| Bigger Picture Topic | Step | Learning Intention | Support |
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| **Rationale:** This block consolidates the previous two blocks focusing on understanding powers generally, and in particular in standard form. Negative and fractional indices are explored in detail. Again, some of this content will be familiar from KS3. This block aims to consolidate the learning on index laws from KS3, and to extend to the applying the index laws to standard form.<br><br>**Learning Progression:** *topics students have seen that will play a vital role in understanding this block*<br>Y7: Spring block 2 (use factors and multiples)<br>Y7: Summer block 5 (prime factorisation, HCF and LCM)<br>Y7: Spring block 1 (multiply and divide by powers of 10)<br>Y8: Spring block 3 (work with indices)<br>Y8: Spring block 5 (write numbers of any size in standard form)<br>Y9: Spring block 1 (types of number)<br><br>**Key Vocabulary: Square, cube, root, prime, integer, exponent, power, base, simplify, negative, unit fraction, standard form** | | | |
| **Careers Link:** Index numbers, powers and indices are used in lots of parts of our modern technological world. They are used in computer game physics, pH Richter measuring scales, science, engineering economics and many other disciplines. | | | |
| Block 14<br>Indices & roots | 1. Square and cube numbers | TBAT work with square and cube numbers | It is helpful if students can commit the first 12 square numbers to memory and at least the first five cubes |
| | 2. Calculate higher powers and roots | TBAT calculate higher powers and roots | It is often far more appropriate to use a calculator to work out these values and students may need to be taught how to use the $x^n$ (or equivalent) key |
| | 3. Powers of ten and standard form | TBAT work with powers of 10 and standard form | It is always helpful to look at numbers in context e.g., populations, land areas, atoms etc. to provide meaning. There is a good chance to revisit words like million, billion etc. Some students may need to be supported with a place value chart |
| | 4. The addition and subtraction rules for indices | TBAT use the addition and subtraction rules for indices | Students have met the rules of indices at KS3 so this review step is designed to reinforce their prior learning. It is helpful to look at questions with both numerical and algebraical bases |
| | 5. Understand and use the power zero and negative indices | TBAT use the power zero and negative indices | The common misconception that a number raised to the power of zero gives the result zero needs to be addressed. Using a calculator to verify results is useful here |
| | 6. Work with powers of powers | TBAT work with powers of powers | Deriving the law from writing calculations in full helps understanding and retention |
| | 8. Calculate with numbers in standard form | TBAT calculate with numbers in standard form | Non-calculator work is useful in reinforcing the laws of indices from earlier in this block. It may be useful to remind students how to round to significant figures and how this works with numbers given in standard form |

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| | Check out<br>Check in next block | TBAT complete check out | |
| | Feedback lesson | TBAT respond to feedback | |
| **Rationale:** This block builds on earlier study of straight-line graph in years 9 and 10. Students plot straight lines from a given equation and find and interpret the equation of a straight line from a variety of situations and given information. There is an opportunity to revisit graphical solutions of simultaneous equations.<br><br>**Learning Progression:** *topics students have seen that will play a vital role in understanding this block*<br>Y8: Autumn Block 4 (plotting and interpreting straight line graphs)<br>Y8 Autumn Block 4 (understand and use equations of a straight line)<br>Y9: Autumn Block 1 (interpret straight line graphs)<br>Y9 Autumn Block 1 (find and use the equation of a straight line)<br>Y9 Summer Block 2 (direct proportion graphs and conversion graphs)<br>Y10 Autumn Block (form and solve a pair of linear simultaneous equations graphically)<br><br>**Key Vocabulary:** Parallel, horizontal, vertical, axis, intercept, graph, table of values, y-intercept, scale, coordinates, substitute, gradient, below, above, satisfies | | | |
| **Career Links:** Understanding gradient and equations of lines is an important work skill for many jobs. For example, Architecture requires calculating roof pitch and other analytical jobs require the analysis of graphs. Rise over run calculations must also be made when designing and building stairs. Annenberg Media's Learner website diagrams a staircase to demonstrate total rise over run as well as the slope of the individual steps. Incorrect slope calculations can cause poor head room at the top of the stairs. | | | |
| Block 1<br>Gradients & Lines | 1. Equations of lines parallel to the axes (R)<br>2. Plot straight line graphs (R) | TBAT write equations of lines parallel to the axes & plot straight line graphs | Students should understand that any point on a line satisfies the equation of that line. Students should pay close attention to the scale on the axes when plotting coordinates. They cannot assume (1,2) is always 1 square right and 2 squares up from the origin, so this misconception should be challenged. |
| | 3. Interpret y=mx+c | TBAT interpret y=mx+c | Building on from the previous step, students could be encouraged to plot the straight lines y = mx + a and y = mx + b to see that they are parallel. |
| | 4. Find the equation of a straight line from a graph (R)<br>5. Find the equation of a straight line from a graph | TBAT find the equation of a straight line from a graph | This step reiterates that the gradient is m and the y intercept is c, but sometimes students find it conceptually more difficult to 'work backwards' in this way. It is helpful to consider what information can be seen immediately from the graph, before calculating the gradient. |

