Term	Week	Chapter	Section	Spread
Autumn term	1 & 2	apter 1 – Algebra 1	1	Argument and proof
			2	Index laws
			3	Surds
	3 & 4		4	Quadratic functions
			5	Simultaneous equations

Autumn term	5 & 6	Ch	6	Lines and circles
			7	Inequalities
		omials and the heorem	1	Expanding and factorising
			2	The binomial theorem
			3	Algebraic division

Autumn term	7 & 8	Chapter 2 – Polyno binomial th	4	Curve sketching
	9 & 10	Chapter 3 – Trigonometry	1	Sine, cosine and tangent
			2	The sine and cosine rules
		n	1	Differentiation from first principles

Autumn term	11 & 12	Chapter 4 – Differentiation and integration	2	Differentiating ax^n and Leibniz notation
			3	Rates of change
			4	Tangents and normals
Spring term	13 & 14		5	Turning points
			6	Integration
			7	Area under a curve
			1	The laws of logarithms

Spring term	15 & 16	Chapter 5 – Exponentials and logarithms	2	Exponential functions
			3	Exponential processes
			4	Curve fitting

Spring term	17 & 18	Chapter 6 – Vectors	1	Definitions and properties
			2	Components of a vector
	19 & 20	nd kinematics	1	Standard units and basic dimensions
			2	Motion in a straight line – definitions and graphs

Spring term	20	Chapter 7 – Units a	3	Equations of motion for constant acceleration
	21 & 22		4	Motion with variable acceleration
		Newton's laws	1	Forces
			2	Dynamics

Spring term	23 & 24	Chapter 8 – Forces anc	3	Motion under gravity
			4	Systems of forces
Summer term		g and interpreting data	1	Sampling
			2	Central tendency and spread

Summer term	25 & 26	Chapter 9 – Collecting, representing	3	Single-variable data
			4	Bivariate data
	27	nd discrete random es	1	Probability

Summer term	27 & 28	Chapter 10 – Probability a variable	2	Binomial distribution
	29 & 30	Chapter 11 – Hypothesis testing 1	1	Formulating a test
			2	The critical region

Objectives	Syllabus ref
● Construct and present mathematical arguments through appropriate use of diagrams; sketching graphs; logical deduction; precise statements involving correct use of symbols and connecting language, including: constant, coefficient, expression, equation, function, identity, index, term, variable. ● Comprehend and critique mathematical arguments, proofs and justifications of methods and formulae, including those relating to applications of mathematics. ● Understand and use the structure of mathematical proof, proceeding from given assumptions through a series of logical steps to a conclusion; use methods of proof, including proof by deduction, proof by exhaustion, disproof by counter example.	OT1.1 [c, d] OT1.5 [a, b] A1 [a - d]
● Understand and use the laws of indices for all rational exponents.	B1 [a]
● Use and manipulate surds, including rationalising the denominator.	B2 [a, b]
● Work with quadratic functions and their graphs; the discriminant of a quadratic function, including the conditions for real and repeated roots; completing the square; solution of quadratic equations including solving quadratic equations in a function of the unknown. ● Understand the effect of simple transformations on the graph of y = f(x) including sketching associated graphs: $y = af(x)$, $y = f(x) + a$, $y = f(x + a)$, $y = f(ax)$.	B3 [a - g] B9 [a - d]
• Construct and present mathematical arguments through appropriate use of diagrams; sketching graphs; logical deduction; precise statements involving correct use of symbols and connecting language, including: constant, coefficient, expression, equation, function, identity, index, term, variable. ● Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics. ● Solve simultaneous equations in two variables by elimination and by substitution, including one linear and one quadratic equation. ● Understand and use graphs of functions; sketch curves defined by simple equations including polynomials, the modulus of a linear function, $y = a/x$ and $y = a/x^2$ and (including their vertical and horizontal asymptotes); interpret algebraic solution of equations graphically; use intersection points of graphs to solve equations Understand and use proportional relationships and their graphs.	OT1.1 [b] OT2.7 [a, b] B4 [a - c] B7 [g]

