

# Mathematics

## Secondary: Key Stage 4

Curriculum plan 2020-21



**OAK**  
NATIONAL  
ACADEMY

# 1. Curriculum Principles

As mathematics teachers we want our pupils to reach fluency in what we are teaching them. In mathematics, fluency requires a deep understanding of concepts and the ability to apply them flexibly and with automaticity. The mathematics curriculum uses multiple representations to help make connections across concepts to help build a deep conceptual understanding. By making consistent use of the same core representations we will scaffold pupils' thinking to help them understand abstract mathematical concepts. The curriculum will also include intelligent practice that is designed to help pupils develop automaticity in their mathematics.

We also aim for our pupils to be able to use the precise language of mathematics, as distinct from everyday language. The curriculum will do this by explicitly teaching mathematical vocabulary and introducing core sentence structures with which to express, connect, reason with and apply mathematical structures and ideas.

Finally, we also aim for our pupils to be able to think mathematically. The tasks and activities used in the curriculum teach pupils the components of mathematical thinking: to sort and classify, compare and contrast, specialise and generalise, to make conjectures and to prove them.

Below are the set of principles we have used to build this curriculum, with these ambitions for our pupils in mind.



## Coherence and flexibility

We strive to support schools by offering a maths curriculum that can fit alongside a range of existing structures. However, complete flexibility over unit ordering is impossible due to the cumulative nature of mathematics and the importance of prior knowledge.

We have grouped lessons into units: coherent sequences of 5 or more lessons. Although each lesson can be accessed individually, explicit connections are made to earlier lessons and later lessons in the same unit. This is because the connections between mathematical concepts are so vital to deepening understanding.

## Knowledge organisation

The units in the maths curriculum have been organised by strand. We have also created a set of sequences for pupils targeting different grades at GCSE and who are at different stages in KS4, organised based on the topics that are most useful for the GCSE course.

## Inclusive and ambitious

We know the difference it makes when children believe they “can do” maths. We are guided by the principles of the National Curriculum to ensure that every pupil, regardless of starting point, develops their fluency, reasoning and problem solving. Our activities are scaffolded so all children can succeed. Pupils are offered frequent opportunities to be and feel successful in their maths education.



We develop conceptual understanding by always building new understanding on what pupils already know, by representing concepts in different ways, and by making connections between concepts. The mathematics curriculum makes consistent use of the same core representations across year groups to help pupils connect prior learning to new learning. These representations are selected to make key mathematical structures and ideas accessible to all pupils, no matter what their starting points.

To support every child to communicate mathematically, pupils are introduced to core sentence structures with which to express, connect, reason with and apply mathematical structures and ideas.

## **Pupil engagement**

You learn maths by thinking about maths. Our lessons include mathematical tasks which have multiple solutions. Mathematical thinking is woven into the units using scaffolds and prompts such as ‘what is the same and what’s different?’, ‘is it sometimes, always or never true?’ and ‘which could be the odd one out?’. Throughout the curriculum, all pupils have opportunities to sort and classify, compare and contrast, specialise and generalise, to make conjectures and to prove them.

## **Motivation through learning**

We believe that mathematics is inherently interesting and that all children are entitled to a genuine experience of mathematics. The tasks and activities that pupils engage with harness innate ways of thinking and develop the habits of mind that are drawn upon when being mathematical. Problem solving is at the heart of every lesson with opportunities to investigate, explore and reason.



## 2. Subject structure overview

The Mathematics Key Stage 4 structure is organised into the 4 strands of Number(N), Algebra(A), Shape and Space(S) and Handling Data/Probability(D). These are organised into units of 4 lessons. These units will develop the pupils' previous learning at Key Stage 3. The units have been designed to allow for flexibility of order, however in some cases there are suggested prior units. Units that are in bold are for Higher Tier pupils only.

<b>Strand</b>	<b>Unit #</b>	<b>Unit Name</b>	<b>Prior Unit</b>
N	1	Directed Numbers	
N	2	4 Rules of Number	
N	3	Rules of Indices (numbers)	
N	4	Standard Form (Writing and converting)	
N	5	Standard Form 4 operations	
N	6	Factors Multiples and Primes	
N	7	Venn Diagrams	



N	8	HCF and LCM	
N	9	Types of Numbers	
N	10	Fraction Equivalents	
N	11	Fractions 1 (adding and subtracting)	
N	12	Fractions 2 (multiplying and dividing)	
N	13	Fraction Change	
N	14	Percentages	
N	15	Percentage Increase and Decrease	
N	16	Repeated Percentage Increase	
N	17	FDP Equivalents	
N	18	Decimals	
N	19	Rounding and Estimating	
N	20	Ratios (all these include 1 or 2 examples of using x and y)	