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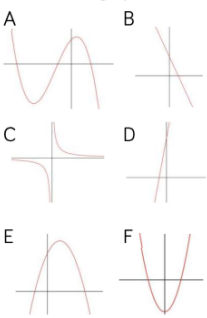
| | 6. Find the equation of a straight-line graph given one point & gradient | TBAT find the equation of a graph given one point & the gradient | Students need to be able to find the equation of a line given the gradient and a point that lies on the line. Using their knowledge of parallel lines having the same gradient, they can find the equation a line parallel passing through a point. |
| | 7. Find the equation of a straight-line graph given two points | TBAT find the equation of a straight-line graph given two points | They should start by working out the equation of a line where one of the points is the y-intercept. Students will need to use their knowledge of substitution and solving equations to work out the y intercept. |
| | 8. Determine whether a point is on a line | TBAT determine whether a point lies on a line | Students need to understand that the equation of a line is a relationship between the x and y coordinates at any point on that line. |
| | 9. Solve linear simultaneous equations graphically | TBAT solve linear simultaneous equations graphically | Students should understand that two straight lines will only ever intercept at a single point, and the coordinates of this point provide the solutions to the pair of simultaneous equations. |
| | Check out<br>Check in next block | TBAT complete check out | |
| | Feedback lesson | TBAT respond to feedback | |

**Rationale:** Students develop their knowledge of non-linear graphs in this block, looking at quadratic, cubic and reciprocal graphs, so they recognise the different shapes. They find the roots of quadratics graphically and will revisit this when they look at algebraic methods in the Functions block during Autumn 2, where they will also look at turning points.

**Learning Progression:** *topics students have seen that will play a vital role in understanding this block*
Y7: Autumn Block 2 (function machines, substitution & representing functions graphically)
Y8: Autumn Block 4 (using coordinates, plotting graphs & y=mx+c)
Y9: Autumn Block 1 (simplify, use and interpret y=mx+c & solve simultaneous equations graphically)
Y9: Summer Block 5 (Interpret graphs in various forms including quadratic & exponential)
Y10: Autumn Block 3 (factorising quadratics)
Y10: Autumn Block 4 (solve quadratic simultaneous equations graphically)

**Key Vocabulary:** Quadratic, parabola, curve, substitute, equation, vertical, horizontal, estimate, cube, cubic, asymptote, reciprocal, gradient, solution, coordinate

**Career Links:** Quadratic equations in real life are used in many fields and in everyday activities. Astrology, Engineering, Agriculture, Sciences, Military, and Sports are some of the fields that use quadratic equations. Quadratic equations are used in many real-life situations such as calculating the areas of an enclosed space, the speed of an object, the profit and loss of a product, or curving a piece of equipment for designing.

