Pearson

# YEAR 7

## NUMBERS AND THE NUMBER SYSTEM

### INTEGERS

| Reference | Objective | Notes and guidance |
|---|---|---|
| N7.1A | Recognise the place value of each digit in numbers beyond 1 000 000 (one million) to 1 000 000 000 (one billion). | Use a place-value table. Move on to reading, writing and saying aloud numbers not on a place-value table. |
| N7.1B | Add and subtract positive and negative numbers. | Begin by using ±1 number counters, and finding zero pairs. For example:<br>$^{-}5 + {}^{+}3$<br>(−1) (−1) (−1) (−1) (−1)<br>(+1) (+1) (+1)<br>Zero pairs<br>For larger numbers, support with a number line.<br>Use contexts, such as temperature and above/below sea level. |
| N7.1C | Compare and order positive and negative numbers and write statements using inequality signs, > and <, in context. | Revise and reinforce the use of inequality signs to compare and order numbers including a mixture of negative and positive values in context, as well as more than two values. For example:<br>$^{-}47\,°C < {}^{-}32\,°C < 0\,°C$ |
| N7.1D | Identify factors of any integer; identify common factors and the highest common factor of two integers. | Use this as an opportunity to revise multiplication tables.<br>Introduce 'factor pairs' to help with finding *all* factors of an integer.<br>Encourage listing of factors and circle the common factors.<br>Identify the highest common factor. |
| N7.1E | Identify multiples of any integer; identify common multiples and the lowest common multiple of two integers. | Use this as an opportunity to revise multiplication tables.<br>Encourage listing of multiples and circle the common multiples.<br>Identify the lowest common multiple. |
| N7.1F | Use rules for divisibility by 2, 3, 4, 5, 9, 10. | Introduce the term 'divisible' using multiplication tables. For example:<br>9 is in the 3 and 9 multiplication tables; 9 is divisible by 1, 3 and 9<br>21 is in the 3 and 7 multiplication tables; 21 is divisible by 1, 3, 7 and 21<br>Discuss rules for divisibility by 2, 5 and 10.<br>Explore rules for divisibility by 3, 4 and 9, paying attention to the digit sums.<br>Also connect divisibility by 4 with halving, and then halving again. |
| N7.1G | Recognise prime numbers. | Establish whether a number up to 100 is prime and recall prime numbers up to 19. |
| N7.1H | Know square numbers up to and including 144 and related square roots; calculate other squares and square roots. | Support with counters arranged in squares, and square grids/arrays.<br>Use this as an opportunity to revise multiplication tables.<br>Recognise the square and square root keys on a calculator.<br>Use a calculator to explore squares greater than $12^2$ and square roots of numbers greater than 144. |

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| N7.1I | Know cube numbers up to and including 125 and related cube roots; calculate other cubes and cube roots. | Support with cubes made of 1 cm-sided cubes.<br>Use this as an opportunity to revise multiplication.<br>Recognise the cube and cube root keys on a calculator.<br>Use a calculator to explore cubes greater than $3^3$ and cube roots of numbers greater than 27. |
| N7.1J | Use index notation up to and including powers of 3. | Use the terms 'squared', 'cubed', 'index', 'indices' and 'to the power of'. |

## FRACTIONS AND DECIMALS

| Reference | Objective | Notes and guidance |
|---|---|---|
| N7.2A | Recognise the place value of each digit in a number with three decimal places. | Use a place-value table. Move on to reading, writing and saying aloud decimal numbers not in a place-value table. |
| N7.2B | Write decimals with up to three decimal places in order of size and write statements using inequality signs, < or >. | Use this as an opportunity to review how to say decimals. For example:<br>0·451 is 'nought point four five one' not 'nought point four hundred and fifty-one'.<br>Use a number line or place-value table to determine. For example:<br>*Which is greatest, 0·451 or 0·7?* |
| N7.2C | Round decimals to one decimal place. | Use a number line or place-value table.<br>Relate to measures. |
| N7.2D | Round decimals to make estimates and approximations of calculations. | For example:<br>$5{\cdot}78 \times 7{\cdot}2 \approx 6 \times 7 = 42$<br>$12{\cdot}55 \div 4{\cdot}01 \approx 12 \div 4 = 3$<br>$\sqrt{8{\cdot}6} \approx \sqrt{9} = 3$ |
| N7.2E | Multiply decimals mentally. | Use multiplication facts. For example:<br>$4 \times 0{\cdot}3 = 4 \times 3 \div 10 = 12 \div 10 = 1{\cdot}2$<br>or $4 \times 0{\cdot}3 = 4 \times 3$ tenths $= 12$ tenths $= 1{\cdot}2$<br>Use doubling and halving. For example:<br>$8 \times 2{\cdot}5 = 4 \times 5 = 20$<br>Use the distribution law. For example:<br>$32 \times 2{\cdot}5 = 30 \times 2{\cdot}5 + 2 \times 2{\cdot}5 = 75 + 5 = 80$<br>Understand where to position the decimal point by considering equivalent calculations. For example:<br>$0{\cdot}73 \times 28 = 20{\cdot}44$<br>Use this fact to work out:<br>$7{\cdot}3 \times 28$; $0{\cdot}73 \times 2{\cdot}8$; $0{\cdot}073 \times 28$ and so on. |
| N7.2F | Add and subtract decimals up to and including three decimal places. | Add and subtract decimal numbers of varying decimal places, using the column method.<br>$7{\cdot}742 + 9{\cdot}41$<br>$\begin{array}{r} 7{\cdot}742 \\ +\ 9{\cdot}41 \\ \hline 17{\cdot}152 \end{array}$<br>$82{\cdot}1 - 0{\cdot}574$<br>$\begin{array}{r} 82{\cdot}100 \\ -\ 0{\cdot}574 \\ \hline 81{\cdot}526 \end{array}$ |

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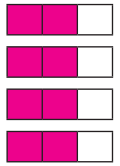
| N7.2G | Multiply and divide decimals by single-digit whole numbers. | $5{\cdot}6 \times 4 \approx 6 \times 4 = 24$<br>$\begin{array}{r} 56 \\ \times\ 4 \\ \hline 224 \\ {\scriptstyle 2} \end{array}$<br>$5{\cdot}6 \times 4 = 22{\cdot}4$<br>$5{\cdot}6 \div 4 = 1{\cdot}4$<br>$4\overline{)5^{1}6}\ \ 1{\cdot}4$ |
| N7.2H | Solve problems involving decimals. | Use the contexts of measures. For example:<br>*You have four lengths of ribbon, each 0·6 m long. What length of ribbon do you have altogether?* |
| N7.2I | Understand and use equivalent fractions and write fractions in their simplest form. | Know that $\frac{4}{5}$ is the same as $\frac{8}{10}$ or that $\frac{40}{100}$ is the same as $\frac{2}{5}$.<br>Be able to write, for example, $\frac{40}{100}$ as $\frac{20}{50}$, $\frac{10}{25}$ or $\frac{2}{5}$. |
| N7.2J | Compare and order simple decimals, fractions and percentages. | Know that $\frac{5}{10}$ is equivalent to 50% or 0·5 and understand the relationship. Be able to order values. For example:<br>0·3, $\frac{2}{4}$, 65%, 0·72. |
| N7.2K | Change an improper (vulgar) fraction to a mixed number. | Support with pictorial representations. For example:<br>  <br>$\frac{5}{3} = 1\frac{2}{3}$ |
| N7.2L | Multiply fractions by whole numbers. | Start with pictorial representations. For example:<br>  <br>2 thirds $\times 4 = 8$ thirds<br>$\frac{2}{3} \times 4 = \frac{8}{3}$<br>$= 2\frac{2}{3}$ |
| N7.2M | Add a mixed number and a fraction where one denominator is a multiple of the other; subtract a fraction from a mixed number where one denominator is a multiple of the other. | $2\frac{2}{5} + \frac{3}{10} = 2\frac{4}{10} + \frac{3}{10}$<br>$= 2\frac{7}{10}$<br>$1\frac{5}{8} - \frac{3}{4} = 1\frac{5}{8} - \frac{6}{8}$<br>$= 1 - \frac{1}{8}$<br>$= \frac{7}{8}$ |
| N7.2N | Write one number as a fraction of another. | Use contexts. For example:<br>*There are 29 students in a class. 17 are boys. What fraction are boys?*<br>Move on to contexts where the answer is a fraction that requires simplifying.<br>Solve problems. For example:<br>*There are 20 coats in a cloakroom. 12 are black. What fraction are not black? Write the answer in its simplest form.* |

