimal solution	Total supply
Cost matrix	Exiting cell	Particular solution	Transportation
Cycle of adjustments	Exiting route	Route	Transportation algorithm
Decision variables	Feasible solution	Shadow costs	Transportation costs
Degenerate solution	Improved solution	Source	Unbalanced
Demand	Improvement index	Source cost	Unit cost
Demand point	Initial solution	Stepping-stone method	
Destination cost	Iteration	Stock	
Dummy demand point	Linear programming	Supply	