<table>
<tr><td colspan="4">One such real-life example is that if an object is projected, then the place where the object will reach the ground, the distance travelled by the object, and the time taken by the object to reach the peak height can all be determined using quadratic equations.</td></tr>
<tr><td rowspan="7">Block 2<br>Non-Linear Graphs</td><td>1. Plot and read from quadratic graphs</td><td>TBAT plot and read from quadratic graphs</td><td>Check that students can substitute a negative into an expression containing $x^2$</td></tr>
<tr><td>2. Plot and read from cubic graphs</td><td>TBAT plot and read from cubic graphs</td><td>Remind students that cubing a negative gives a negative result. A common mistake is for students to multiply by 3 instead of cubing. Ensure they use a smooth curve to join the points.</td></tr>
<tr><td>3. Plot and read from reciprocal graphs</td><td>TBAT plot and read from reciprocal graphs</td><td>Allow students time to investigate the reciprocal function using their calculators. It is useful to introduce concepts such as infinity and negative infinity to describe the behaviour of the curves at extreme values.</td></tr>
<tr><td>4. Recognise graph shapes</td><td>TBAT recognise graph shapes</td><td>It is important to make explicit the similarities and differences of straight line, quadratic, cubic and reciprocal graphs.<br><br>Match each graph with its equation.<br>  <br><br><table><tr><th>Equation</th><th>Letter</th><th>Type of Graph</th></tr><tr><td>$y = 10x + 10$</td><td></td><td></td></tr><tr><td>$y = \frac{1}{x}$</td><td></td><td></td></tr><tr><td>$y = x^2 - 10$</td><td></td><td></td></tr><tr><td>$y = x^3$</td><td></td><td></td></tr><tr><td>$y = -x^2 + 2x + 3$</td><td></td><td></td></tr><tr><td>$y = -2x + 4$</td><td></td><td></td></tr><tr><td>$y = -x^3 - 2x^2 + x + 1$</td><td></td><td></td></tr></table>One equation in the table doesn't have a match.<br>Sketch a graph to match this equation.</td></tr>
<tr><td>5. Identify and interpret roots and intercepts of quadratics</td><td>TBAT identify and interpret roots and intercepts of quadratics</td><td>It is important that the students write the y-intercept as a coordinate.</td></tr>
<tr><td>Check out<br>Check in next block</td><td>TBAT complete check out</td><td></td></tr>
<tr><td>Feedback lesson</td><td>TBAT respond to feedback</td><td></td></tr>
<tr><td colspan="4">Rationale: This block revises conversion graphs and reflection in straight lines. Students also study other real-life graphs, including speed/distance/time, constructing and interpreting these.<br><br>Learning Progression: topics students have seen that will play a vital role in understanding this block</td></tr>
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| Y7: Autumn Block 2 (represent functions graphically)<br>Y8: Autumn Block 2 (conversion graphs, direct proportion graphs & currency conversion graphs)<br>Y9: Summer Block 2 (conversion graphs)<br>Y9: Summer Block 3 (speed, distance and time)<br><br>**Key Vocabulary:** Parallel, axis, reflection, mirror, direct proportion, convert, interpret, speed, distance, constant, scale, acceleration, inverse, pressure | | | |
| **Career Links:** Graphs are heavily used in sports analysis jobs. \| STEM This video resource from Teachers TV is presented by Fran and Dave, who demonstrate practical applications of mathematics as they investigate how distance/time graphs can be used to measure sporting fitness. Graphics demonstrate how the speed at different stages of a journey is calculated. Data, collected from exercising at a gym, is plotted on graphs for comparison. The average speed is then calculated, and an analysis of individual performances is done. | | | |
| Block 3<br>Using Graphs | 1. Reflect shapes in given lines | TBAT reflect shapes in given lines | Students should be familiar with the equations of straight lines from the first block of the Autumn term. This step provides a reminder about lines of the form x=a and y=a in the context of practicing reflection. Students should be able to both perform and describe reflections in these lines using precise mathematical language. |
| | 2. Construct & interpret conversion graphs (R)<br>3. Construct & interpret other real-life straight-line graphs (R) | TBAT construct and interpret real-life straight-line graphs | Students may need reminding to use a ruler to draw lines to/from axes to the line rather than reading off by eye.<br>With other real-life graphs, it is useful to consider the practical meaning of the gradient and intercept e.g. the unit increase and the fixed charge. |
| | 4. Interpret distance time graphs | TBAT interpret distance time graphs | The key point is to understand that the gradient represents the speed of travel, e.g., a straight line is constant speed, and a flat section implies the object is stationary. Various scales should be used, and students will need support to calculate speed in section of less than one hour. |
| | 5. Construct distance time graphs | TBAT construct distance time graphs | This is relatively straightforward given times and distances but can lead to difficulty if the speed is given, particularly if dealing with non-integer multiples of an hour. Students need to practice working out distances covered over periods of 10, 20, 30 and 45 minutes to inform their plotting of the graph. |
| | 6. Construct & interpret speed time graphs | TBAT construct and interpret speed time graphs | Students need to know the difference between speed/time and distance/time graphs, appreciating that the gradient here represents the change in speed and that this is called acceleration. They should also understand that negative gradient now represents slowing down/deceleration. |
| | 8. Recognise and interpret graphs of | TBAT recognise & interpret graphs of direct & | These are discontinuous and students will be less familiar with these. Students can make links to the solutions of inequalities represented on number lines, as in this |