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## PERCENTAGES

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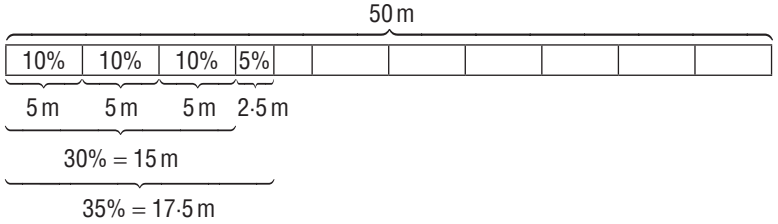
| N7.3A | Convert percentages to decimals, and decimals to percentages. | Support with a $10 \times 10$ grid and place-value table.<br>Use this as an opportunity to revise dividing and multiplying by 100. |
| N7.3B | Convert fractions whose denominator is a factor of 10 and fractions whose denominator is a factor of 100. | For example, convert $\frac{2}{5}, \frac{3}{10}, \frac{7}{20}, \frac{4}{25}$, and so on. |
| N7.3C | Write one number as a fraction of another (where the denominator is a factor of 100) and then as a percentage. | Write one number as a fraction of another and convert to an equivalent fraction with denominator 100. For example:<br>$\frac{3}{10} = \frac{30}{100} = 30\%$<br>$\frac{4}{5} = \frac{80}{100} = 80\%$<br>$\frac{7}{50} = \frac{14}{100} = 14\%$ |
| N7.3D | Mentally calculate percentages of an amount. | Use equivalent fractions, for example, $\frac{1}{2}$ to find 50%, $\frac{1}{4}$ to find 25%, and so on.<br>Find and use 10%. For example, find 10% and then:<br>• half to find 5%<br>• ×2 to find 20%<br>• ×3 to find 30%<br>• half to find 5% + ×3 to find 30% = 35%.<br>Support with fraction bars. For example:<br>  <br>Convert to a decimal and multiply. For example:<br>70% of 20 = 0·7 × 20 = 0·7 × 10 × 2 = 7 × 2 = 14 |

## CALCULATION SKILLS

| Reference | Objective | Notes and guidance |
|---|---|---|
| N7.4A | Use estimates to check answers. | Use rounding and other number knowledge. |
| N7.4B | Use priority of operations for calculations involving the four operations. | Introduce BIDMAS:<br>Brackets<br>Indices (powers)<br>Division<br>Multiplication<br>Addition<br>Subtraction<br>Include brackets, but not powers and roots. |

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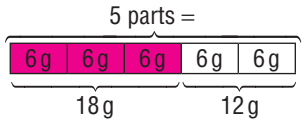
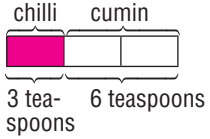
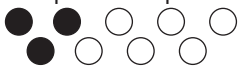
| N7.4C | Use a calculator for the four operations and interpret the answer in different contexts. | Use a calculator to solve problems involving money, measure and time.<br>For money, give answers to two decimal places.<br>For measures in cm, give the answer to one decimal place, indicating mm; for measures in m, give the answer to two decimal places, indicating cm, and so on.<br>For time, convert decimals to the appropriate unit, for example, 3·25 h = 3 h and 15 min. |

## RATIO AND PROPORTION

| Reference | Objective | Notes and guidance |
|---|---|---|
| N7.5A | Solve simple problems involving direct proportion in a range of contexts. | Use the unitary method, finding the value of one item before finding the value of more. |
| N7.5B | Write and interpret ratios written in ratio notation. | Use the language 'for every'. For example:<br>3 : 1 – there are 3 grey beads for every 1 white bead.<br>Use pictorial representations, such as a bar. For example:<br>  |
| N7.5C | Reduce a ratio to its simplest form. | Relate to highest common factors and cancelling/simplifying. |
| N7.5D | Solve word problems that involve dividing a quantity into two parts in a given ratio. | Use pictorial representations, such as a bar. For example:<br>*Share 30 g in the ratio 3 : 2:*<br>  <br>Use the unitary method, finding the value of one item before finding the value of more. |
| N7.5E | Solve word problems where given a ratio and one quantity and have to find the other quantity. | Use pictorial representations, such as a bar. For example:<br>*The ratio of chilli to cumin in a recipe is 1 : 2.*<br>*Three teaspoons of chilli are used. How much cumin is used?*<br>  |
| N7.5F | Use fractions to describe and compare proportions. | Use pictorial representations. For example:<br>  <br>$\frac{1}{3}$ are black<br>$\frac{2}{3}$ are white |

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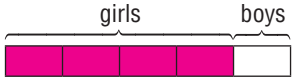
| N7.5G | Use percentages to describe and compare proportions. | Write as fractions first, and then as percentages. For example:<br>*A student gets 15 out of 20 for a science test and 21 out of 25 for a mathematics test. Compare the results using percentages.*<br>science $\overset{\times 5}{\underset{\times 5}{\frac{15}{20} = \frac{75}{100}}} = 75\%$<br>maths $\overset{\times 4}{\underset{\times 4}{\frac{21}{25} = \frac{84}{100}}} = 84\%$<br>The student did better in the maths test. |
| N7.5H | Understand and use the relationship between ratio and proportion. | *The ratio of girls to boys in a choir is 4 : 1. What fraction is girls? What percentage is girls?*<br>Support with a bar. For example:<br>  <br>girls $\overset{\times 20}{\underset{\times 20}{\frac{4}{5} = \frac{80}{100}}} = 80\%$<br>boys $\overset{\times 20}{\underset{\times 20}{\frac{1}{5} = \frac{20}{100}}} = 20\%$ |

## ALGEBRA

### EXPRESSIONS AND FORMULAE

| Reference | Objective | Notes and guidance |
|---|---|---|
| A7.1A | Use letters to represent unknown values. | Use letters to represent unknown values in mathematics and science formulae that are already familiar. |
| A7.1B | Write simple expressions using correct algebraic notation and the four operations. | Write $3 \times m$ as $3m$ and $b \div 5$ as $\frac{b}{5}$ |
| A7.1C | Simplify simple linear algebraic expressions by collecting like terms. | For example:<br>$a + 3 + a = 2a + 3$<br>$4 + b - 2 - 3b = 2 - 2b$<br>$2x + 3y + 4x - y = 6x + 2y$ |
| A7.1D | Simplify simple linear algebraic expressions involving multiplication and division. | For example:<br>$2a \times 5 = 10a$<br>$8\frac{b}{2} = 4b$<br>$2c \times 3d = 6cd$ |
| A7.1E | Expand brackets by multiplying a single positive number term over a bracket. | Multiply a single number term over a bracket containing a linear expression. For example:<br>$2(x + 3) = 2x + 3$<br>$3(y - 5) = 3y - 15$<br>$4(10 - d) = 40 - 4d$<br>$6(3a + 4) = 18a + 24$<br>$5(2b - 1) = 10b - 5$ |
| A7.1F | Substitute positive integers into simple formulae written in words. | Substitute integers into word formulae involving any of the four operations (but not powers or brackets), and use the order of operations to calculate the result. |
| A7.1G | Substitute integers into formulae written in letters. | Substitute integers into algebraic formulae involving any of the four operations (but not powers or brackets), and use the order of operations to calculate the result. |
| A7.1H | Write simple formulae using letters. | Write expressions and then formulae to model situations, using any of the four operations (but not powers or brackets). |
| A7.1I | Solve missing-number problems and problems involving formulae. | For example:<br>• missing-number problems<br>• problems involving missing lengths<br>• angles and coordinates represented by letters<br>• problems involving writing and using formulae. |

