Weeks	Topic	Chapter	Notes and Examples	Extension
2	**Integers** understand and use integers (positive, negative and zero) both as positions and translations on a number line; understand place value; use directed numbers in practical situations; order integers; use the four rules of addition, subtraction, multiplication and division; use brackets and the hierarchy of operations; use the terms odd, even and prime numbers, factors and multiples; identify prime factors, common factors and common multiples; express integers as the product of powers of prime factors; evaluate Highest Common Factors (HCF) and Lowest Common Multiples (LCM)	1	$720 = 2^4 \times 3^2 \times 5$	Types of number: Natural, integers, rational, irrational and real and place them in the correct place in a venn diagram
1	**Fractions and decimals** understand and use equivalent fractions, simplifying a fraction by cancelling common factors (writing in its simplest form); understand and use mixed numbers and vulgar fractions; identify common denominators; apply common denominators to order fractions; calculate a given fraction of a given quantity, expressing the answer as a fraction; express a given number as a fraction of another number; use common denominators to add and subtract fractions; convert a fraction to a decimal or a percentage; understand and use unit fractions as multiplicative inverses; multiply and divide a given fraction by an integer, by a unit fraction and by a general fraction; use decimal notation order decimals; convert a decimal to a fraction or a percentage (terminating decimals only); recognise that a terminating decimal is a fraction; convert recurring decimals into fractions; round integers to a given power of 10; round to a given number of significant figures or decimal places; identify upper and lower bounds where values are given to a degree of accuracy.	2 and 23.5	$\frac{8}{60} = \frac{2}{15}$ in its simplest form (lowest terms) $\frac{3}{5} = 0.6 = 60\%$ $0.65 = \frac{65}{100} = \frac{13}{20}$ $0.\dot{3} = \frac{1}{3}, 0.23333\ldots = \frac{21}{90}$ The dimensions of a rectangle are 12 cm and 8 cm to the nearest cm. Calculate, to 3 significant figures , the smallest possible area as a percentage of the largest possible area.	Work with algebraic fractions Bounds of more complicated expressions
2	**Ratios and percentages** use ratio notation, including reduction to its simplest form and its various links to fraction notation; divide a quantity in a given ratio or ratios; understand that 'percentage' means 'number of parts per 100'; express a given number as a percentage of another number; express a percentage as a fraction and as a decimal; understand the multiplicative nature of percentages as operators; solve simple percentage problems, including percentage increase and decrease; solve compound interest problems; use reverse percentages;	3	$15\%\ of\ 120 = \frac{15}{100} \times 20$ Find the compound interest earned after 5 years at 5% per annum. In a sale, prices were reduced by 30%. The sale price of an	Find the annual percentage interest for simple and compound given start amount and final amount. Find the length of time for a quantity to double or to

	repeated percentage change.		item was £17.50. Calculate the original price of the item. Calculate the total percentage increase when an increase of 30% is followed by a decrease of 20%.	halve (the doubling time or the half-life) Work with exponential functions
1	**Powers, roots and reciprocals** identify square numbers and cube numbers; calculate squares, square roots, cubes and cube roots; use index notation and index laws for multiplication and division of positive integer powers; use index laws to simplify and evaluate numerical expressions involving integer, fractional and negative powers; express numbers in the form a $\times 10^n$, where n is an integer and $1 \leq a < 10$; solve problems involving standard form.	4	Evaluate: $\sqrt[3]{8^2}$, $625^{-\frac{1}{2}}$, $(\frac{1}{25})^{\frac{3}{2}}$	Calculate logarithms in various bases and use the laws of logarithms
2	**Working with algebra** understand that symbols may be used to represent numbers in equations or variables in expressions and formulae; understand that algebraic expressions follow the generalised rules of arithmetic; evaluate expressions by substituting numerical values for letters; use index notation for positive integer powers; use index laws in simple cases; use index notation involving fractional, negative and zero powers; collect like terms multiply a single term over a bracket; expand the product of two or more linear expressions; take out single common factors; understand the concept of a quadratic expression and be able to factorise such expressions; use formulae from mathematics and other real-life contexts expressed initially in words or diagrammatic form and convert to letters and symbols; understand the process of manipulating formulae to change the subject; complete the square for a given quadratic expression; use algebra to support and construct proofs.	5	$a^3 = a \times a \times a$ $x^3 \times x^2 = x^5$ $\frac{x^7}{x^3} = x^4$ $(x^2)^3 = x^6$ $\left(\sqrt{9x^4}\right)^{-1} = \frac{1}{3x^2}$ $(2x-3)(x+5) = 2x^2 + 7x - 15$ $(2x-3)(x+5)(x-1) = \ldots$ Factorise $x^2 - 3x$ Factorise $2x^2 - x - 3$	More simplification expand three brackets and factorise cubic expressions by spotting a root. Binomial expansion
	Autumn Holiday			
1	**Algebraic equations** solve linear equations, with integer or fractional coefficients, in one unknown	6	$3x + 7 = 22$	