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| | direct & inverse proportion | inverse proportion | topic they again need to be careful when considering what values are included and not included. |
| | 9. Find approximate solutions to equations using graphs | TBAT find approximate solutions to equations using graphs | It is good to compare the graphs of inverse proportion relationships with that of the reciprocal function covered in the previous block. |
| | Check out<br>Check in next block | TBAT complete check out | |
| | Feedback lesson | TBAT respond to feedback | |
| **Rationale:** This block reviews expanding and factorising with a single bracket before moving onto quadratics. The use of interactive algebra tiles to is used to help develop conceptual understanding throughout. Context questions are also included in this block that interleave topics such as area and Pythagoras' theorem to help aid retrieval.<br><br>**Learning Progression:** *topics students have seen that will play a vital role in understanding this block*<br>Y7: Spring Block 2 (use factors and multiples)<br>Y7: Spring Block 4 (use the four operations with directed number)<br>Y8: Spring Block 1 (expand over a single bracket)<br>Y9: Autumn Block 1 (expand a pair of binomials)<br>Y10: Autumn Block 3 (factorising quadratics)<br><br>**Key Vocabulary:** Expand, factorise, coefficient, identity, HCF, bracket, binomial, like/unlike terms, quadratic, factor, product, solve, solutions, expression | | | |
| **Career Links:** Chemical engineers, civil engineers, electrical engineers, mechanical engineers, and aerospace engineers represent top professional engineers that make use of linear and quadratic equations on a regular basis. For example, an equation can be used to estimate measurements for both solids and liquids. | | | |
| Block 4<br>Expanding & Factorising | 1. Expand and factorise with a single bracket (R) | TBAT expand and factorise single brackets | This reviews concepts covered in KS3. Make sure to illustrate expanding a single bracket using the area model or by using algebra tiles. Factorise numbers before algebraic expressions to make the link between factors and factorising. A common mistake is that students don't find the HIGHEST common factor of the terms in an expression. |
| | 2. Expand binomials (R) | TBAT expand binomials | Concrete resources such as algebra tiles are useful in supporting student confidence in this step. Where appropriate, extend to contexts where students generate the binomials and then manipulate them. |

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| | 3. Factorise quadratic expressions | TBAT factorise quadratic expressions | Students need to link finding factors with factorisation. Students should understand that a quadratic expression has a maximum of two binomial factors. Students should factorise quadratics with negative x terms or a negative constant to ensure a deep conceptual understanding. |
| | 3. Factorise quadratic expression | TBAT factorise quadratic expressions | There is a repeated step in her to ensure students have a deep conceptual understanding. Students should be pushed to factorise quadratics with negative x terms or a negative constant. |
| | 5. Solve equations equal to zero | TBAT solve equations equal to zero | The purpose of this small step is to prepare students for solving quadratics by factorisation. Firstly, students practice solving linear equations equal to zero. They then need to understand that if the product of two numbers or terms is zero, then at least one of the two numbers / terms must be zero. |
| | 6. Solve quadratic equations by factorisation | TBAT solve quadratic equations by factorisation | It is important to emphasise the difference between factorising and solving. Students should make links between the solutions of a quadratic equation and the roots of a quadratic. They should also solve quadratic equations in context and choose the most sensible solution given the context, e.g. avoiding negative lengths. |
| | Check out<br>Check in next block | TBAT complete check out | |
| | Feedback lesson | TBAT respond to feedback | |

**Rationale:** Students consolidate and build on their study of changing the subject from year 9. The block begins with a review of solving equations and inequalities before moving on to rearrangement of both familiar and unfamiliar formulae. Checking by substitution is encouraged throughout this block so that student gain a deep and conceptual understanding and revisit their substitution skills.

**Learning Progression:** *topics students have seen that will play a vital role in understanding this block*
Y7: Spring Block 1 (solve perimeter problems)
Y7: Spring Block 2 (area of shapes)
Y8: Spring Block 1 (form and solve equations with brackets)
Y9: Autumn Block 1 (change the subject of a formula)

**Key Vocabulary**: Equation, solve, unknown, coefficient, expand, solution, subject, inequality, form, solve, perimeter, area, volume, rearrange, inverse

**Career Links:** Equation skills are in high demand! According to the UK of Labour Statistics, the job growth for mathematicians is at 33 percent between 2020 and 2030, which is much higher than average. This means that jobs for people with mathematical skills are increasing. Equations are important in solving real life problems in careers such as Architectural design, video gaming, business trend analysis and much more.