• Understand and use graphs of functions; sketch curves defined by simple equations including polynomials, y = a/x and y = a/x2 and (including their vertical and horizontal asymptotes); interpret algebraic solution of equations graphically; use intersection points of graphs to solve equations. Understand and use proportional relationships and their graphs. ● Understand and use the equation of a straight line, including the forms $y - y_1 = m(x - x_1)$ and $ax + by + c = 0$; gradient conditions for two straight lines to be parallel or perpendicular Be able to use straight line models in a variety of contexts. ● Understand and use the coordinate geometry of the circle including using the equation of a circle in the form $(x - a)^2 + (y - b)^2 = r^2$; completing the square to find the centre and radius of a circle; use of the following properties: ○ the angle in a semicircle is a right angle	B7 [c] C1 [a - e] C2 [a - e]
• Construct and present mathematical arguments through appropriate use of diagrams; sketching graphs; logical deduction; precise statements involving correct use of symbols and connecting language, including: constant, coefficient, expression, equation, function, identity, index, term, variable. ● Understand and use language and symbols associated with set theory, as set out in the glossary. Apply to solutions of inequalities. (see B5 [g]) ● Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics. ● Solve linear and quadratic inequalities in a single variable and interpret such inequalities graphically, including inequalities with brackets and fractions. Express solutions through correct use of 'and' and 'or', or through set notation. Represent linear and quadratic inequalities such as $y > x + 1$ and $y = ax^2 + bx + c$ graphically.	OT1.1 [b] OT1.3 [b] OT2.7 [a, b] B5 [a - i]
• Manipulate polynomials algebraically, including expanding brackets and collecting like terms, factorisation and simple algebraic division; use of the factor theorem.	B6 [a, b]
• Understand and use mathematical language and syntax as set out in the glossary. • Evaluate, including by making reasoned estimates, the accuracy or limitations of solutions, including those obtained using numerical methods. • Understand and use the binomial expansion of $(a + bx)^n$ for positive integer n; the notations $n!$ and ${}^nC_r$; link to binomial probabilities.	OT1.2 [a] OT2.5 [a] D1 [a - c]
• Manipulate polynomials algebraically, including expanding brackets and collecting like terms, factorisation and simple algebraic division; use of the factor theorem.	B6 [c, d]

• Construct and present mathematical arguments through appropriate use of diagrams; sketching graphs; logical deduction; precise statements involving correct use of symbols and connecting language, including: constant, coefficient, expression, equation, function, identity, index, term, variable. ● Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics. • Understand and use graphs of functions; sketch curves defined by simple equations including polynomials, $y = a/x$ and $y = a/x^2$ and (including their vertical and horizontal asymptotes); interpret algebraic solution of equations graphically; use intersection points of graphs to solve equations. Understand and use proportional relationships and their graphs. • Understand the effect of simple transformations on the graph of $y = f(x)$ including sketching associated graphs: $y = af(x)$, $y = f(x) + a$, $y = f(x + a)$, $y = f(ax)$.	OT1.1 [b] OT2.7 [a] B7 [a, b, d - i] B9 [a - d]
• Understand and use mathematical language and syntax as set out in the glossary. ● Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics. • Understand the effect of simple transformations on the graph of $y = f(x)$ including sketching associated graphs: $y = af(x)$, $y = f(x) + a$, $y = f(x + a)$, $y = f(ax)$. • Use of functions in modelling, including consideration of limitations and refinements of the models. • Understand and use the definitions of sine, cosine and tangent for all arguments; the sine and cosine rules; the area of a triangle in the form $1/2\ ab\sin C$. • Understand and use the sine, cosine and tangent functions; their graphs, symmetries and periodicity. • Understand and use $\tan\theta = \sin\theta/\cos\theta$, Understand and use $\sin^2\theta + \cos^2\theta = 1$. • Solve simple trigonometric equations in a given interval, including quadratic equations in sin, cos and tan and equations involving multiples of the unknown angle.	OT1.2 [a] OT2.7 [a, b] B9 [a - d] B11 [a] E1 [a] E3 [a - d] E5 [a, b] E7 [a - b]
• Comprehend and critique mathematical arguments, proofs and justifications of methods and formulae, including those relating to applications of mathematics. • Understand and use the definitions of sine, cosine and tangent for all arguments; the sine and cosine rules; the area of a triangle in the form $1/2\ ab\sin C$.	OT1.5 [b] E1 [b - d]
• Understand and use the derivative of $f(x)$ as the gradient of the tangent to the graph of $y = f(x)$ at a general point (x, y); the gradient of the tangent as a limit; interpretation as a rate of change; sketching the gradient function for a given curve; second derivatives; differentiation from first principles for small positive integer powers of x. Understand and use the second derivative as the rate of change of gradient. • Differentiate x^n, for rational values of n, and related constant multiples, sums and differences.	G1 [a - c, f] G2 [a]