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## SEQUENCES

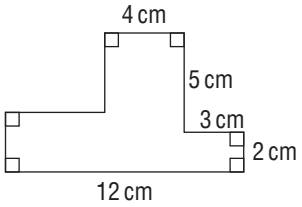
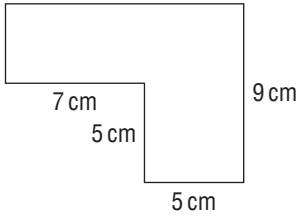
| Reference | Objective | Notes and guidance |
|---|---|---|
| A7.2A | Describe simple pattern or number sequences. | Describe how the patterns in a pattern sequence grow.<br>Describe a linear number sequence, or simple geometric sequence, by stating the first term and term-to-term rule. |
| A7.2B | Find or generate terms of a sequence using a term-to-term rule. | Generate a sequence given the first term and the term-to-term rule.<br>Continue a linear or simple geometric sequence by first identifying the term-to-term rule. |
| A7.2C | Recognise different types of sequence. | Recognise and name:<br>• arithmetic sequences<br>• simple geometric sequences<br>• sequence of square numbers<br>• sequence of triangle numbers. |
| A7.2D | Generate terms of a sequence using a simple position-to-term rule given in words. | For example:<br>6 × position number<br>position number + 5<br>2 × position number – 1 |
| A7.2E | Use linear expressions to describe the $n$th term of simple sequences. | Identify the position-to-term rule for a sequence of multiples, and write the $n$th term using algebra.<br>For example:<br>For 3, 6, 9, 12, 15, . . . the position-to-term rule is 3 × position number = $3n$. |
| A7.2F | Solve problems involving sequences. | For example:<br>• Write and use number sequences to model real-life problems.<br>• Decide whether a number is a term in a sequence.<br>• Decide whether there are enough counters to make the 10th pattern in a sequence.<br>• Work out the missing terms in a linear or simple geometric sequence, such as ___, 4, 6, ___, 10, __, 14. |

## GRAPHS

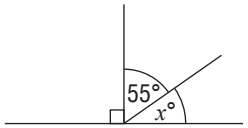
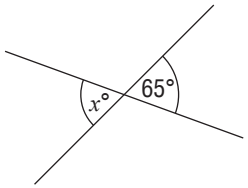
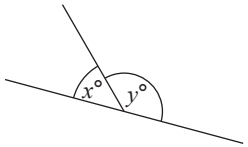
| Reference | Objective | Notes and guidance |
|---|---|---|
| A7.3A | Recognise, name and plot graphs parallel to the axes and the graphs of $y = x$ and $y = -x$. | Generate and plot coordinates from a rule given in words, such as 'the $x$-coordinate is always 4', or 'the $y$-coordinate is always the same as the $x$-coordinate'. Write these relationships using algebra: $x = 4$, and $y = x$. |
| A7.3B | Plot straight-line graphs using a table of values. | Substitute $x$ values into the equation of the line.<br>Read pairs of $x$, $y$ values as coordinates. |
| A7.3C | Draw graphs to represent relationships. | Plot data given in a table to give a straight-line graph, for example, data from science experiments. |
| A7.3D | Find the midpoint of a line segment, given the coordinates of the end points. | Start by plotting the points on a grid and finding the midpoint by measuring.<br>Derive and use the rule:<br>midpoint = (sum of the two $x$ coordinates divided by 2, sum of the two $y$ coordinates divided by 2) |
| A7.3E | Solve problems involving coordinates and straight lines. | For example:<br>*Given three coordinates, A, B, C, write down the coordinates of D such that ABCD is a parallelogram.* |

## GEOMETRY AND MEASURE

### MEASURE

| Reference | Objective | Notes and guidance |
|---|---|---|
| G7.1A | Convert between metric units of measures of length, mass and capacity, up to and including three decimal places. | Convert between mm and cm, cm and m, mm and m, m and km, g and kg, kg and tonnes, or ml and l.<br>For example:<br>• *Write 0·123 m in mm.*<br>• *How many kg in 1247 tonnes?* |
| G7.1B | Solve problems in everyday contexts involving measures and conversions. | For example:<br>• Convert measures to the same units to make a comparison.<br>• Solve problems where the measure in the question is different to the measure asked for in the answer.<br>Use this as an opportunity to reinforce Year 7 Statistics, for example, find the median of a list of measures, where some conversions are necessary to place the measures in order. |
| G7.1C | Work out the perimeters of regular and irregular polygons, when not all lengths are given, including compound shapes. | For example:<br>*Work out the perimeter of this shape:*<br>  |
| G7.1D | Calculate the areas of squares and rectangles and shapes made from rectangles. | For example:<br>*Work out the area of this shape:*<br>  |
| G7.1E | Solve perimeter and area problems. | For example:<br>• *The side of a square and the side of an equilateral triangle are equal. The perimeter of the triangle is 12 cm. What is the perimeter of the square?*<br>• *The area of a square is 25 cm$^2$. What is its perimeter?* |

## ANGLES

| Reference | Objective | Notes and guidance |
|---|---|---|
| G7.2A | Describe and name acute, obtuse and reflex angles. | Use the terms 'less than 90 degrees', 'more than 90 degrees and less than 180 degrees' and 'more than 180 degrees and less than 360 degrees'. |
| G7.2B | Use a protractor to measure and draw angles; estimate the size of angles. | Include measuring acute, obtuse and reflex angles, as well as angles in shapes.<br>Include drawing acute, obtuse and reflex angles, using estimation before measuring as a 'check' that the correct scale on the protractor is used. |
| G7.2C | Know and use the rules for the sum of angles on a straight line and angles around a point. | For example:<br>*Find angle $x$:*<br>  <br>Encourage the writing of a reason for an answer:<br>Angles on straight line add to 180°. |
| G7.2D | Identify vertically opposite angles and know that they are equal. | For example:<br>*Find angle $x$:*<br>  <br>Encourage the writing of a reason for an answer:<br>Vertically opposite angles are equal. |
| G7.2E | Solve problems involving angles. | For example:<br>*Angle $x$ is half the size of angle $y$. What is the size of angle $x$?*<br>  <br>Encourage the writing of a reason for an answer. |

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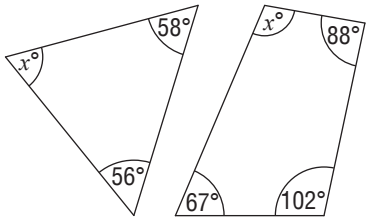
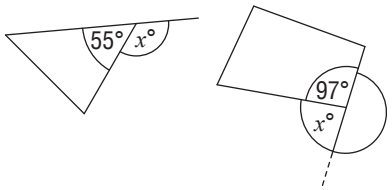
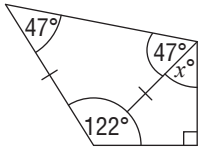
## POLYGONS

| Reference | Objective | Notes and guidance |
|---|---|---|
| G7.3A | Describe, name and compare equilateral, scalene, isosceles and right-angled triangles. | Use angle and side properties. |
| G7.3B | Describe, name and compare quadrilaterals (square, rectangle, rhombus, parallelogram, kite and trapezium). | Use angle and side properties. |
| G7.3C | Know and use the sum of angles in a triangle and sum of angles in a quadrilateral. | For example:<br>*Find angle $x$:*<br>  <br>Encourage the writing of a reason for an answer:<br>Angles in a triangle sum to 180°.<br>Angles in a quadrilateral sum to 360°. |
| G7.3D | Calculate exterior angles of triangles and quadrilaterals. | For example:<br>*Find angle $x$:*<br>  <br>Encourage the writing of a reason for an answer. |
| G7.3E | Use a ruler and protractor to draw triangles accurately, including simple scale drawings. | Include measuring in cm and mm.<br>Include simple scale drawings, for example, where 1 cm represents 1 m. |
| G7.3F | Solve angle problems involving triangles and quadrilaterals. | For example:<br>*Find angle $x$:*<br>  <br>Encourage the writing of a reason for an answer. |

## SYMMETRY

| Reference | Objective | Notes and guidance |
|---|---|---|
| G7.4A | Recognise and describe rotational symmetry. | Explore the rotational symmetry of lots of 2D shapes. Recognise when a shape has no rotational symmetry.<br>Use the term 'order of rotational symmetry'. |
| G7.4B | Identify and describe all the symmetries of common 2D shapes (reflection and rotation). | Include isosceles and equilateral triangles, as well as quadrilaterals (i.e. square, rectangle, rhombus, parallelogram, kite and trapezium). |
| G7.4C | Identify reflection symmetry in common 3D solids. | Include cuboids, cylinders, pyramids and cubes. |