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| Block 5<br>Changing the Subject | 1. Solve linear equations (R) | TBAT solve linear equations and inequalities | Students are familiar with solving equations from previous years' content. This step provides an opportunity to check the basics are secure. |

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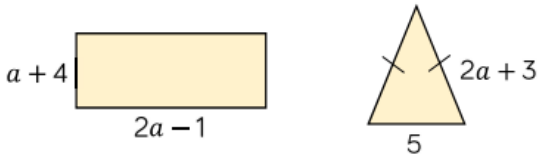
| | 2. Solve linear inequalities (R) | | |
| | 3. Form and solve equations & inequalities in the context of shape | TBAT solve equations & inequalities in the context of shape | Students should be confident in forming as well as solving equations, and this step uses shape as a context to support this. Students should be encouraged to check answers by substituting solutions back into the original problem as well as in the equation or inequality.<br>The perimeter of the rectangle is greater than the perimeter of the triangle. Find the smallest possible integer value of $a$.<br>  |
| | 4. Change the subject of a simple formula | TBAT change the subject of a simple formula | Students have studied changing the subject of a formula in year 9 using function machines and this step is to review the basic principles. |
| | 5. Change the subject of a known formula | TBAT change the subject of a known formula | Changing the subject can be a rather abstract concept, so it can be useful for students to see it in the context of formulae with which they are familiar with. It is particularly useful in checking the accuracy of the rearrangement as they know what the letters represent and make sense of their answers. |
| | 6. Change the subject of a complex formula | TBAT change the subject of a complex formula | The order in which steps are taken is paramount, so comparing similar formulae is useful. Students should also be able to identify errors as part of A02 reasoning, and this topic provides |
| | Check out<br>Check in next block | TBAT complete check out | |
| | Feedback lesson | TBAT respond to feedback | |

**Rationale:** This block introduces formal function notation and brings together what was built on in the recent study of quadratic functions and graphs. This block also provides an opportunity to revisit trigonometric functions, first studied at the start of Year 10. Due to the nature of the assessment for this block and the retrieval purpose of interleaving Trigonometric functions, two extra steps have been added in to revisit Trigonometric functions.

**Learning Progression:** *topics students have seen that will play a vital role in understanding this block*
Y7: Autumn Block 2 (function machines and substitution)
Y7: Autumn Block 3 (collecting like terms)
Y8: Spring Block 1 (solve equations)
Y8: Autumn Block 4 (plotting graphs)
Y9: Summer Block 5 (algebraic representation)

Y9: Autumn Block 2 (form and solve equations)
Y10: Autumn Block 4 (linear and quadratic simultaneous equations graphically)
Y10: Autumn Block 2 (use trigonometry to find missing sides and angles)
**Key Vocabulary: Input, output, inverse, operation, function, evaluate, substitute, expression, formulae, evaluate, solve, turning point, roots, intercept**

**Career Links:** Trigonometry was first studied in the third century B.C as a way of applying geometry to astronomy. Early astronomers noted fixed relationships between the sides and angles of right-angled triangles. The trig functions are used in many fields, including electrical and mechanical engineering, acoustics, ecology, astronomy, physics, and surveying. Even in smaller projects you'll find construction workers such as carpenters, landscapers and roofers relying on trigonometry to calculate the necessary angles and fittings to meet building code requirements efficiently and sufficiently.

Quadratic equations are often used to describe the motion of objects that fly through the air. If you plan to join the military and work with artillery or tanks, then you will regularly use the quadratic equation to predict where shells will land. Police also use it in determining the trajectories of bullets and in figuring out the speeds of cars that have been involved in accidents.

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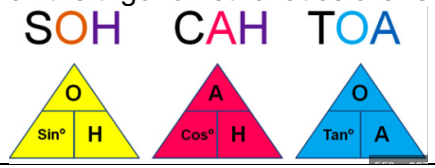
| Block 6 Functions | 1. Use function machines (R) | TBAT use function machines | Students will recap using function machines in order to aid their understanding when moving onto more abstract functions in later steps. |
| | 2. Substitute into expression and formulae | TBAT substitute into expressions and formulae | There is an opportunity here to recap other areas of the curriculum such as fractions, area and volume. It is useful to explore misconceptions such as $2x^2 = (2x)^2$ |
| | 3. Use function notation | TBAT use function notation | Students are introduced to formal function notation for the first time. Students should be aware that it is not just f(x) that is used, it can be g(x) etc |
| | 6. Graphs of quadratic functions | TBAT plot quadratic graphs | This is an extra step added in to ensure students have a good understanding of how a quadratic graph is plotted, before going on to interpreting it. This is revisiting content taught in block 2 previously. |
| | 6. Graphs of quadratic functions | TBAT interpret quadratic graphs | This step aims to consolidate quadratic graphs. Students need to be able to estimate solutions and identify the coordinates of the turning point. |
| | EXTRA STEP | TBAT use trig to work out missing angles | Ensure that variation is used when selecting appropriate questions for pupils so that they are not just fluent in this skill and so that they have a deep understanding. |
| | EXTRA STEP | TBAT use trig to work out missing lengths | This step aims to revisit the use of Trigonometry to find missing lengths. Ensure that all the trigonometric ratios are revisited and that the trig triangles are used.   |