• Understand and use mathematical language and syntax as set out in the glossary. • Differentiate x^n, for rational values of n, and related constant multiples, sums and differences.	OT1.2 [a] G2 [a]
• Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics. • Use a mathematical model with suitable inputs to engage with and explore situations (for a given model or a model constructed or selected by the student). • Understand and use the derivative of f(x) as the gradient of the tangent to the graph of y = f(x) at a general point (x, y); the gradient of the tangent as a limit; interpretation as a rate of change; sketching the gradient function for a given curve; second derivatives; differentiation from first principles for small positive integer powers of x. Understand and use the second derivative as the rate of change of gradient.	OT2.7 [a] OT3.2 [a] G1 [c - e, h]
• Apply differentiation to find gradients, tangents and normals, maxima and minima and stationary points. Identify where functions are increasing or decreasing.	G3 [a, b]
• Understand and use the derivative of f(x) as the gradient of the tangent to the graph of y = f(x) at a general point (x, y); the gradient of the tangent as a limit; interpretation as a rate of change; sketching the gradient function for a given curve; second derivatives; differentiation from first principles for small positive integer powers of x. Understand and use the second derivative as the rate of change of gradient. • Apply differentiation to find gradients, tangents and normals, maxima and minima and stationary points. Identify where functions are increasing or decreasing.	G1 [e] G3 [c, d, f]
• Understand and use mathematical language and syntax as set out in the glossary. • Know and use the Fundamental Theorem of Calculus. • Integrate x^n (excluding $n = -1$), and related sums, differences and constant multiples.	OT1.2 [a] H1 [a] H2 [a]
• Know and use the Fundamental Theorem of Calculus. • Integrate x^n (excluding $n = -1$), and related sums, differences and constant multiples. • Evaluate definite integrals; use a definite integral to find the area under a curve.	H1 [a] H2 [a] H3 [a, b]
• Understand and use mathematical language and syntax as set out in the glossary. • Know and use the function a^x and its graph, where a is positive. Know and use the function e^x and its graph. • Know that the gradient of e^{kx} is equal to ke^{kx} and hence understand why the exponential model is suitable in many applications. • Know and use the definition of $\log_a x$ as the inverse of a^x, where a is positive and $x > 0$. Know and use the function ln x and its graph. Know and use ln$x$ as the inverse function of e^x.	OT1.2 [a] F1 [a, b] F2 [a, b] F3 [a - c]

• Understand and use mathematical language and syntax as set out in the glossary. • Understand and use the laws of logarithms: $\log_a x + \log_a y = \log a(xy)$; $\log_a x - \log_a y = \log_a (x/y)$; $k \log_a x = \log_a (xk)$ (including, for example, the cases $k = -1$ and $k = 1/2$) • Solve equations of the form $a^x = b$	OT1.2 [a] F4 [a - c] F5 [a]
• Translate a situation in context into a mathematical model, making simplifying assumptions. • Use a mathematical model with suitable inputs to engage with and explore situations (for a given model or a model constructed or selected by the student). • Interpret the outputs of a mathematical model in the context of the original situation (for a given model or a model constructed or selected by the student). • Understand that a mathematical model can be refined by considering its outputs and simplifying assumptions; evaluate whether the model is appropriate. • Understand and use modelling assumptions. • Use of functions in modelling, including consideration of limitations and refinements of the models. • Understand and use exponential growth and decay; use in modelling (examples may include the use of e in continuous compound interest, radioactive decay, drug concentration decay, exponential growth as a model for population growth); consideration of limitations and refinements of exponential models.	OT3.1 [a] OT3.2 [a] OT3.3 [a] OT3.4 [b] OT3.5 [a] B11 [a - c] F7 [a - g]
• Evaluate, including by making reasoned estimates, the accuracy or limitations of solutions. • Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics. • Use a mathematical model with suitable inputs to engage with and explore situations (for a given model or a model constructed or selected by the student). • Interpret the outputs of a mathematical model in the context of the original situation (for a given model or a model constructed or selected by the student). • Understand that a mathematical model can be refined by considering its outputs and simplifying assumptions; evaluate whether the model is appropriate. • Use of functions in modelling, including consideration of limitations and refinements of the models. • Use logarithmic graphs to estimate parameters in relationships of the form $y = ax^n$ and $y = kb^x$, given data for x and y.	OT2.5 [a] OT2.7 [a] OT3.2 [a] OT3.3 [a] OT3.4 [b] B11 [a - c] F6 [a, b]