## TRANSFORMATIONS

| Reference | Objective | Notes and guidance |
|---|---|---|
| G7.5A | Translate 2D shapes. | Start with squared paper and move on to using a coordinate grid. |
| G7.5B | Recognise and carry out reflections in a mirror line. | Include diagonal mirror lines, and mirror lines that pass through the shape. Use the terms 'object' and 'image'. |
| G7.5C | Reflect a shape on a coordinate grid; describe a reflection on a coordinate grid. | Use this as an opportunity to reinforce Year 7 Algebra.<br>Include drawing the mirror line from its equation, $y = a$, $x = a$, $y = \pm x$, and then reflecting a shape.<br>Also, given the mirror line, write its equation to describe a reflection. |
| G7.5D | Recognise and draw rotations about a centre of rotation. | Use centres inside, outside and on the shape, drawn on squared paper. |
| G7.5E | Rotate a shape on a coordinate grid; describe a rotation on a coordinate grid. | Use coordinate grids.<br>Use the term 'degrees clockwise' (or anti-clockwise) about centre of rotation. |
| G7.5F | Transform 2D shapes by combinations of rotations, reflections and translations. | Draw the transformations on a coordinate grid. |
| G7.5G | Identify congruent shapes. | Include lots of 2D shapes in different orientations. |
| G7.5H | Enlarge shapes using positive-integer scale factors (without a centre of enlargement). | Use squared paper (no centre of enlargment). |
| G7.5I | Work out the scale factor given an object and its image. | Use this as an opportunity to reinforce Year 7 Number work on ratio. |

## STATISTICS

### DATA

| Reference | Objective | Notes and guidance |
|---|---|---|
| S7.1A | Find the mode of a set of data presented in a list, table or bar chart. | Students can find the mode of a set of data in a range of real-life contexts. |
| S7.1B | Find the median and range of a set of data presented in a list. | Include integer and decimal values. Use this as an opportunity to reinforce Year 7 Number. For example, ordering decimals up to and including three decimal places. |
| S7.1C | Calculate and interpret the mean of a set of data presented in a list. | Include integer and decimal values. Use this as an opportunity to reinforce Year 7 Number. For example, adding and subtracting decimal numbers of varying decimal places, and dividing decimals by single-digit whole numbers. |
| S7.1D | Find the modal class of grouped data. | Include grouped data in a grouped frequency table or bar chart. |
| S7.1E | Compare sets of data using their ranges and averages. | Use the terms 'greater/less than' and 'lower/higher' and include interpretation. For example:<br>*The range of number of goals scored by team A is greater than the range of number of goals scored by team B. This means team B has a more consistent sports performance.* |
| S7.1F | Analyse and present data using spreadsheets in a computer software program. | Enter data in lists or tables in a spreadsheet and use formulae to find the averages and range. Create bar charts. |
| S7.1G | Solve problems involving mean, median, mode and range. | For example:<br>• *The mean of 4, 5, 7 and $n$ is 5. What is the value of $n$?*<br>• *The range of 3, 9, 4 and $x$ is 7. What is the value of $n$?* |

### CHARTS AND DIAGRAMS

| Reference | Objective | Notes and guidance |
|---|---|---|
| S7.2A | Represent data in tally charts, frequency tables, bar charts, bar-line charts and pie charts. | Draw a tally chart, record data, complete the frequency column and then draw a bar chart or bar-line chart. |
| S7.2B | Interpret simple tables and bar charts for grouped data. | Use the terms 'How many were between...?' and 'most/least popular'. |
| S7.2C | Identify discrete and continuous data. | Use examples such as shoe size and numbers of students in the class for discrete data (that can be counted or take a particular value), and temperatures or heights/lengths for continuous data (that can be measured to many different degrees of accuracy). |
| S7.2D | Represent data in grouped tally charts or frequency tables; draw bar charts for grouped data. | Include bar charts for discrete data (leaving gaps between bars) and for continuous data (with no gaps between bars). |

| | | |
|---|---|---|
| S7.2E | Read and interpret information from tally charts, frequency tables, bar charts, bar-line charts, compound bar charts, line graphs and pie charts. | Interpret graphs with different scales on each axis, and with a key (for dual/compound bar charts, or line graphs showing more than one set of data). |
| S7.2F | Decide how best to represent the data. | For example, use a table (grouped or ungrouped), pictogram, bar chart (grouped or ungrouped, simple, dual or compound) or line graph. |
| S7.2G | Solve problems by interpreting or drawing graphs, charts and tables. | Organise and represent data in a graph or chart, and interpret data presented in graphs or charts, in a range of real-life contexts. Include the use of spreadsheets in a computer software program. |

## PROBABILITY

| Reference | Objective | Notes and guidance |
|---|---|---|
| S7.3A | Use and interpret a probability scale with words. | Mark probabilities of events on a probability scale with words.<br>Use the language of probability: impossible, certain, likely, unlikely, even, chance. |
| S7.3B | Use and interpret the probability scale from 0 to 1 or 0% to 100%. | Mark probabilities of events on a probability scale with fractions, decimals or percentages.<br>Use a probability scale numbered from 0 to 1 in fractions and decimals, or from 0% to 100%. |
| S7.3C | Identify outcomes and equally likely outcomes. | Identify outcomes from spinners, dice, coloured counters taken from a bag, cards taken from a pack and in real-life contexts.<br>Use the terms 'outcome', 'event' and 'equally likely'. |
| S7.3D | Calculate probabilities of single and mutually exclusive events. | For example, for a spinner with equal sections numbered 1 to 12:<br>• The probability of 3 is $\frac{1}{12}$.<br>• The probability of 4 or 5 is $\frac{2}{12} = \frac{1}{6}$.<br>Calculate probabilities as percentages, fractions and decimals in appropriate contexts. |
| S7.3E | Calculate the probability of an event not happening. | Use this as an opportunity to revise Number work: subtracting decimals or fractions from 1.<br>If the probability an event occurs is $p$, the probability that it does not occur is $1 - p$. |
| S7.3F | Solve problems involving probability. | For example, design a spinner where the probability of landing on red is twice the probability of landing on blue. |

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# YEAR 8

## NUMBERS AND THE NUMBER SYSTEM

### INTEGERS

| Reference | Objective | Notes and guidance |
|---|---|---|
| N8.1A | Add, subtract, multiply and divide positive and negative numbers. | For adding and subtracting, support with a number line.<br>For multiplying and dividing, give students the opportunity to discover the rules.<br>Use contexts. For example:<br>*London is $^{-}2$ degrees Celsius; Moscow is four times as cold. What is the temperature in Moscow?* |
| N8.1B | Use BIDMAS and calculate combinations of powers, roots and brackets. | Include mental methods, using priority of operations. For example:<br>$19^2 + 19 = 19 \times 19 + 19 = 19 \times 20 = 19 \times 10 \times 2 = 380$<br>Practise with calculators too. |
| N8.1C | Use index notation. | Include powers greater than 3.<br>Use the terms 'index', 'indices' and 'to the power of'. |
| N8.1D | Write a number as the product of its prime factors. | Use factor trees. |
| N8.1E | Find the highest common factor (HCF) and lowest common multiple (LCM). | Use prime-factor decomposition, or other methods. Use lists of prime factors; circle the relevant factors for finding the highest common factor or for finding the lowest common factor. |