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| | Check out<br>Check in next block | TBAT complete check out | |
| | Feedback lesson | TBAT respond to feedback | |
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| **Rationale:** Students develop their multiplicative reasoning in a variety of context, from simple scale factors through to complex equations involving direct and inverse proportion. They link inverse proportion with the formulae for pressure and density. There are also opportunities throughout this block to review ratio problems.<br><br>**Learning Progression:** *topics students have seen that will play a vital role in understanding this block*<br>Y7: Summer Block 3 (use multiplicative relationships between known facts)<br>Y8: Spring Block 4 (using multipliers)<br>Y8: Autumn Block 2 (understand and use scale factors)<br>Y8: Autumn Block 1 (understand and use ratio, divide in a ratio)<br>Y9: Summer Block 2 (solve direct proportion problems)<br>Y9: Summer Block 3 (density)<br>Y10: Spring Block 4 (working with ratios and fractions)<br><br>**Key Vocabulary:** Enlargement, multiplier, scale factor, similar, linear, direct proportion, density, pressure, mass, volume, force, area, inverse proportion, substitute | | | |
| **Career Links:** Many industries and jobs use ratios, but few industries rely as heavily on ratios as banking and finance. From credit counsellors to mortgage brokers, stockbrokers, retail banks, auto finance officers or commercial lenders — all things finance-related rely heavily on ratios. Here are some common financial jobs that use ratios and examples of the ratios they rely on. Stock analysts, real estate lenders and retail bankers.<br><br>Density helps organisations set petrol prices and helps to understand how to transport fluids like oil, petrol, and water etc. Engineers that are designing aerospace also have a great need to know about the density of the materials they are using. Also, a paint chemist also needs to know the density of paints. | | | |
| Block 7 Multiplicative Reasoning | 1. Use scale factors (R) | TBAT use scale factors | This is a good opportunity to use scale factors between 0 and 1, as well as those above 1. Students should practice finding scale factors as well as using them. |
| | 2. Understand direct proportion | TBAT calculate direct proportion problems | The aim of this step is to understand direct proportion before introducing y=kx. Direct proportion relationships such as diameter and circumference, converting units and currency conversion can all be revisited. |

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| | 4. Calculate with pressure and density | TBAT calculate with pressure and density | Students will consider the similar formulae for pressure and density. Understanding of the units used is important. |
| | EXTRA STEP | TBAT calculate speed, distance & time | This is an opportunity for students to review speed, distance, and time, making links to direct proportion. |
| | 5. Understand inverse proportion | TBAT calculate inverse proportion problems | Students can now consider the three variables in the speed, distance, time or mass, density and volume relationships to distinguish between direct and inverse proportion. Inverse proportion relationships should be explored in different representations such as word problems, graphs, and equations. |
| | 7. Ratio problems | TBAT solve ratio problems | This step provides an opportunity for students to revisit ratio problems and strategies for solving these. Students should be encouraged to use bar models and two-way tables where appropriate. |
| | Check out<br>Check in next block | TBAT complete check out | |
| | Feedback lesson | TBAT respond to feedback | |

**Rationale:** Students consolidate their knowledge of angle facts and develop increasingly complex chains of reasoning to solve geometric problems. Students also revisit vectors and the key topics of Pythagoras' theorem and trigonometry which was taught in the Autumn block in year 10.

**Learning Progression:** *topics students have seen that will play a vital role in understanding this block*
Y7: Summer Block 1 (geometric notation)
Y7: Summer Block 2 (angle rules and angles in quadrilaterals)
Y8: Summer Block 1 (find and prove simple geometric facts)
Y9: Autumn Block 4 (properties of 2D shapes)
Y9: Spring Block 4 (chains of reasoning to find angles)
Y10: Autumn Block 2 (Pythagoras' theorem & trigonometry)
Y10: Spring Block 3 (understand and use vectors)

**Key Vocabulary**: Angle, adjacent, point, vertically opposite, parallel, corresponding, bearing, alternate, interior, exterior, polygon, isosceles, hypotenuse, ratio

**Career Links:** People whose profession involves the movement of things usually depend on vectors to help them organise their thoughts. Examples are airline pilots, sea captains, doctors tracking the progress of an epidemic, meteorologists tracking weather systems and engineers dealing with forces and motion. Health diagnosing and treating occupations also use vectors in their everyday work as chiropractors when treating patients.