N	21	Ratio 2 (Ratio and Fractions/Direct Proportion/Best Buy)	
N	22	<b>Negative and Fractional Indices</b>	
N	23	<b>Surds (Simplifying)</b>	
N	24	<b>Adding surds</b>	N23
N	25	<b>Multiplying Surds</b>	N24
N	26	<b>Dividing and Rationalising surds</b>	N25
N	27	<b>Upper and Lower Bounds</b>	
N	28	<b>Recurring decimals</b>	



Strand	Unit #	Unit Name	Prior Unit
A	1	Collecting Terms and Simple Expansion	
A	2	Expand and Simplify Brackets	
A	3	Rules of Indices	
A	4	Solving Equations 1 (One step, Two Step and Brackets)	
A	5	Solving Equations 2 (Simple algebraic fractions)	
A	6	Substitution and Rearranging formulae	
A	7	Factorising (single bracket)	
A	8	Factorise and Solve a Quadratic ( $a=1$ )	
A	9	Solve Inequalities and Represent on Number Line	
A	10	Linear Sequences	
A	11	Simple Graphs (Linear from a table)	





A	12	Straight Line Graphs ( $y=mx+C$ )	
A	13	Quadratic Graphs ( $a=1$ )	
A	14	Simultaneous Equations (Linear)	
A	15	Straight line graphs 2 (Parallel Lines)	
A	16	Travel Graphs	
A	17	Compound Measures	
A	18	Cubic and Reciprocal Graphs	
A	19	<b>Algebraic Fractions</b>	
A	20	<b>Factorise and solve quadratics(<math>a &gt; 1</math>)</b>	
A	21	<b>Further Quadratic equations</b>	
A	22	<b>One linear and one quadratic simultaneous equations</b>	
A	23	<b>Quadratic sequences and Inequalities</b>	



A	24	<b>Further Algebra (Change the subject/Binomial expansion)</b>	
A	25	<b>Higher Straight lines (Perpendicular Lines)</b>	
A	26	<b>Quadratic graphs 2 (<math>a &gt; 1</math>)</b>	
A	27	<b>Other Graphs (Trig, Exponential and Transformations)</b>	
A	28	<b>Further graphs (Gradients/Area of curves)</b>	
A	29	<b>Circle Graphs</b>	
A	30	<b>Graphs of inequalities</b>	
A	31	<b>Direct and Inverse Proportion</b>	
A	32	<b>Further Algebraic Fractions</b>	S19
A	33	<b>Algebraic Proof</b>	
A	34	<b>Solve equations numerically (Iteration)</b>	
A	35	<b>Functions</b>	



Strand	Unit #	Unit Name	Prior Unit
S	1	Reflection	
S	2	Rotation and Enlargement	
S	3	Pythagoras Theorem 1	
S	4	Pythagoras Theorem 2	S3
S	5	Area and Perimeter	
S	6	Circles	
S	7	Cylinders	S6
S	8	Volume and Surface Area 1 (Prisms)	
S	9	Angle Facts	
S	10	Parallel Lines and Polygons 1	
S	11	Polygons 2 (Interior and Exterior)	S10
S	12	Translate and Vectors 1	



S	13	Vectors 2	S12
S	14	Bearings	
S	15	Views and Maps	
S	16	Constructions and Loci	
S	17	Loci	
S	18	Similarity	
S	19	Parts of Circles 1 (Semi and quarter circles)	S19
S	20	Parts of Circles 2 (Arcs and Sectors)	
S	21	Volume and Surface Area 2	
S	22	<b>Trigonometry 1</b>	
S	23	<b>Trigonometry 2</b>	S23
S	24	<b>Trigonometry 3</b>	S24
S	25	<b>Enlargement and Similarity</b>	



S	26	<b>Volume and Surface Area Higher 3</b>	
S	27	<b>Circle Theorems 1</b>	
S	28	<b>Circle Theorems 2</b>	S27
S	29	<b>Advanced Trigonometry 1</b>	
S	30	<b>Advanced Trigonometry 2</b>	S29
S	31	<b>Advanced Trigonometry 3</b>	S30
S	32	<b>Vectors Higher 1</b>	
S	33	<b>Vectors Higher 2 and Congruent Triangles</b>	S32



Strand	Unit #	Unit Name	Prior Unit
D	1	Frequency charts (Data Collection, Bar and Pictograms)	
D	2	Averages (From a list and tables, Stem and Leaf)	
D	3	Charts and Tables (Pie Chart and Two way tables)	
D	4	Scatter Diagrams and Frequency Trees	
D	5	Probability 1 ( Scale and equally likely events)	
D	6	Probability 2 (Sample space, Venn diagrams and experimental)	
D	7	Probability 3 (tree diagrams)	
D	8	<b>Higher Probability (conditional and Further Set Notation)</b>	
D	9	<b>Higher Data 1 (CF and Box Plots)</b>	
D	10	<b>Histograms</b>	
D	11	<b>Data Collection Higher</b>	



### 3. Suggested sequence

#### Year 10 Pupils 2020-21

Provided is a suggested sequence for pupils who may follow this course for two years to sit their GCSE exam in June 2022. There are three possible pathways available:

- i) Foundation for pupils aiming for a Grade 4
- ii) Core for pupils who will take the Higher Tier paper but are aiming for a grade 5 or 6
- iii) Higher Tier for pupils aiming for a Grade 7+.