### FRACTIONS AND DECIMALS

| Reference | Objective | Notes and guidance |
|---|---|---|
| N8.2A | Round numbers to two or three decimal places. | Use a number line or place-value table.<br>Relate to measures and money. |
| N8.2B | Multiply and divide any number by 0·1, 0·01 and 0·001. | Relate to dividing by 10, 100 or 1000. |
| N8.2C | Multiply decimals using a written method. | Use an estimate to determine the position of the decimal point. For example:<br>$2{\cdot}3 \times 6{\cdot}8$<br>Estimate: $2 \times 7 = 14$<br>$\begin{array}{r} 23 \\ \times\ 68 \\ \hline 184 \\ 1380 \\ \hline 1564 \end{array}$<br>$2{\cdot}3 \times 6{\cdot}8 = 15{\cdot}64$ |

| | | |
|---|---|---|
| N8.2D | Divide by decimals. | Use multiplying by powers of 10 to give integer calculations. For example:<br>$39{\cdot}9 \div 1{\cdot}9$ ($\times 10$ / $\times 10$)<br>$= 399 \div 19$<br>$19\overline{)399}$ = 21, 38, 19, 19, 0<br>$39{\cdot}9 \div 1{\cdot}9 = 21$ |
| N8.2E | Recognise recurring and terminating decimals. | For recurring decimals, use the term 'repeating digits' and recognise common shorthand notation for this. Recognise that terminating decimals can be written as a fraction. |
| N8.2F | Add and subtract fractions with any size of denominator. | Use the lowest common multiple of the denominators to find the lowest common denominator. |
| N8.2G | Multiply integers by a fraction and multiply fractions by a fraction. | Include positive and negative integers and fractions. |
| N8.2H | Convert fractions to decimals by dividing the numerator by the denominator. | For example:<br>*Write $\frac{5}{8}$ as a decimal:*<br>$8\overline{)5{\cdot}^{5}0^{2}0^{4}0} = 0{\cdot}6\,2\,5$<br>$\frac{5}{8} = 0{\cdot}625$ |
| N8.2I | Convert recurring decimals to a fraction using an algebraic method. | For example:<br>If $x = 0{\cdot}2999\ldots$, then $10x = 2{\cdot}9999\ldots$ and $100x = 29{\cdot}9999\ldots$, so $100x - 10x = 90x$ which = 27, so $x = \frac{27}{99} = \frac{3}{11}$. |
| N8.2J | Write the reciprocal of a number or a fraction. | Recognise that a number or a fraction multiplied by its reciprocal is always 1. |
| N8.2K | Divide integers by a fraction and divide fractions by a fraction. | Use fraction bars to illustrate divisions. For example:<br>$\frac{2}{3}$ = $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$ $\frac{1}{6}$<br>$\frac{2}{3} \div \frac{1}{6} = 4$<br>Recognise that dividing by a fraction is the same as multiplying by its reciprocal:<br>$\frac{2}{3} \div \frac{1}{6} = \frac{2}{3} \times \frac{6}{1} = \frac{12}{3} = 4$ |
| N8.2L | Use the four operations with mixed numbers. | Convert mixed numbers to improper fractions before calculating. |
| N8.2M | Solve problems involving decimals and fractions. | For example:<br>*Ali has three and a half times as much money as Sophie. Sophie has £4.52. Kamal has $\frac{3}{5}$ of the amount Ali and Sophie have in total. What is the difference between the amount of money Ali has and the amount of money Kamal has?*<br>Order and compare lengths, given as fractions (such as $\frac{3}{8}$m, $\frac{2}{5}$m and so on) by converting them to decimals or equivalent fractions. |

## PERCENTAGES

| Reference | Objective | Notes and guidance |
|---|---|---|
| N8.3A | Find equivalent fractions, decimals and percentages, including mixed numbers and percentages over 100%. | Include converting decimal numbers to percentages, and decimal percentages to decimals. For example:<br>0·567 as a percentage is 56·7%.<br>$1\frac{1}{2}$ as a percentage is 150%.<br>6·4% as a decimal is 0·064. |
| N8.3B | Calculate percentages of amounts. | Use an equivalent decimal multiplier.<br>Include both mental methods and using a calculator. |
| N8.3C | Use the equivalence of fractions, decimals and percentages to solve problems that involve comparing proportions. | For example:<br>*On Friday, an ice cream seller sells 205 ice creams in a day. 82 are vanilla. On Saturday, he reports that 45% of the ice creams he sells are vanilla. Which day was the biggest proportion of vanilla ice creams sold?* |
| N8.3D | Write a quantity as a percentage of another, where the quantities are measured in different units. | Convert so that the quantities are in the same unit, and then write as a fraction. |
| N8.3E | Work out a percentage increase or decrease. | Start by finding percentages and adding and subtracting. Move on to using a decimal multiplier. |
| N8.3F | Calculate the original amount after a percentage increase or decrease. | For example, using the unitary method:<br>*A tree is pruned to a height of 2·4 m. This is 80% of its original height. What was its original height?*<br>$80\% = 2{\cdot}4 \text{ m}$ (÷ 80 to 1%, × 100 to 100%)<br>$1\% = \frac{2{\cdot}4}{80} \text{ m}$<br>$100\% = \frac{2{\cdot}4 \times 100}{80} \text{ m}$<br>$= \frac{240}{80} \text{ m}$<br>$= 3 \text{ m}$ |
| N8.3G | Calculate simple interest. | Calculate simple interest in contexts such as savings. |
| N8.3H | Calculate compound interest. | For example:<br>*Saidur invests $4000 for 6 years at 2% per annum compound interest. Calculate the value of the investment at the end of 6 years.* |

## CALCULATION SKILLS

| Reference | Objective | Notes and guidance |
|---|---|---|
| N8.4A | Use estimates to check answers. | For example, estimate to check a result is the correct order of magnitude:<br>If calculating $2{\cdot}89 \times 7{\cdot}1$, estimate the answer first: $2{\cdot}89 \times 7{\cdot}1 \approx 3 \times 7 = 21$. |
| N8.4B | Work out calculations involving the four operations with integers, fractions and decimals, and also including powers, roots and brackets. | Include mental calculating, using the priority of operations. Also, include the use of calculators. Recognise how to input fractions into a calculator. |

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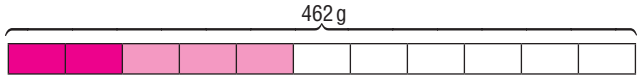
|---|---|---|
| N8.4C | Solve problems involving the four operations with integers, fractions, decimals, powers, roots and brackets. | For example:<br>*Cube A has volume 8000 cm³. Cube B has side length 2·5 cm less than Cube A. Work out the area of a square face of Cube B.* |

## RATIO AND PROPORTION

| Reference | Objective | Notes and guidance |
|---|---|---|
| N8.5A | Simplify and use ratios involving decimals. | Use multiplying by powers of 10 to give integer ratios, and then simplify. For example:<br>3·25 : 12 (×100) → 325 : 1200 (÷25) → 13 : 48<br>3·25 : 12 (×100) → 325 : 1200 (÷25) → 13 : 48 |
| N8.5B | Divide a quantity into three parts in a given ratio. | Use pictorial representations, such as a bar. For example:<br>*Share 462 g in the ratio 2 : 3 : 6:*<br>  <br>462 g ÷ 11 = 42 g<br>2 × 42 g = 84 g<br>3 × 42 g = 126 g<br>6 × 42 g = 252 g<br>Check: 84 g + 126 g + 252 g = 462 g |
| N8.5C | Write and compare unit ratios (1 : n or n : 1). | For example:<br>*Write 4 : 3 as a unit ratio in the form 1 : n:*<br>4 : 3 (÷4) → 1 : 0·75 (÷4) |
| N8.5D | Solve simple word problems using ratio and proportion. | For example:<br>*In an athletics competition, athletes swim 0·5 km, then cycle 10 km, and then run 3 km.*<br>*Write the ratio for swim : cycle : run in a simplified form, using integers.*<br>*What proportion of the competition is swimming?* |

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## ALGEBRA

### EXPRESSIONS AND FORMULAE

| Reference | Objective | Notes and guidance |
|---|---|---|
| A8.1A | Use index notation for algebraic powers. | Use indices of any size.<br>Use the terms 'squared', 'cubed', 'index', 'indices' and 'to the power of'. |
| A8.1B | Simplify simple algebraic expressions involving powers, using the index laws. | Include index laws for multiplication and division. For example:<br>$m \times m = m^2$<br>$t^3 = t \times t \times t$<br>$3b \times b = 3b^2$<br>$x^3 \times x^2 = x^5$<br>$y^7 \div y^3 = y^4$ |
| A8.1C | Expand and simplify expressions involving brackets by multiplying a negative number term, or terms involving letters and numbers, over a bracket. | For example:<br>$^-2(3 - x) = {}^-6 + x$<br>$4c(c + 2) = 4c^2 + 8c$<br>$5 - 2(d + 5) = 5 - 2d - 10$<br>$= {}^-5 - 2d$ |
| A8.1D | Factorise expressions. | Factorise expressions where the highest common factor is a number, a letter, or a number and letter term.<br>For example:<br>$2x + 4 = 2(x + 2)$<br>$2y^2 - y = y(2y - 1)$<br>$8z + 2z^2 = 2z(4 + z)$ |
| A8.1E | Substitute values into expressions and formulae involving powers or brackets. | For example, expressions:<br>$x^2$<br>$r^3$<br>For example, formulae:<br>$P = 2(l + w)$<br>$V = s^3$ |
| A8.1F | Solve problems involving formulae. | Solve problems involving writing and using formulae. |