• Construct and present mathematical arguments through appropriate use of diagrams; sketching graphs; logical deduction; precise statements involving correct use of symbols and connecting language, including: constant, coefficient, expression, equation, function, identity, index, term, variable. • Understand and use mathematical language and syntax as set out in the glossary. ● Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics. • Use vectors in two dimensions. • Add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations. • Use vectors to solve problems in pure mathematics and in context, including forces and kinematics.	OT1.1 [a] OT1.2 [a] OT2.7 [a] J1 [a] J3 [a, d] J5 [a, b]
• Construct and present mathematical arguments through appropriate use of diagrams; sketching graphs; logical deduction; precise statements involving correct use of symbols and connecting language, including: constant, coefficient, expression, equation, function, identity, index, term, variable. • Use vectors in two dimensions. • Calculate the magnitude and direction of a vector and convert between component form and magnitude/direction form. • Add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations. • Understand and use position vectors; calculate the distance between two points represented by position vectors. • Use vectors to solve problems in pure mathematics and in context, including forces .	OT1.1 [a} J1 [a] J2 [a-c] J3 [b, c] J4 [a, b] J5 [b]
• Understand and use mathematical language and syntax as set out in the glossary. • Understand and use fundamental quantities and units in the S.I. system: length, time, mass. Understand and use derived quantities and units: velocity, acceleration, force, weight.	OT1.2 [a] P1 [a - g]
● Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics. • Translate a situation in context into a mathematical model, making simplifying assumptions. • Understand that a mathematical model can be refined by considering its outputs and simplifying assumptions; evaluate whether the model is appropriate. • Understand and use modelling assumptions. • Understand and use the language of kinematics: position; displacement; distance travelled; velocity; speed; acceleration. • Understand, use and interpret graphs in kinematics for motion in a straight line: displacement against time and interpretation of gradient; velocity against time and interpretation of gradient and area under the graph.	OT2.7 [c] OT3.1 [a] OT3.4 [a] OT3.5 [a] Q1 [a - f] Q2 [a - d]

• Evaluate, including by making reasoned estimates, the accuracy or limitations of solutions, including those obtained using numerical methods. • Use a mathematical model with suitable inputs to engage with and explore situations (for a given model or a model constructed or selected by the student). • Interpret the outputs of a mathematical model in the context of the original situation (for a given model or a model constructed or selected by the student). • Understand that a mathematical model can be refined by considering its outputs and simplifying assumptions; evaluate whether the model is appropriate. • Understand, use and derive the formulae for constant acceleration for motion in a straight line.	OT2.5 [b] OT3.2 [a] OT3.3 [a] OT3.4 [a] Q3 [a - b]
• Use a mathematical model with suitable inputs to engage with and explore situations (for a given model or a model constructed or selected by the student). • Interpret the outputs of a mathematical model in the context of the original situation (for a given model or a model constructed or selected by the student). • Use calculus in kinematics for motion in a straight line: $v = \mathrm{d}r/\mathrm{d}t$, $a = \mathrm{d}v/\mathrm{d}t$, $r = \int v \, \mathrm{d}t$, $a = \int v \, \mathrm{d}t$.	OT3.2 [a] OT3.3 [a] Q4 [a - d]
• Recognise the underlying mathematical structure in a situation and simplify and abstract appropriately to enable problems to be solved. ● Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics. • Translate a situation in context into a mathematical model, making simplifying assumptions. • Understand and use modelling assumptions. • Understand the concept of a force; understand and use Newton's first law.	OT2.1 [a] OT2.7 [c] OT3.1 [a] OT3.5 [a] R1a, b
• Recognise the underlying mathematical structure in a situation and simplify and abstract appropriately to enable problems to be solved. • Evaluate, including by making reasoned estimates, the accuracy or limitations of solutions, including those obtained using numerical methods. • Translate a situation in context into a mathematical model, making simplifying assumptions. • Understand that a mathematical model can be refined by considering its outputs and simplifying assumptions; evaluate whether the model is appropriate. • Understand and use modelling assumptions. • Understand and use Newton's second law for motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors).	OT2.1 [a] OT2.5 [b] OT3.1 [a] OT3.4 [a] OT3.5 [a] R2 [a]

● Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics. • Use a mathematical model with suitable inputs to engage with and explore situations (for a given model or a model constructed or selected by the student). • Interpret the outputs of a mathematical model in the context of the original situation (for a given model or a model constructed or selected by the student). • Understand that a mathematical model can be refined by considering its outputs and simplifying assumptions; evaluate whether the model is appropriate. • Use of functions in modelling, including consideration of limitations and refinements of the models. • Understand and use weight and motion in a straight line under gravity; gravitational acceleration, g, and its value in S.I. units to varying degrees of accuracy (The inverse square law for gravitation is not required and g may be assumed to be constant, but students should be aware that g is not a universal constant but depends on location).	OT2.7 [c] OT3.2 [a] OT3.3 [a] OT3.4 [a] B11 [a - c] R3 [a - c]
• Use a mathematical model with suitable inputs to engage with and explore situations (for a given model or a model constructed or selected by the student). • Interpret the outputs of a mathematical model in the context of the original situation (for a given model or a model constructed or selected by the student). • Understand and use Newton's third law; equilibrium of forces on a particle and motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors); application to problems involving smooth pulleys and connected particles.	OT3.2 [a] OT3.3 [a] R4 [a - d]
• Evaluate, including by making reasoned estimates, the accuracy or limitations of solutions, including those obtained using numerical methods. • Understand and use the terms 'population' and 'sample'. Use samples to make informal inferences about the population. Understand and use sampling techniques, including simple random sampling and opportunity sampling. Select or critique sampling techniques in the context of solving a statistical problem, including understanding that different samples can lead to different conclusions about the population.	OT2.5 [a, b] K1 [a - g]
• Understand and use mathematical language and syntax as set out in the glossary. • Interpret measures of central tendency and variation, extending to standard deviation. Be able to calculate standard deviation, including from summary statistics. • Recognise and interpret possible outliers in data sets and statistical diagrams. Select or critique data presentation techniques in the context of a statistical problem. Be able to clean data, including dealing with missing data, errors and outliers.	OT1.2 [a] L3 [a - e] L4 [a - e]

● Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics. • Interpret diagrams for single-variable data, including understanding that area in a histogram represents frequency. Connect to probability distributions. • Recognise and interpret possible outliers in data sets and statistical diagrams. Select or critique data presentation techniques in the context of a statistical problem. Be able to clean data, including dealing with missing data, errors and outliers.	OT2.7 [a] L1 [a, b] L4 [a - e]
• Evaluate, including by making reasoned estimates, the accuracy or limitations of solutions, including those obtained using numerical methods. ● Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics. • Use a mathematical model with suitable inputs to engage with and explore situations (for a given model or a model constructed or selected by the student). • Interpret the outputs of a mathematical model in the context of the original situation (for a given model or a model constructed or selected by the student). • Interpret scatter diagrams and regression lines for bivariate data, including recognition of scatter diagrams which include distinct sections of the population (calculations involving regression lines are excluded). Understand informal interpretation of correlation. Understand that correlation does not imply causation. • Recognise and interpret possible outliers in data sets and statistical diagrams. Select or critique data presentation techniques in the context of a statistical problem. Be able to clean data, including dealing with missing data, errors and outliers.	OT2.5 [b] OT2.7 [a, b] OT3.2 [a] OT3.3 [a] L2 [a - d] L4 [a, e]
• Understand and use mathematical language and syntax as set out in the glossary. • Understand and use language and symbols associated with set theory, as set out in the glossary. Apply to solutions of inequalities. (see B5 [g]) • Understand and use mutually exclusive and independent events when calculating probabilities. Link to discrete and continuous distributions. • Interpret diagrams for single-variable data, including understanding that area in a histogram represents frequency. Connect to probability distributions. • Understand and use simple, discrete probability distributions (calculation of mean and variance of discrete random variables is excluded), including the binomial distribution, as a model; calculate probabilities using the binomial distribution.	OT1.2 [a] OT1.3 [a] M1 [a - c] L1 [c] N1 [a]