	in which the unknown appears on either side or both sides of the equation. derive a formula or expression		$\frac{4}{5}x = 16$ $5x + 17 = 3(x + 6)$ $\frac{15 - x}{4} = 2$	More advanced equations involving fractions
1	**Graphs of straight lines** understand and use conventions for rectangular cartesian coordinates; plot points (x, y) in any of the four quadrants; locate points with given coordinates; determine the coordinates of points identified by geometrical information; determine the coordinates of the midpoint of a line segment, given the coordinates of the two end points; find the gradient of a straight line; gradient of parallel and perpendicular lines; recognise that equations of the form $y = mx + c$ are straight line graphs; generate points and plot graphs of linear functions.	7	$m = \frac{y_2 - y_1}{x_2 - x_1}$ Find the equation of the straight line through (1, 7) and (2, 9) Including $x = k, y = c,$ $ax + by = c$	Perpendicular gradient. The equation of the perpendicular bisector between two points. Distance between two points
1	**Simultaneous equations** calculate the exact solution of two simultaneous equations in two unknowns; interpret the equations as lines and the common solution as the point of intersection.	8	$2x + 3y = 17$ $3x - 5y = 35$	
1	**Inequalities** understand and use the symbols >, <, ≥ and ≤; understand and use the convention for open and closed intervals on a number line; solve simple linear inequalities in one variable and represent the solution set on a number line; represent simple linear inequalities on rectangular cartesian graphs; identify regions on graphs defined by linear inequalities; solve quadratic inequalities in one unknown and represent the solution set on a number line.	9	$3x - 2 < 10$, so $x < 4$ Shade the region defined by the inequalities, $y \leq 2x + 1$ $5x + 2y \leq 20$ $x^2 \leq 25, \quad 4x^2 \geq 25$	Quadratic inequalities with three terms. The modulus function and inequalities involving the modulus function.
1	**Number Sequences** generate terms of a sequence using term-to term and position-to-term definitions of the sequence; find subsequent terms of an integer sequence and the rule for generating it; use linear expressions to describe the nth term of an arithmetic sequence. Know and use the *n*th term: $u_n = u_1 + (n\text{-}1)d$ Find the sum of the first *n* terms of an arithmetic sequence, S_n.	10	1, 3, 5, 7, 9, … n^{th} term is $2n - 1$	Geometric sequences and quadratic sequences

½	**Working with shape and space** distinguish between acute, obtuse, reflex and right angles; use angle properties of intersecting lines, parallel lines and angles on a straight line; understand the exterior angle of a triangle property and the angle sum of a triangle property; understand the terms isosceles, equilateral and right-angled triangles and the angle properties of these triangles; understand and use the term quadrilateral and the angle sum property of quadrilaterals; understand and use the properties of the parallelogram, rectangle, square, rhombus, trapezium and kite; understand the term regular polygon and calculate interior and exterior angles of regular polygons understand and use the angle sum of polygons; find the perimeter of shapes made from triangles and rectangles; find the area of simple shapes using the formulae for the areas of triangles and rectangles; find the area of parallelograms and trapezia; find the surface area of simple shapes using the area formulae for triangles and rectangles; convert between area measures.	12	cm^2 to m^2	
1	**Circles and cylinders** find circumferences and areas of circles using relevant formulae; find perimeters and areas of sectors of circles; find the surface area of a cylinder find the volume of right prisms, including cuboids and cylinders, using an appropriate formula; convert between units of volume within the metric system.	13	cm^3 to litres	
½	**Geometric constructions** construct triangles and other two-dimensional shapes using a combination of a ruler, a protractor and compasses solve problems using scale drawings use straight edge and compasses to: (i) construct the perpendicular bisector of a line segment (ii) construct the bisector of an angle understand angle measure including three figure bearings	14		
1	**Transformation and similarity** understand that rotations are specified by a centre and an angle; rotate a shape about a point through a given angle; recognise that an anti-clockwise rotation is a positive angle of rotation and a clockwise rotation is a negative angle of rotation; understand that reflections are specified by a mirror line; construct a mirror line given an object reflect a shape given a mirror line; understand that translations are specified by a distance and direction; translate a shape; understand that rotations, reflections and translations preserve length and angle so that a transformed shape under any of these transformations remains congruent to the original shape; understand that enlargements are specified by a centre and a scale factor; understand that enlargements preserve	15		