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| There are a wide range of jobs that use angles every day! These include engineers, architects, athletes, carpenters, artists, doctors, and maths teachers. | | | |
| Block 8 Geometric Reasoning | 1. Angles at a point | TBAT solve problems involving angles at a point | This step provides students with an opportunity to revise rules of angles at points. As students have already seen these rules, interleaving other topics such as ratio and equations can be used to maintain the level of challenge whilst still securing this essential knowledge. |
| | 2. Angles in parallel lines and shapes | TBAT work out missing angles in parallel lines and shapes | Students should be confident in what is meant by alternate, corresponding and co-interior angles. This small step provides opportunity to revisit other content such as bearings. |
| | 3. Exterior and interior angles of polygons | TBAT work out interior angles in polygons | This step has been split up into interior angles and exterior angles over two lessons so that students can have a deep understanding of the sum of interior angles by splitting the shape up into triangles / quadrilaterals. |
| | 3. Exterior and interior angles of polygons | TBAT work out exterior angles in polygons | Students should be able to work fluently with this rule in both regular and irregular shapes. |
| | 4. Proving geometric facts | TBAT prove geometric facts | This is a good opportunity to revisit properties of shape covered earlier in the curriculum. There should be a clear focus placed on the explanations used throughout each proof. |
| | 5. Solve problems involving vectors | TBAT solve problems using vectors | Students should be able to find a column vector given a diagram and vice versa. They need to be able to calculate with vectors using addition and subtraction and multiply a vector by a scalar.<br>$\boldsymbol{a} = \begin{pmatrix} 5 \\ -1 \end{pmatrix}$ $\boldsymbol{b} = \begin{pmatrix} -3 \\ 2 \end{pmatrix}$<br>Draw a diagram to show that $\boldsymbol{a} + \boldsymbol{b} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$<br>Work out $\boldsymbol{a} + 2\boldsymbol{b}$ |
| | 11. Review Pythagoras' theorem and using trig ratios | TBAT use Pythagoras' theorem to solve problems | This small step provides an opportunity to revisit Pythagoras' theorem and trigonometry. |
| | 11. Review Pythagoras' theorem and using trig ratios | TBAT use trig to solve problems | Links can be made to different areas of the national curriculum including coordinates and vectors. Students should be able to recognise when to use which rules to answer the questions. |
| | Check out | TBAT complete check out | |

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| | Check in next block | | |
| | Feedback lesson | TBAT respond to feedback | |
| **Rationale:** Students develop their algebraic reasoning by looking at more complex situations, using their knowledge of sequences and rules as well.<br><br>**Learning Progression:** *topics students have seen that will play a vital role in understanding this block*<br>Y7: Autumn Block 2 (algebraic notation & substitution)<br>Y7: Autumn Block 1 (recognise linear and non-linear sequences)<br>Y8: Spring Block 2 (revise and extend Y7 content to include more complex rules)<br>Y9: Autumn Block 3 (testing conjectures about sequences)<br>Y9: Summer Block 6 (finding a rule for the nth term of a linear sequence)<br>Y10: Summer Block 3 (revise and extend KS3 content, including names and types of sequences)<br><br>**Key Vocabulary:** Term, expression, power, index, simplify, coefficient, linear, sequence, non-linear, difference, constant, Fibonacci, geometric, quadratic | | | |
| **Career Links:** Sequences are used widely in various different jobs. Demographics use sequences to forecast population growth, physicists and engineers work with mathematical functions that include geometric sequences and farmers use sequences to predict crop growth and corresponding revenue growth. | | | |
| Block 9 Algebraic Reasoning | 1. Simplify complex expressions | TBAT simplify complex expressions | Students have an opportunity to revise algebraic notation and the rules for collecting like terms and indices. Answers could be checked by substitution. Students may need a reminder of the word coefficient. |
| | 2. Find the rule for the nth term of a linear sequence (R) | TBAT find the rule for the nth term of a linear sequence | Encourage students to check their answers by substituting several values for n. To extend challenge, students could look at patterns and explain how the values of a and b in the rule an+b relate to the pattern. |
| | 4. Use rules for sequences | TBAT use rules for sequences | Students build on their learning and use reasoning to determine, for example, whether a term is a member of a sequence or not. Students may need support to realise that the questions can be approached through forming and solving equations and inequalities rather than trying to list an excessive number of terms. |
| | EXTRA STEP | TBAT work out terms in a Fibonacci sequence | Students can be reminded about geometric and Fibonacci sequences. |
| | 5. Solve linear simultaneous equations (R) | TBAT solve linear simultaneous equations | Students explored solving a pair of linear simultaneous equations in Autumn year 10, so this provides a timely reminder. |