• Recognise the underlying mathematical structure in a situation and simplify and abstract appropriately to enable problems to be solved. • Translate a situation in context into a mathematical model, making simplifying assumptions. • Use a mathematical model with suitable inputs to engage with and explore situations (for a given model or a model constructed or selected by the student). • Interpret the outputs of a mathematical model in the context of the original situation (for a given model or a model constructed or selected by the student). • Understand that a mathematical model can be refined by considering its outputs and simplifying assumptions; evaluate whether the model is appropriate. • Understand and use modelling assumptions. • Use of functions in modelling, including consideration of limitations and refinements of the models. • Understand and use simple, discrete probability distributions (calculation of mean and variance of discrete random variables is excluded), including the binomial distribution, as a model; calculate probabilities using the binomial distribution.	OT2.1 [a] OT3.1 [a] OT3.2 [a] OT3.3 [a] OT3.4 [b] OT3.5 [a] B11 [a - c] N1 [b, c]
• Understand and use mathematical language and syntax as set out in the glossary. • Understand and apply the language of statistical hypothesis testing, developed through a binomial model: null hypothesis, alternative hypothesis, significance level, test statistic, 1-tail test, 2-tail test, critical value, critical region, acceptance region, *p* -value. • Conduct a statistical hypothesis test for the proportion in the binomial distribution and interpret the results in context. Understand that a sample is being used to make an inference about the population and appreciate that the significance level is the probability of incorrectly rejecting the null hypothesis.	OT1.2 [a] O1 [a - i] O2[a - d]
• Understand and apply the language of statistical hypothesis testing, developed through a binomial model: null hypothesis, alternative hypothesis, significance level, test statistic, 1-tail test, 2-tail test, critical value, critical region, acceptance region, p-value. • Conduct a statistical hypothesis test for the proportion in the binomial distribution and interpret the results in context. Understand that a sample is being used to make an inference about the population and appreciate that the significance level is the probability of incorrectly rejecting the null hypothesis.	O1 [a - j] O2 [a, b]

MM codes
2252, 2253
2033, 2034, 2035
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2005, 2018

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2008, 2009, 2256
2006
2041
2042, 2043