### EQUATIONS

| Reference | Objective | Notes and guidance |
|---|---|---|
| A8.2A | Find pairs of numbers that satisfy a linear equation with two unknowns. | For example:<br>*Find pairs of solutions* $x, y,$ *for* $x + y = 7$. |

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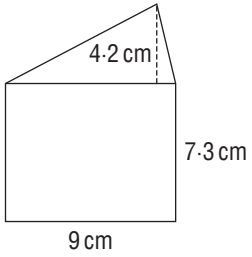
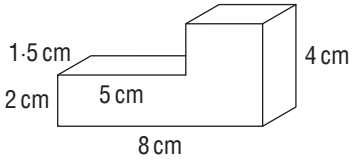
|---|---|---|
| A8.2B | Solve 1-step linear equations with integer coefficients, with one unknown, with the unknown on either side of the equation. | Use equations involving one of the four operations, with positive, negative or fraction solutions. For example:<br>$x + 3 = 9$<br>$\frac{-x}{2} = 4$<br>$3 = 15x$ |
| A8.2C | Solve 2-step linear equations (including those with one set of brackets) with integer coefficients, with one unknown, with the unknown on either side of the equation. | Use equations involving two of the four operations, with positive, negative or fraction solutions. For example:<br>$5x - 2 = 23$<br>$14 = \frac{x}{5} + 12$<br>$2(x + 3) = 12$, $^{-}3(x - 5) + 7 = 18$ |
| A8.2D | Solve problems by writing and solving linear equations. | For example:<br>Write and solve an equation to find:<br>• missing angles<br>• missing lengths, given a perimeter<br>• real-life problems, such as: *A father is three times the age of his son. Their ages total 52. What age is the father?* |

## GRAPHS

| Reference | Objective | Notes and guidance |
|---|---|---|
| A8.3A | Draw, use and interpret conversion graphs. | For example:<br>Convert between:<br>• currencies<br>• units of measure. |
| A8.3B | Draw, use and interpret distance–time graphs. | Describe a journey represented in a distance–time graph. Compare speeds by comparing the steepness of the line by eye (not by calculating gradient). |
| A8.3C | Draw and interpret line graphs for real-life contexts. | Plot graphs from tables of data from a range of sources, including science and finance.<br>Read values and describe trends. |
| A8.3D | Draw and interpret non-linear graphs for real-life contexts. | Plot graphs from tables of data from a range of sources, including science and finance.<br>Read values and describe trends. |
| A8.3E | Identify a directly proportional relationship from a graph. | Recognise that, when two quantities are in direct proportion, their graph is a straight line through the origin. |
| A8.3F | Work out the gradient of a linear graph. | Include positive, negative and zero gradients. |
| A8.3G | Write the equation of a straight-line graph in the form $y = mx + c$. | Find the gradient $m$ and $y$-intercept $c$, and write the equation of the line. |
| A8.3H | Solve problems by sketching, drawing and interpreting real-life graphs. | For example:<br>• distance–time graphs<br>• conversion graphs<br>• graphs arising from science<br>• graphs arising from other real-life contexts. |

## GEOMETRY AND MEASURE

### MEASURE

| Reference | Objective | Notes and guidance |
|---|---|---|
| G8.1A | Derive, know and use the formula for the area of a triangle. | Use triangles in a rectangle to derive the formula.<br>Use the formula $A = \frac{1}{2}bh$ where $A$ is the area, $b$ is the base length and $h$ is the perpendicular height, to calculate the areas of different triangles, in different orientations. |
| G8.1B | Calculate the area of compound shapes made from rectangles and triangles. | For example:<br>*Work out the area of this shape:*<br>  |
| G8.1C | Derive, know and use the formula for the area of a parallelogram. | Use triangles and a rectangle to derive the formula.<br>Use the formula $A = bh$ where $A$ is the area, $b$ is the base length and $h$ is the perpendicular height, to calculate the areas of different parallelograms, in different orientations. |
| G8.1D | Know and use the formula for the area of a trapezium. | Use the formula $A = \frac{1}{2}(a + b)\,h$ where $A$ is the area, $a$ and $b$ are the parallel sides and $h$ is the perpendicular height, to calculate the areas of different trapeziums, in different orientations. |
| G8.1E | Calculate the volume of cubes and cuboids and 3D solids made from cuboids. | For example:<br>*Work out the volume of this 3D solid:*<br>  |
| G8.1F | Sketch nets of 3D solids. | For example:<br>• cubes<br>• cuboids<br>• cylinders<br>• pyramids. |
| G8.1G | Draw and interpret 2D representations of 3D solids. | Use isometric paper.<br>Identify plan and elevation views. |

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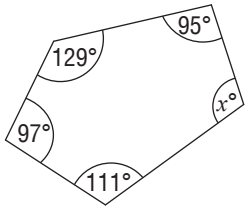
|---|---|---|
| G8.1H | Calculate the surface area of cubes and cuboids. | Use nets to introduce surface area. |
| G8.1I | Solve problems involving area, surface area and volume. | For example:<br>*A cuboid has length 2·8 cm and width 1·5 cm. Its volume is 21 $cm^3$. Work out its surface area.* |
| G8.1J | Convert between metric units of measure of area, volume and capacity. | Convert between $mm^2$ and $cm^2$, $cm^2$ and $m^2$, $m^2$ and hectares, $cm^3$ and litres. For example:<br>• *Write 3400 $cm^3$ in litres.*<br>• *How many hectares is 12 000 $m^2$?* |
| G8.1K | Solve problems in everyday contexts involving measures. | For example:<br>*A cake is cuboid in shape. It measures 25 cm long, 20 cm wide and 12 cm high.*<br>*It is covered with icing that is 5 mm thick. What volume of icing is required for the cake?* |

## ANGLES

| Reference | Objective | Notes and guidance |
|---|---|---|
| G8.2A | Identify and use properties of quadrilaterals, including their angles, sides, diagonals and symmetry. | For example:<br>• *all sides are equal*<br>• *opposite sides are parallel*<br>• *opposite angles are equal*<br>• *diagonals bisect each other at 90 degrees*<br>• *there are two lines of symmetry*<br>*What is the quadrilateral?* |
| G8.2B | Calculate the sum of the interior and exterior angles of an irregular or regular polygon. | Find the sum of interior angles of polygons with different numbers of sides. Relate the number of sides to multiples of 180.<br>Explore the sum of exterior angles of polygons to determine it is always 360 degrees. |
| G8.2C | Calculate the interior and exterior angles of an irregular or regular polygon. | Use knowledge of the sum of interior and exterior angles to calculate missing angles in polygons. |
| G8.2D | Solve geometric problems using side and angle properties of quadrilaterals and other polygons. | For example:<br>*Find angle $x$:*<br>  <br><br>Encourage the writing of a reason for an answer. For example:<br>*Angles in a pentagon sum to 540 degrees.* |

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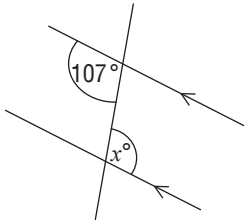
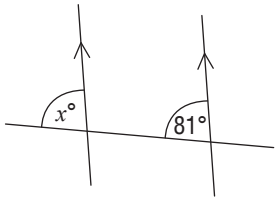
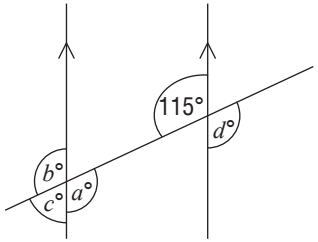
|---|---|---|
| G8.2E | Identify alternate angles and know that they are equal. | For example:<br>*Find angle $x$:*<br>  <br>Encourage the writing of a reason for an answer:<br>*Alternate angles are equal.* |
| G8.2F | Identify corresponding angles and know that they are equal. | For example:<br>*Find angle $x$:*<br>  <br>Encourage the writing of a reason for an answer:<br>*Corresponding angles are equal.* |
| G8.2G | Solve simple problems using properties of angles in parallel and intersecting lines and polygons, giving reasons. | For example:<br>*Find angles $a$, $b$, $c$ and $d$:*<br>  <br>Encourage the writing of a reason for an answer. |