If units are labelled in red then they are a combination of the units given in section 2.

There are 39 weeks of content provided here for pupils to study in year 10:

Week	Topic	Foundation (Aiming for 4)	Higher (Aiming for 7/8/9)	Core (Aiming for 5/6)
1	Number 1	Directed numbers	Simplifying surds	Directed numbers
2		Four Rules	Adding surds	Rules of Indices with numbers
3		Types of Number	Multiplying surds	Standard form
4		Rules of indices with numbers	Dividing and rationalising surds	Standard form operations



5	Algebra 1	Collecting like terms, simplifying	Solving equations 2	Collecting, indices, expand and simplify, solving equations 1
6		Expand and simplify	Algebraic fractions	Solving equations 2
7		Indices	Factorise and solve quadratic $a = 1$	Adding and Subtracting fractions
8		Solving equations 1	Factorise and solve quadratic $a > 1$	Algebraic fractions
9		Solving equations 2	Substitution and rearrange formulae	Factorise and solve quadratic $a = 1$
10		Substitution and rearrange formulae	Further algebra	Substitution and rearrange formulae
11	Shape 1	Reflections	Similarity	Rotation and enlargement
12		Rotation and enlargement	Trigonometry 1	Similarity
13		Pythagoras 1	Trigonometry 2	Pythagoras 1
14		Pythagoras 2	Trigonometry 3	Pythagoras 2
15	Number 2	Factors multiples and primes	Types of Number and Rules of Indices	Factors multiples and primes
16		Venn diagrams	Fractional and negative indices	Venn diagrams
17		HCF and LCM	Recurring decimals	HCF and LCM





18		Rounding and Estimating	Upper and lower bounds	Rounding and estimating
19	Algebra 2	Factorise 1	Straight line graphs	Simple graphs
20		Factorise 2	Straight line graphs 2	Straight line graphs
21		Inequalities	Higher straight lines	Straight line graphs 2
22		Linear sequences	Linear simultaneous equations	Linear simultaneous equations
23	Number & Statistics	Fraction equivalents	Scatter diagrams and frequency trees and Averages	Scatter diagrams and frequency trees
24		Fractions 1	Higher data 1	Averages
25		Fractions 2	Probability 2	Higher data 1
26		Fraction change	Higher Probability	Probability 2
27	Algebra 3	Simple graphs	Further quadratic equations	Quadratic graphs
28		Straight line graphs	Quadratic graphs	Quadratic graphs 2
29		Quadratic graphs 1	Quadratic graphs 2	Ratio 1 and 2
30		Percentages	Quadratic sequences	Percentages, increase and decrease



31	Shape and Number	Percentage Increase and decrease	One linear and one quadratic simultaneous equations	Repeated percentage change
32		Repeated percentage change	Parts of a circle 1/2	Fractions 1, 2 and Fractional Change
33		FDP Equivalents	Volume and Surface Area 1	Parts of circle 1
34		Decimals	Volume 2	Parts of circle 2
35		Rounding and Estimating	Surface Area 2	Cylinders
36		Ratio	Volume and Surface Area 2	Area and perimeter
37		Area and perimeter	Advanced Trig 1	Trigonometry 1
38		Circles	Advanced Trig 2	Trigonometry 2
39		Volume and surface area 1	Advanced Trig 3	Trigonometry 3



There are then 24 weeks of content provided for pupils in year 11:

Week	Topic	Foundation (Aiming for 4)	Higher (Aiming for 7/8/9)	Core (Aiming for 5/6)
1	Shape	Angle facts	Circle Theorems 1	Revise - angles, polygons, bearings
2		Parallel Lines and Polygons 1	Circle Theorems 2	Circle Theorems 1
3		Polygons 2	Constructions and Loci	Circle Theorems 2
4	Number & Algebra	Standard form - writing and converting	Solve equations numerically	Simplifying surds
5		Standard form - four operations	Direct and inverse proportion	Adding surds
6		Ratio 2	Functions	Functions
7		Revise - Solving equations	Further algebraic fractions	Quadratic sequences
8		Simultaneous equations	Algebraic Proof	Revise - simultaneous equations
9	Statistics and Probability	Frequency charts	Circle graphs	Charts and tables
10		Averages	Probability 3 (tree diagrams)	Revise - data (mean table, CF charts)
11		Charts and tables	Higher Probability (conditional)	Probability 3
12		Scatter diagrams	Histograms	Higher Probability (conditional)



