

# Year 13 Further Mathematics - Pure Teacher

Topic		Ref	Ex
<b>Complex Numbers</b>	<b>Exponential Form</b> <ul style="list-style-type: none"> <li>• Know and use the definition <math>e^{i\theta} = \cos \theta + i \sin \theta</math> and the form <math>z = re^{i\theta}</math></li> <li>• Multiply and divide complex numbers in exponential form.</li> </ul>	P2.9	1A 1B
	<b>De Moivre's Theorem</b> <ul style="list-style-type: none"> <li>• Understand de Moivre's theorem.</li> <li>• Use de Moivre's theorem to derive trigonometric identities</li> <li>• Use de Moivre's theorem to find sums of series.</li> </ul>	P2.8	1C 1D 1E
	<b>nth roots of a complex number</b> <ul style="list-style-type: none"> <li>• Understand the nth roots of unity (solve <math>z^n = 1</math>) and their representation in an Argand diagram</li> <li>• Be able to find the nth roots of any complex number.</li> <li>• Use complex roots of unity to solve geometric problems.</li> </ul>	P2.10 P2.11	1F 1G
<b>Complex Numbers Assessment</b>			
<b>Series</b>	<b>Method of Differences</b> <ul style="list-style-type: none"> <li>• Understand and use the method of differences to sum finite series</li> </ul>	P4.4	2A
	<b>Maclaurin Series</b> <ul style="list-style-type: none"> <li>• Know how to express functions as an infinite series in ascending powers using Maclaurin series expansion.</li> <li>• Be able to find the series expansions of compound functions.</li> </ul>	P4.5 P4.6	2B 2C 2D
<b>Series Assessment</b>			
<b>Further Calculus</b>	<b>Improper Integrals</b> <ul style="list-style-type: none"> <li>• 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.</li> </ul>	P5.2	3A
	<b>Mean Value of a function</b> <ul style="list-style-type: none"> <li>• Understand and evaluate the mean value of a function.</li> </ul>	P5.3	3B
	<b>Inverse Trigonometric Functions</b> <ul style="list-style-type: none"> <li>• Differentiate inverse trigonometric functions</li> <li>• Integrate rational functions and be able to choose trigonometric substitutions to integrate associated functions.</li> </ul>	P5.5 P5.6	3C 3D
	<b>Partial Fractions</b> <ul style="list-style-type: none"> <li>• Extend integration using partial fractions to quadratics factors of the form <math>ax^2 + c</math> in the denominator.</li> </ul>	P5.4	3E
<b>Further Calculus Assessment</b>			

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<b>Further Volumes of Revolution</b>	<b>Volumes of Revolution</b> <ul style="list-style-type: none"> <li>• Find volumes of revolution around the x-axis or y-axis for more complex functions.</li> <li>• Find volumes of revolution around the x-axis or y-axis for curves defined parametrically.</li> </ul>	P5.1	4A 4B  4C
	<b>Modelling with Volumes of Revolution</b> <ul style="list-style-type: none"> <li>• Using volumes of revolution to model real life situations.</li> </ul>	P5.1	4D
<b>Volumes of Revolution Assessment</b>			
<b>Polar Coordinates</b>	<b>Definition and Cartesian conversion</b> <ul style="list-style-type: none"> <li>• Understand and use polar coordinates <math>(r, \theta)</math></li> <li>• Convert from polar to Cartesian coordinates and vice-versa.</li> <li>• Convert equations between polar and Cartesian form.</li> </ul>	P7.1	5A
	<b>Sketching curves</b> <ul style="list-style-type: none"> <li>• Be able to sketch curves with simple polar equations, including trigonometric functions.</li> </ul>	P2.1	5B
	<b>Area enclosed by a polar curve</b> <ul style="list-style-type: none"> <li>• Find the area enclosed by a polar curve.</li> <li>• Find the area of a region enclosed between two polar curves.</li> </ul>	P7.3	5C
	<b>Tangents to polar curves</b> <ul style="list-style-type: none"> <li>• Find equations of tangents parallel to or at right angles to the initial line.</li> </ul>	P7.3	5D
<b>Polar Coordinates Assessment</b>			
<b>Hyperbolic Functions</b>	<b>Definition and Graphs – sinh, cosh, tanh</b> <ul style="list-style-type: none"> <li>• Understand the definitions of hyperbolic functions: <math>\sinh x</math>, <math>\cosh x</math> and <math>\tanh x</math>.</li> <li>• Be able to sketch their graphs and know their domains and ranges.</li> </ul>	P8.1	6A
	<b>Inverse hyperbolic functions – arsinh, arcosh, artanh</b> <ul style="list-style-type: none"> <li>• Understand and be able to use the definitions of the inverse hyperbolic functions and their domains and ranges.</li> <li>• Derive and use the logarithmic forms of the inverse hyperbolic functions.</li> </ul>	P8.3 P8.4	6B
	<b>Identities and Equations</b> <ul style="list-style-type: none"> <li>• Prove identities and solve equations using hyperbolic functions.</li> </ul>	P8.1 P8.3	6C
	<b>Calculus with hyperbolic functions</b> <ul style="list-style-type: none"> <li>• Be able to differentiate and integrate hyperbolic functions.</li> <li>• Use standard results for differentiating inverse hyperbolic functions to integrate functions of that type.</li> <li>• Choose and use a suitable hyperbolic substitution to integrate certain functions.</li> </ul>	P8.2 P8.5	6D 6E
<b>Hyperbolic Functions Assessment</b>			

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<b>Differential Equations</b>	<b>Integrating Factor</b> <ul style="list-style-type: none"> <li>• Solve first order differential equations using an integrating factor.</li> <li>• Find both general and particular solutions using given boundary conditions.</li> </ul>	P9.1 P9.2	7A
	<b>Second order differential equations</b> <ul style="list-style-type: none"> <li>• Solve second order homogeneous DEs (RHS = 0) by using the Auxiliary Equation.</li> <li>• Understand what to do in the case of distinct, repeated and complex roots of the auxiliary equation.</li> <li>• Solve second order non-homogeneous DEs (RHS = <math>f(x)</math>) by finding the complementary function and particular integral.</li> </ul>	P9.4 P9.5 P9.6	7B 7C 7D
	<b>Modelling with differential equations</b> <ul style="list-style-type: none"> <li>• Model real life situations with first order DEs.</li> <li>• Use DEs to model simple harmonic motion and relate the solution to the model.</li> <li>• Models damped and forced oscillations using DEs and interpret their solutions.</li> <li>• Model real-life situations using coupled first order DEs and be able to solve them.</li> </ul>	P9.3 P9.7 P9.8 P9.9	8A 8B 8C 8D
<b>Differential Equations Assessment</b>			