## STATISTICS

### DATA

| Reference | Objective | Notes and guidance |
|---|---|---|
| S8.1A | Calculate the mean from a frequency table (ungrouped data). | Students can find the mean of a set of data in a range of real-life contexts. |
| S8.1B | Choose the most appropriate average to use. | Know that an average is a measure of the central value of a set of data. Use this to decide which of the mean, median or mode best represents a set of data. For example, the extreme value in a set of data will distort the mean; median may be more appropriate. |
| S8.1C | Compare two sets of data using statistics or the shape of the graph. | For example, compare two sets of data using range and an average, or compare two sets of data by comparing their graphs or charts, for example, line graphs for rainfall, or bar charts for species observed.<br>Use graphs from a range of contexts and other subjects, including science and finance. |
| S8.1D | Solve problems involving comparing data. | Use a range of contexts. For example:<br>• *Which sports person is best, based on performance data?*<br>• *Which holiday destination is best in December, based on temperature graphs?* |

### CHARTS AND DIAGRAMS

| Reference | Objective | Notes and guidance |
|---|---|---|
| S8.2A | Design, read and interpret tables for grouped data. | Use inequality notation for classes of continuous data. For example: $0 \leq t < 5$. |
| S8.2B | Design, read and interpret two-way tables. | Read information from two-way tables, calculate 'missing values' in two-way tables and design two-way tables to represent data. |
| S8.2C | Draw and interpret pie charts to represent data. | Calculate angles and draw accurate pie charts to represent data in grouped and ungrouped frequency tables. Use pie charts to identify the mode, or modal class. |
| S8.2D | Draw and interpret stem and leaf diagrams. | Include discrete and continuous data. Use stem and leaf diagrams to find the mode, median and range. |
| S8.2E | Draw and interpret scatter graphs (including correlation). | Describe correlation using the terms 'positive correlation', 'negative correlation', 'no correlation' and 'as ____ increases/decreases, ____ increases/decreases'.<br>Plot points on a scatter graph, choosing and using suitable scales for both axes. |
| S8.2F | Draw a line of best fit by eye on a scatter graph. | The line of best fit should follow the shape of the distribution. |
| S8.2G | Explain why a graph or chart is misleading. | Include the effect of changing the axis scales. |
| S8.2H | Solve problems by drawing or interpreting graphs, charts and tables. | Use two-way tables, pie charts, scatter graphs, stem and leaf diagrams and line graphs from a variety of subjects and real-life contexts, including science and finance. |

## PROBABILITY

| Reference | Objective | Notes and guidance |
|---|---|---|
| S8.3A | Record data from a simple probability experiment. | For example, throwing a number cube, or tossing a coin. |
| S8.3B | Estimate probability based on experimental or collected data. | Use the terms 'relative frequency' and 'experimental probability'; understand that the greater the number of trials, the more reliable the estimated probability, and that when you repeat an experiment you may get different results. |
| S8.3C | Use experimental probability to model and predict future outcomes. | Use experimental probability to predict the expected number of wins in a game, or the expected number of customers the next day. |
| S8.3D | Solve problems using experimental probability. | Carry out an experiment and draw conclusions based on the result of an experiment (for example, test a manufacturer's claim); estimate probabilities from experimental data in a range of contexts. |

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# YEAR 9

## NUMBERS AND THE NUMBER SYSTEM

### INTEGERS

| Reference | Objective | Notes and guidance |
|---|---|---|
| N9.1A | Round numbers to a given number of significant figures. | Understand when zero is significant, and why; understand when zero is not significant, and why. |
| N9.1B | Solve problems where answers are required to a specified number of significant figures. | For example:<br>*A steel beam is a cuboid 6·52 m long, 0·85 m wide, 0·85 m tall. What is the volume of the beam? Give the answer to two significant figures.* |
| N9.1C | Understand negative and 0 indices. | Explore patterns. For example:<br>$10^3 = 1000$<br>$10^2 = 100$<br>$10^1 = 10$<br>$10^0 = 1$<br>$10^{-1} = 0{\cdot}1$ |
| N9.1D | Use powers of 10 and their prefixes. | Include 'giga-', 'mega-', 'kilo-', 'deci-', 'centi-', 'milli-', 'micro-' and 'nano-'.<br>For example, 'mega-' means $10^6$ and is represented by the letter M, as in Mb for megabit. |
| N9.1E | Find upper and lower bounds for discrete data. | When rounding, identify the possible range of values for $x$. For example:<br>*John is 123 cm tall to the nearest cm. What is the shortest he could be? What is the tallest?* |

### PERCENTAGES

| Reference | Objective | Notes and guidance |
|---|---|---|
| N9.2A | Use inverse operations to work out the original amount after a percentage increase or decrease. | Use decimal multipliers and inverse operations. Know the term 'reverse percentages' when working back to find an original amount. |
| N9.2B | Calculate percentage change. | Use the formula:<br>$\text{percentage change} = \frac{\text{actual change}}{\text{original amount}} \times 100$ |
| N9.2C | Solve problems involving percentage increase, decrease and change. | Include finance examples. For example:<br>• *A computer is bought on a website for $720. It had been reduced by 20%. What was the original price?*<br>• *This computer is sold one year later for $540. What is the percentage loss in value?* |

## STANDARD FORM

| Reference | Objective | Notes and guidance |
|---|---|---|
| N9.3A | Write large and small numbers using standard form. | Include 10 to the power of positive or negative powers.<br>Include science contexts, such as distances between planets, or size of cells.<br>Note that standard form is sometimes called scientific notation. |
| N9.3B | Enter and read standard-form numbers on a calculator. | Recognise the exponent button on a calculator. Know how to interpret a standard-form answer on a calculator.<br>For example, an answer $2{\cdot}5 \times 10^8$ may be displayed as 2·5E8. |
| N9.3C | Order numbers written in standard form. | For example, order populations of different continents, or different molecules. |
| N9.3D | Add, subtract, multiply and divide numbers in standard form and be able to solve problems involving standard-form calculations. | For example:<br>*An electron microscope magnifies 1 000 000 times. The diameter of a molecule is 0·2 mm when viewed using the microscope. Work out the actual diameter of the molecule, giving the answer in metres in standard form.* |

## RATIO AND PROPORTION

| Reference | Objective | Notes and guidance |
|---|---|---|
| N9.4A | Calculate an unknown quantity from quantities that vary in direct proportion. | Use the notation of $y \propto x$ for $y$ varies directly as $x$.<br>Use real-life contexts taken from science, for example, an experiment that demonstrates Hooke's law: when a spring is stretched, its extension is directly proportional to the force applied to it. |
| N9.4B | Identify a proportional relationship between sets of data. | Include variables in tables or graphs.<br>For example, this data may be presented in a table or in a graph:<br>Distance \| Time<br>50 m \| 20 s<br>100 m \| 40 s<br>120 m \| 48 s<br>180 m \| 72 s<br>195 m \| 78 s<br>*Is the distance travelled by this object directly proportional to the time taken? How do you know?* |
| N9.4C | Solve word problems using ratio and/or proportion. | For example:<br>*What is the ratio of your foot length to your height? Is foot length in direct proportion to height?* |

