1. Polynomial and Rational Functions

Weeks 1–8

多项式函数与有理函数

They should be able to

1. Describe how the input and output values of a function vary together by comparing function values.
2. Construct a graph representing two quantities that vary with respect to each other in a contextual scenario.
3. Compare the rates of change at two points using average rates of change near the points.
4. Describe how two quantities vary together at different points and over different intervals of a function.
5. Determine the average rates of change for sequences and functions, including linear, quadratic, and other function types.
6. Determine the change in the average rates of change for linear, quadratic, and other function types.
7. Identify key characteristics of polynomial functions related to rates of change.
8. Identify key characteristics of a polynomial function related to its zeros when suitable factorizations are available or with technology.
9. Determine if a polynomial function is even or odd.
10. Describe end behaviors of polynomial functions.
11. Describe end behaviors of rational functions.
12. Determine the zeros of rational functions.
13. Determine vertical asymptotes of graphs of rational functions.
14. Determine holes in graphs of rational functions.
15. Rewrite polynomial and rational expressions in equivalent forms.
16. Determine the quotient of two polynomial functions using long division.
17. Rewrite the repeated product of binomials using the binomial theorem.
18. Construct a function that is an additive and/or multiplicative transformation of another function.
19. Identify an appropriate function type to construct a function model for a given scenario.
20. Describe assumptions and restrictions related to building a function model.
21. Construct a linear, quadratic, cubic, quartic, polynomial of degree n, or related piecewise-defined function model.
22. Construct a rational function model based on a context.
23. Apply a function model to answer questions about a data set or contextual scenario.

Stage	Use	Your notes
Starter 10 min · retrieval practice	Topic quiz 01 (10 questions, answers on sheet 2)	
Teach the new content	Handout 01 Slide deck 01 Vocabulary list 01	
Practice guided then independent	Exercise sheets 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 1.10, 1.11, 1.12, 1.13, 1.14 Past-paper sheets 1.1, 1.2, 1.3, 1.5, 1.6, 1.13, 1.14	
Check before they leave	Unit test 1 (with mark scheme)	

Stage	Use	Your notes
Homework set from the Library	Any unused exercise sheet above Holiday homework pack	

2. Exponential and Logarithmic Functions

Weeks 9–16

指数函数与对数函数

They should be able to

1. Express arithmetic sequences found in mathematical and contextual scenarios as functions of the whole numbers.
2. Express geometric sequences found in mathematical and contextual scenarios as functions of the whole numbers.
3. Construct functions of the real numbers that are comparable to arithmetic and geometric sequences.
4. Identify key characteristics of exponential functions.
5. Rewrite exponential expressions in equivalent forms.
6. Construct a model for situations involving proportional output values over equal-length input-value intervals.
7. Construct linear, quadratic, and exponential models based on a data set.
8. Validate a model constructed from a data set.
9. Evaluate the composition of two or more functions for given values.
10. Construct a representation of the composition of two or more functions.
11. Rewrite a given function as a composition of two or more functions.
12. Determine the input-output pairs of the inverse of a function.
13. Determine the inverse of a function on an invertible domain.
14. Evaluate logarithmic expressions.
15. Construct representations of the inverse of an exponential function with an initial value of 1.
16. Identify key characteristics of logarithmic functions.
17. Rewrite logarithmic expressions in equivalent forms.
18. Solve exponential and logarithmic equations and inequalities.
19. Construct the inverse function for exponential and logarithmic functions.
20. Construct a logarithmic function model.
21. Determine if an exponential model is appropriate by examining a semi-log plot of a data set.
22. Construct the linearization of exponential data.