2022, 2023, 2024, 2027, 2258
2047, 2048, 2053, 2257, 2284, 2285
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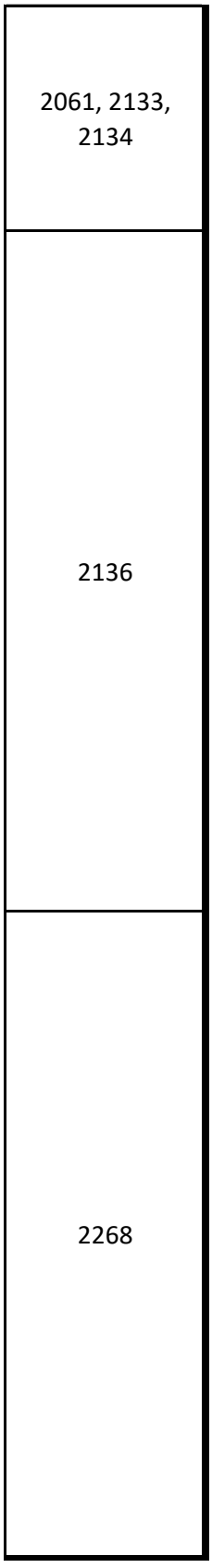
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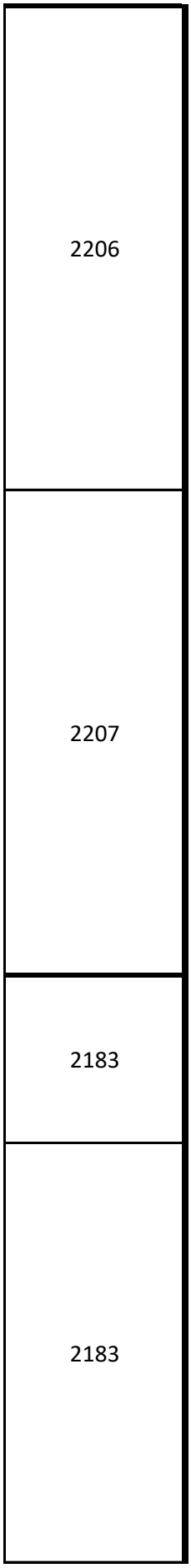
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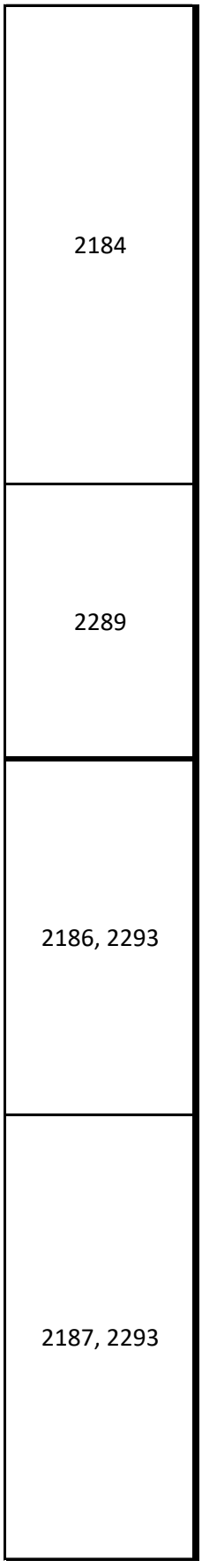
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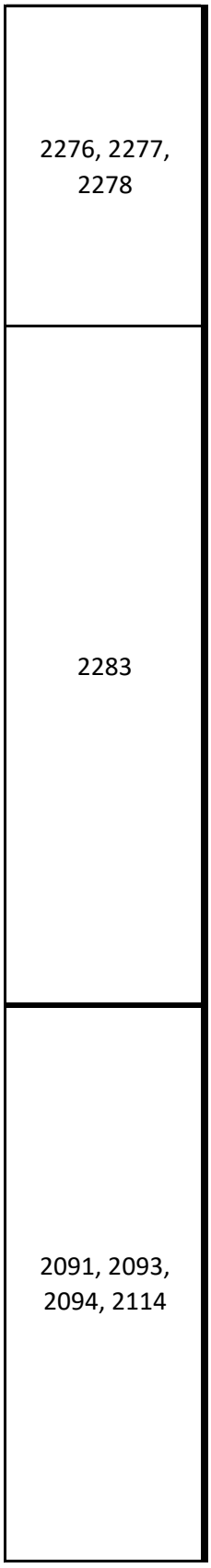
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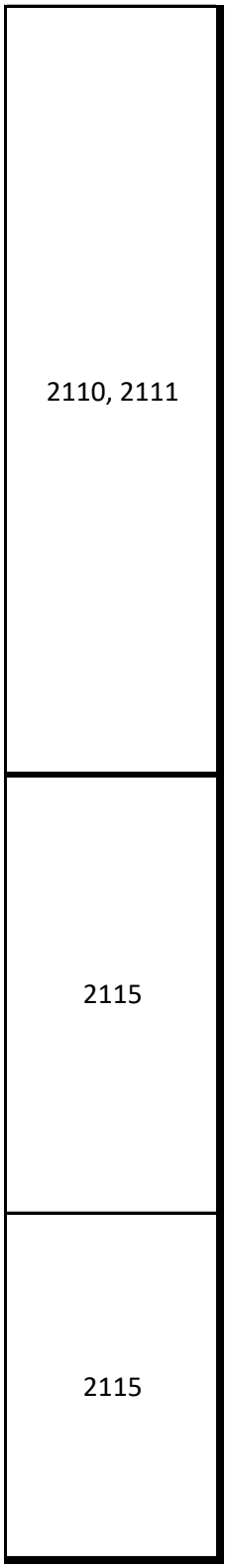
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