	angles and not lengths; enlarge a shape given the scale factor; identify and give complete descriptions of transformations; understand that areas of similar figures are in the ratio of the square of corresponding sides; understand that volumes of similar figures are in the ratio of the cube of corresponding sides; use areas and volumes of similar figures in solving problems.			
½	**Pythagoras' theorem** understand and use Pythagoras' Theorem in two and three dimensions.	16		
	Christmas Holiday			
2	**Trigonometry** understand and use sine, cosine and tangent of acute and obtuse angles to determine lengths and angles of a right-angled triangle; apply trigonometrical methods to solve problems in two dimensions; understand and use angles of elevation and depression understand and use the sine and cosine rules for any triangle; understand and use the formula ½*ab*sin *C* for the area of a triangle; apply trigonometrical methods to solve problems in 3 dimensions, including finding the angle between a line and a plane.	17 and 28	Include bearings	
1	**3D objects** find the surface area and volume of a sphere and a right circular cone using relevant formulae; convert between volume measures.	18	m^3 to cm^3 and vice versa	
1	**Circle theorems** understand and use the internal and external intersecting chord properties; recognise the term *cyclic quadrilateral;* understand and use angle properties of the circle including: □ angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the remaining part of the circumference □ angle subtended at the circumference by a diameter is a right angle □ angles in the same segment are equal □ the sum of the opposite angles of a cyclic quadrilateral is 180□ □ the alternate segment theorem	19		
1	**Sets** understand the definition of a set; use the set notation ∪, ∩ and ∈ and ∉; understand the concept of the Universal Set and the Empty Set and the symbols for these sets; understand sets defined in algebraic terms; understand and use subsets; understand and use the complement of a set; use Venn diagrams to represent sets and the number of elements in sets; use the notation *n*(*A*) for the number of elements in the set *A;* use sets in practical situations.	20		

	Winter Holiday			
1	**Working with data** use different methods of presenting data; use appropriate methods of tabulation to enable the construction of statistical diagrams; interpret statistical diagrams; construct and interpret histograms; construct cumulative frequency diagrams from tabulated data; use cumulative frequency diagrams; understand the concept of average; calculate the mean, median, mode and range for a discrete data set; calculate an estimate for the mean for grouped data; identify the modal class for grouped data; estimate the median from a cumulative frequency diagram; understand the concept of a measure of spread; find the interquartile range from a discrete data set; estimate the interquartile range from a cumulative frequency diagram.	21 and 33.1	For continuous variables with unequal class intervals The terms 'upper quartile' and 'lower quartile' may be used	The standard deviation
1	**Probability** understand the language of probability (Outcomes, equal likelihood, events, random); understand and use the probability scale; understand and use estimates or measures of probability from theoretical models; understand the concepts of a sample space and an event, and how the probability of an event happening can be determined from the sample space; list all the outcomes for single events and for two successive events in a systematic way; estimate probabilities from previously collected data; calculate the probability of the complement of an event happening; use the addition rule of probability for *mutually exclusive* events; understand and use the term *expected frequency;* draw and use tree diagrams; determine the probability that two or more independent events will both occur; use simple conditional probability when combining events; find probabilities from a Venn diagram; apply probability to simple problems.	22 and 33.2	Picking two balls out of a bag, one after the other, without replacement.	More complicated conditional probability (Bayes Theorem)
1	**Direct and inverse proportion** use the process of proportionality to evaluate unknown quantities; calculate an unknown quantity from quantities that vary in direct or inverse proportion; solve word problems about ratio and proportion; set up problems involving direct or inverse proportion and relate algebraic solutions to graphical representation of the equations.	24	To include the following: $y \propto x,\ y \propto \frac{1}{x},$ $y \propto x^2,\quad y \propto \frac{1}{x^2}$ $y \propto x^3,\quad y \propto \sqrt{x}$	
	Quadratic equations			