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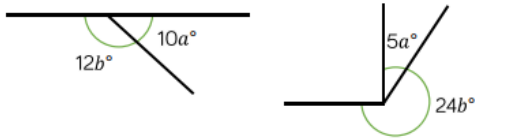
| | | | Use an algebraic method to work out the missing angles.<br>  <br> |
| | EXTRA STEP | TBAT use numerical and algebraic expressions to calculate the area of a triangle | Based on the assessment for this block and the opportunity to interleave area of triangles, this step has been added in as an extra one. |
| | Check out | TBAT complete check out | |
| | Feedback lesson | TBAT respond to feedback | |

**Rationale:** This is a block designed to be adapted to suit the needs of individual classes. Examples of communication in various area of mathematics are provided to highlight gaps in knowledge that need addressing in the run up to the examination. “Show that” is used to encourage students to communicate in a clear mathematical fashion, and this skill should be transferred to their writing of solutions to any type of question. Clear modelling under the visualiser is vital throughout this block.

**Learning Progression:** *topics students have seen that will play a vital role in understanding this block*
Y7: Spring Block 4 (directed number, prime factorisation, HCF & LCM)
Y7: Spring Blocks 1/2 (four operations and order of operations)
Y8: Spring Block 1 (simplifying expressions involving brackets, identifying and using formulae)
Y8: Summer Block 1 (angles in parallel lines, interior & exterior angles)
Y9: Spring Block 4 (chains of reasoning to find angles)
Y9: Autumn Block 4 (surface area and volume of 3D shapes)
Y10: Summer Block 1 (frequency polygons, time series, comparing distributions using diagrams & finding averages)
Y10: Spring Block 6 (using tree diagrams)

**Key Vocabulary:** Equivalent, sum, product, simplest form, identity, expression, equation, trapezium, similar, area, corresponding, alternate, adjacent, co-interior, mean, median, mode, range, quartile, interquartile range, congruent, condition, prove,

**Career Links:** The skills gained throughout this block are transferrable to a wide range of careers such as journalism, book authoring, social media manager, marketing, and advertising. Communicating ideas through clear concise writing and being a logical thinker are very important for these careers.

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| Block 12<br>Show that… | 1. Show that with number | TBAT complete number show that questions | As well as developing students’ reasoning skills, this step provides an opportunity for students to revise arithmetical techniques. |

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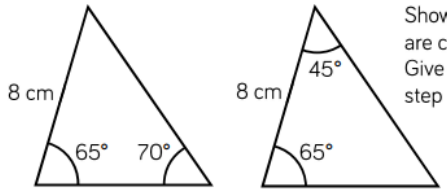
| | | | Amir says, "$\frac{5}{6}$ is greater than $\frac{3}{4}$"<br>Show that Amir is correct<br>• by drawing a diagram.<br>• by converting both numbers to decimals.<br>• by converting both numbers to fractions.<br>Can you find any other ways to show that Amir is correct? |
| | 2. Show that with algebra | TBAT complete algebra show that questions | This step can be used to revise solving linear equations and inequalities, sequences, substitution, expanding brackets and factorisation as appropriate. |
| | 3. Show that with shape | TBAT complete shape show that questions | Here students have the opportunity to revise finding areas and perimeters of rectilinear and other shapes. Revisiting Pythagoras' theorem and similarity are also included. |
| | 4. Show that with angles | TBAT complete angles show that questions | Students may need reminding of the precise wording and how to 'give reasons for your answer.' Model and encourage clear detailed solutions. |
| | 5. Show that with data | TBAT complete data show that questions | Students need to be comfortable with the vocabulary surrounding data and in interpreting as well as constructing charts and calculating measures. Probability is also included within this step. |
| | 6. Show that with congruent triangles | TBAT complete congruent triangles show that questions | Concentrate on examples where numerical values are given in this step. Students may need reminding of the four sets of conditions for congruency.<br>  |
| | Check out | TBAT complete check out | |
| | Feedback lesson | TBAT respond to feedback | |
| **ASSESSMENT** | | | |
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| **Reflection** | | | |