Stage	Use	Your notes
Starter 10 min · retrieval practice	Topic quiz 02 (10 questions, answers on sheet 2)	
Teach the new content	Handout 02 Slide deck 02 Vocabulary list 02	
Practice guided then independent	Exercise sheets 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 2.15 Past-paper sheets 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.10, 2.11, 2.12, 2.13, 2.14	
Check before they leave	Unit test 2 (with mark scheme)	
Homework set from the Library	Any unused exercise sheet above Holiday homework pack	

3. Trigonometric and Polar Functions

Weeks 17–23

三角函数与极坐标函数

They should be able to

1. Construct graphs of periodic relationships based on verbal representations.
2. Describe key characteristics of a periodic function based on a verbal representation.
3. Determine the sine, cosine, and tangent of an angle using the unit circle.
4. Determine coordinates of points on a circle centered at the origin.
5. Construct representations of the sine and cosine functions using the unit circle.
6. Identify key characteristics of the sine and cosine functions.
7. Identify the amplitude, vertical shift, period, and phase shift of a sinusoidal function.
8. Construct sinusoidal function models of periodic phenomena.
9. Construct representations of the tangent function using the unit circle.
10. Describe key characteristics of the tangent function.
11. Construct analytical and graphical representations of the inverse of the sine, cosine, and tangent functions over a restricted domain.
12. Solve equations and inequalities involving trigonometric functions.
13. Identify key characteristics of functions that involve quotients of the sine and cosine functions.
14. Rewrite trigonometric expressions in equivalent forms with the Pythagorean identity.
15. Rewrite trigonometric expressions in equivalent forms with sine and cosine sum identities.
16. Solve equations using equivalent analytic representations of trigonometric functions.
17. Determine the location of a point in the plane using both rectangular and polar coordinates.
18. Construct graphs of polar functions.
19. Describe characteristics of the graph of a polar function.

Stage	Use	Your notes
Starter 10 min · retrieval practice	Topic quiz 03 (10 questions, answers on sheet 2)	
Teach the new content	Handout 03 Slide deck 03 Vocabulary list 03	
Practice guided then independent	Exercise sheets 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 3.8, 3.9, 3.10, 3.11, 3.12, 3.13, 3.14, 3.15 Past-paper sheets 3.4, 3.5, 3.6, 3.9, 3.10, 3.12	
Check before they leave	Unit test 3 (with mark scheme)	
Homework set from the Library	Any unused exercise sheet above Holiday homework pack	

4. Functions Involving Parameters, Vectors, and Matrices **Weeks 24–30**

涉及参数、向量与矩阵的函数

They should be able to

1. Construct a graph or table of values for a parametric function represented analytically.
2. Identify key characteristics of a parametric planar motion function that are related to position.
3. Identify key characteristics of a parametric planar motion function that are related to direction and rate of change.
4. Express motion around a circle or along a line segment parametrically.
5. Construct a graph of an equation involving two variables.
6. Determine how the two quantities related in an implicitly defined function vary together.
7. Represent conic sections with horizontal or vertical symmetry analytically.
8. Represent a curve in the plane parametrically.
9. Represent conic sections parametrically.
10. Identify characteristics of a vector.
11. Determine sums and products involving vectors.
12. Determine a unit vector for a given vector.
13. Determine angle measures between vectors and magnitudes of vectors involved in vector addition.
14. Represent planar motion in terms of vector-valued functions.
15. Determine the product of two matrices.
16. Determine the inverse of a 2×2 matrix.
17. Apply the value of the determinant to invertibility and vectors.
18. Determine the output vectors of a linear transformation using a 2×2 matrix.
19. Determine the association between a linear transformation and a matrix.
20. Determine the composition of two linear transformations.
21. Determine the inverse of a linear transformation.
22. Construct a model of a scenario involving transitions between two states using matrices.
23. Apply matrix models to predict future and past states for n transition steps.

Stage	Use	Your notes
Starter 10 min · retrieval practice	Topic quiz 04 (10 questions, answers on sheet 2)	
Teach the new content	Handout 04 Slide deck 04 Vocabulary list 04	
Practice guided then independent	Exercise sheets 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14	
Check before they leave	*nothing in the Library for this stage yet*	

Stage	Use	Your notes
Homework set from the Library	Any unused exercise sheet above Holiday homework pack	