1	solve quadratic equations by factorisation; solve quadratic equations by using the quadratic formula; solve quadratic equations by completing the square; form and solve quadratic equations from data given in a context	25	$2x^2 - 3x + 1 = 0$ $x(3x - 2) = 0$	Completing the square
1	**Advanced algebra** understand the meaning of surds; manipulate surds, including rationalising the denominator where the denominator is a pure surd; manipulate algebraic fractions where the numerator and/or the denominator can be numeric, linear or quadratic; solve simultaneous equations in two unknowns, one equation being linear and the other being quadratic; change the subject, to include cases where the subject may appear twice.	26	Express in the form $a\sqrt{2}$: $\frac{2}{\sqrt{8}}$, $\sqrt{18} + 3\sqrt{2}$ Raionalise the denominator: $\frac{1+\sqrt{3}}{2-\sqrt{2}}$ $\frac{x+1}{3} + \frac{x-3}{4}$ $\frac{3(4x-1)}{2} - \frac{2(5x-3)}{3}$ $\frac{3}{2x} - \frac{4}{3x}$ $\frac{3}{1-x} + \frac{2}{1+x}$ Factorise and simplify: $\frac{x^2 - 4x}{x^2 - x - 12}$ $y = 2x - 11$ and $x^2 + y^2 = 25$ $y = 11x - 2$ and $y = 5x^2$ $v^2 = u^2 + 2gs$ make s the subject $V = 2\pi\sqrt{\frac{l}{g}}$ make l the subject	

	Easter Holiday			
1	**Functions and function notation** understand the concept that a function is a mapping between elements of two sets; use function notations of the form f(x) = … and f : x ⟼ …; understand the terms domain and range and which values may need to be excluded from the domain; understand and find the composite function fg and the inverse function f^{-1}.	27	$f(x) = \frac{1}{x}$ exclude $x = 0$ $f(x) = \sqrt{x+3}$, exclude $x < -3$ 'fg' will mean *'do g first, then f'*	Interval notation.
2	**Graphs of curves** plot and draw graphs with equation: $y = Ax^3 + Bx^2 + Cx + D$ in which: (i) the constants are integers and some could be zero (ii) the letters x and y can be replaced with any other two letters or: $y = Ax^3 + Bx^2 + Cx + D + \frac{E}{x} + \frac{F}{x^2}$ in which: (i) the constants are numerical and at least three of them are zero (ii) the letters x and y can be replaced with any other two letters. y = sin x, y = cos x, y = tan x for angles of any size (in degrees) find the intersection points of two graphs, one linear (y_1) and one non-linear (y_2), and recognise that the solutions correspond to the solutions of $y_2 - y_1 = 0$. Apply to the graph of $y = f(x)$ the transformations $y = f(x) + a$ $y = f(x + a)$ $y = af(x)$ $y = f(ax)$ for linear, quadratic and sin and cos functions. Interpret and analyse transformations of functions and write the functions algebraically.	29	$y = x^3$, $y = 3x^3 - 2x^2 + 5x - 4$, $y = 2x^3 - 6x + 2$, $V = 60w(60 - w)$ $y = \frac{1}{x}$ $y = 2x^2 + 3x + \frac{1}{x}$ $y = \frac{1}{x}(3x^2 - 5)$ $W = \frac{5}{d^2}$ The x-values of the intersection of the two graphs: $y = 2x + 1$ $y = x^2 + 3x - 2$ are the solutions of $x^2 + x - 3 = 0$ Similarly, the x-values of the intersection of the two graphs:	Graph of a quadratic function. The vertex, intercepts and shape. Equation of a circle. Intersection of a line and a circle.

			$y = 5$ $y = x^3 - 3x^2 + 7$ are the solutions of: $x^3 - 3x^2 + 2 = 0$	
1	**Vectors** understand that a vector has both magnitude and direction; understand and use vector notation; multiply vectors by scalar quantities; add and subtract vectors; calculate the modulus (magnitude) of a vector; find the resultant of two or more vectors; apply vector methods for simple geometrical proofs.	30	The notations $\overrightarrow{OA}$ and **a** will be used. $\overrightarrow{OA} = 3\boldsymbol{a}$, $\overrightarrow{AB} = 2\boldsymbol{b}$, $\overrightarrow{BC} = \boldsymbol{c}$ so: $\overrightarrow{OC} = 3\boldsymbol{a} + 2\boldsymbol{b} + \boldsymbol{c}$ $\overrightarrow{CA} = -\boldsymbol{c} - 2\boldsymbol{b}$	
1	**Mathematical proofs** Algebraic proofs; Use of counter examples	31	For example, prove that the product of an odd and an even number is even.	
2	**Calculus** understand the concept of a variable rate of change; find the gradients of non-linear graphs differentiate integer powers of *x*; determine gradients, rates of change, turning points (maxima and minima) by differentiation and relate these to graphs; distinguish between maxima and minima by considering the general shape of the graph; apply calculus to linear kinematics and to other simple practical problems.	32	 By drawing a tangent $y = x + \frac{9}{x}$ Find the coordinates of the maximum and minimum points The displacement, *s* metres, of a particle from a fixed point *O* after *t* seconds is given by:	

			$s = 24t^2 - t^3$ Find expressions for the velocity and the acceleration.	
1	**Revision**			