13		Probability	Data Collection Higher	Histograms
14	Graphs	Probability 2	Revise - Linear and Quadratic Graphs	Straight line graphs 2
15		Probability 3	Cubic and Reciprocal Graphs	Quadratic graphs 2
16		Straight line graphs 2	Other graphs	Cubic and Reciprocal Graphs
17		Quadratic graphs 1	Further graphs	Travel graphs
18		Travel graphs	Graphs of inequalities	Graphs of inequalities
19		Compound measures	Compound measures	Compound measures
20	Shape and Number	Translate and vectors 1	Volume and Surface area 3	Volume and Surface Area 1 & 2
21		Vectors 2	Translate and vectors	Translate and vectors 1
22		Bearings	Vectors 2	Vectors 2
23		Views and maps	Higher vectors 1	Constructions
24		Constructions	Higher vectors 2	Loci
25		Loci	Enlargement and similarity	Revision



## Year 11 Pupils 2020-21

Provided is a suggested sequence for pupils who can follow this course for one year. This is an “express” sequence to consider that there has been disrupted learning in 2019-20. There are 3 possible pathways available:

- i) Foundation for pupils aiming for a Grade 4
- ii) Core for pupils who will take the Higher Tier paper but are aiming for a grade 5 or 6
- iii) Higher Tier for pupils aiming for a Grade 7+.

If units are labelled in red then they are a combination of the units given in section 2.

Week	Topic	Aiming for a 4	Aiming for 5/6	Aiming for 7/8/9
1	Number 1	Directed Numbers and 4 rules, Rounding and Estimating	Types of Number, Roots and indices	Fractional indices
2		Fractions 1 and 2	Rounding and Estimating	Upper and lower bounds
3	Algebra 1	Expand and Simplify, Factorise Linear, Solving Equations 1 and 2	Solving Equations 1 and 2	Algebraic Fractions
4			Inequalities	Factorise and solve a quadratic ( $a > 1$ )
5			Factorise and solve a quadratic ( $a = 1$ )	Further quadratics equations
6	FDP	Percentages and FDP Equivalence	Percentage Increase/Decrease	Recurring decimals



7	Shape 1	Angle Facts and Parallel Lines	Angle Facts and Parallel Lines	Circle theorems 1
8		Polygons 1 and 2	Polygons 1 and 2	Circle theorems 2
9	Graphs	Simple Graphs and Straight Line Graphs 1	Straight line graphs 1/2	Quadratic Graphs, Cubic and reciprocal graphs, Circle Graphs
10		Quadratic Graphs and Travel Graphs	Quadratic Graphs, Cubic and reciprocal graphs	Straight line Graphs 2, Higher Straight lines
11	Ratio and proportion	Ratio	Ratio 1 and 2	Compound Measures/ Direct and Inverse Proportion
12		Ratio 2	Compound Measures/ Direct and Inverse Proportion	Further Graphs
13	Shape 2	Area and Perimeter, Circles	Parts of circle 1/2	Parts of circle 1/2
14		Volume and Surface Area 1	Volume and surface 2 and Views and Maps	Volume and surface 2 and 3
15	Data	Charts and tables and Frequency Charts	Scatter graphs and Frequency Trees and Averages	Higher Data Collection
16		Scatter graphs and Frequency Trees and Averages	Higher Data 1	Histograms



17	Algebra 2	Substitution and rearranging formulae and rules of indices	Substitution and rearranging formulae and rules of indices	Quadratic Sequences and Further Algebra
18		Linear Sequences	Linear and Quadratic sequences	Algebraic Proof and Functions
19	Pythagoras and Trigonometry	Pythagoras 1	Pythagoras 1 and 2	Advanced Trigonometry 1,2 and 3
20		Pythagoras 2	Trigonometry 1 and 2	
21	Number 2	Factors, Multiples and Primes/ Venn Diagrams	Repeated Percentage Change	Simplify Surds and Add Surds
22		Standard Form Convert/4 Operations	Standard Form - 4 operations	Multiply and Divide Surds
23	Probability	Probability 1 and 2	Probability 2 and 3	Higher Probability
24	Transformations	Bearings/Reflection	Rotation and Enlargement	Enlargement and Similarity
25		Rotation and Enlargement	Similarity	Other graphs (Transforming)
26	Constructions	Views and Maps/Constructions	Constructions and Loci	Constructions and Loci
27	Algebra 3	Solving Equations 2	Simultaneous Equations	Simultaneous Equations Linear/Quadratic
28		Simultaneous Equations	Simultaneous Equations Linear/Quadratic	Solve equations numerically
29	Vectors	Translate and vectors 1	Vectors 2	Higher Vectors 1 and 2