## ALGEBRA

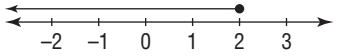
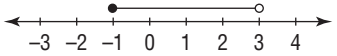
### EXPRESSIONS AND FORMULAE

| Reference | Objective | Notes and guidance |
|---|---|---|
| A9.1A | Substitute values into expressions and formulae involving powers, roots and brackets. | For example, substitute positive and negative integers into:<br>$x + (3y + z)^2$<br>$\sqrt{ab + c}$<br>$\frac{(2m + n)}{(n - m)}$ |
| A9.1B | Write expressions and formulae involving more than one variable. | Include expressions and formulae to represent real-life situations. For example:<br>• production of some goods (cost of raw materials needed plus cost of packaging)<br>• pay (commission for sales people plus piece-rate labour costs). |
| A9.1C | Substitute values into a formula and find the value of a variable that is not the subject. | Use formulae from mathematics, science and other contexts. For example:<br>$F = ma$ |
| A9.1D | Change the subject of a simple formula, involving any of the four operations, powers or roots. | For example:<br>$a = bc$<br>$a = \frac{b}{c}$<br>$a = 2b + c$<br>$a = 4b^2$ |
| A9.1E | Expand and factorise expressions involving powers. | For example:<br>• Expand $x(x^2 + 3x + 4)$<br>• Factorise $10y^4 - 2y^2$ |
| A9.1F | Use index notation and index laws for positive and negative integer powers, including zero. | For example, simplify:<br>$x^0$<br>$\frac{36x^3}{4x^5}$ |
| A9.1G | Expand the product of two linear expressions (where both expressions have $x$ coefficient 1). | For example:<br>$(x + 1)(x - 2)$<br>$(x - 3)^2$ |
| A9.1H | Factorise quadratic expressions of the form $x^2 + bx + c$ (where the squared term has coefficient 1). | For example:<br>$x^2 + 3x - 4$<br>$x^2 - a^2$ (complete the square) |
| A9.1I | Distinguish between expressions, identities and equations. | Recognise and use the correct vocabulary for each. |
| A9.1J | Solve problems involving formulae and expressions. | Include writing and using formulae and expressions that represent real-life problems. |
| A9.1K | Recognise and factorise the difference of two squares. | Recognise expressions that will factorise, such as $x^2 - 1 = (x + 1)(x - 1)$, and carry this out. Recognise expressions that will not factorise, such as $x^2 - 3$. |

## EQUATIONS

| Reference | Objective | Notes and guidance |
|---|---|---|
| A9.2A | Construct and solve equations with the unknown on both sides. | For example, solve:<br>$8x + 6 = 6x$<br>$4x - 3 = 2x + 7$ |
| A9.2B | Construct and solve equations with the unknown on both sides and including brackets and fractions. | For example, solve:<br>$3(2t + 1) = 4t + 7$<br>$\frac{(5x-3)}{4} = 2x + 6$ |
| A9.2C | Solve equations involving an $x^2$ term and a number. | For example, solve:<br>$x^2 + 7 = 23$ |
| A9.2D | Solve quadratic equations of the form $x^2 + bx + c = 0$, by factorising (where the squared term has coefficient 1). | For example, solve:<br>$x^2 - 6x + 8 = 0$ |
| A9.2E | Write equations to represent direct proportion. | Recognise and use the terms '$y$ varies directly as $x$' and '$y$ is (directly) proportional to $x$'.<br>Write the proportionality statement '$y \propto x$' and hence the equation in the form '$y = kx$' by substituting given values to find $k$. |
| A9.2F | Solve a pair of simultaneous linear equations. | For example, solve:<br>$x + y = 5$ and $x - y = 1$<br>$2x - y = 2$ and $x + y = 7$<br>Include where one or both need to be multiplied first. For example, solve:<br>$2x + 3y = -4$ and $4x - y = 6$ |
| A9.2G | Solve problems involving simultaneous linear equations or direct proportion. | Use a range of contexts, for example, from science and real life. |

## INEQUALITIES

| Reference | Objective | Notes and guidance |
|---|---|---|
| A9.3A | Solve linear inequalities in one unknown. | Solve 1- and 2-step linear inequalities. For example:<br>$x + 3 > 12$<br>$\frac{x}{2} < 5$<br>$4(x + 1) \geq 7$<br>$3 \leq 2x + 5 < 6$ |
| A9.3B | Understand and use symbols relating to inequality. | Correctly use $<$, $>$, $\leq$, $\geq$ and $=$. |
| A9.3C | Represent solutions to linear inequalities on a number line. | For example:<br>$x \leq 2$<br>  <br><br>$-1 \leq x < 3$<br>  <br> |

## SEQUENCES

| Reference | Objective | Notes and guidance |
|---|---|---|
| A9.4A | Use the $n$th term to generate a linear or quadratic sequence. | Include $n$th term linear ($an$, $an + b$) or quadratic $an^2$. |
| A9.4B | Find the $n$th term of an arithmetic sequence. | Include $n$th terms of the form $an$, $an + b$. |
| A9.4C | Recognise and continue more complex geometric sequences. | Continue geometric sequences involving fractions, decimals and indices. |
| A9.4D | Solve problems involving sequences. | Write and use number sequences to model real-life problems, including pattern sequences, in a range of contexts. |

## GRAPHS

| Reference | Objective | Notes and guidance |
|---|---|---|
| A9.5A | Recognise, draw and interpret graphs showing constant rates of change. | Recognise that constant gradient represents constant rate of change, for graphs in real-life or science contexts. Plot graphs from tables of values for real-life or science contexts, and use the graphs to compare rates of change. |
| A9.5B | Recognise that equations of the form $y = mx + c$ are straight-line graphs, and state their gradient ($m$) and intercept (0, $c$). | Given the equation of a line, state its gradient and $y$-intercept. |
| A9.5C | Compare linear graphs using their equations, including parallel graphs. | Compare intercepts and gradients of two straight lines from their equations. Know the gradient of a line parallel to $y = mx + c$. |
| A9.5D | Draw graphs with equations of the form $y = mx + c$ and $ax + by = c$. | Draw graphs with or without a table of values. |
| A9.5E | Solve a pair of linear simultaneous equations by drawing graphs. | Draw graphs of two simultaneous equations of the form $ax + by = c$, and interpret their intersection as the solutions of the equations. |
| A9.5F | Draw graphs of quadratic functions. | Draw graphs for functions of the form $y = ax^2$, $y = ax^2 + b$ ($a$ and $b$ positive or negative). |
| A9.5G | Solve problems by sketching, drawing and interpreting real-life linear and quadratic graphs. | Read values and compare rates of change. For example:<br>• Calculate average speed from a linear distance–time graph.<br>• Draw graphs to solve linear simultaneous equations in real-life contexts.<br>• Draw and interpret graphs showing projectile motion and quadratic relationships from science. |

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## GEOMETRY AND MEASURE

### MEASURE

| Reference | Objective | Notes and guidance |
|---|---|---|
| G9.1A | Use and interpret scales on maps and diagrams. | Include interpreting scales written in words (for example, '1 cm represents 20 m') and ratios (for example, '1 : 10 000'). Draw a simple scale diagram given a scale and some information. |
| G9.1B | Describe, use and interpret 3-figure bearings. | Be able to describe bearings, and measure and calculate angles to find a bearing. Draw bearings. For example: *The crosses show the positions of two boats, A and B:*   *What is the bearing of boat B from boat A?* |
| G9.1C | Solve problems involving 3-figure bearings and/or scale drawings. | For example: *Town X is 130 km from town Y. Town X is on a bearing of 087 degrees from town Y. Draw a scale diagram showing the positions of towns X and Y. Use a scale of 1 cm represents 20 km.* |
| G9.1D | Use appropriate apparatus (including compasses) to identify and draw the diameter and radius of a circle; identify the circumference, arc and sector of a circle. | Use compasses to draw circles and label the parts. |
| G9.1E | Calculate the circumference of a circle. | Include numerical answers and answers given in terms of pi. |
| G9.1F | Calculate the area of a circle. | Include numerical answers and answers given in terms of pi. |
| G9.1G | Identify a right prism. | Include naming a triangular prism. |
| G9.1H | Calculate the volume and surface area of a right prism and a cylinder. | Use knowledge of finding areas of different 2D shapes. |
| G9.1I | Solve problems involving circles or prisms. | For example:<br>• *A cardboard tube is made by taking a piece of card, rolling it, and then using an overlap of 0·5 cm to glue it together. The tube has a diameter of 8 cm, and a length that is 2·4 times its diameter. What was the size of the piece of card used to make the tube? Give its length and width. Give your answers to one decimal place.*<br>• *A triangular prism has volume 3750 $cm^3$. Its triangular face has area 150 $cm^2$. What length is the triangular prism?* |
| G9.1J | Solve problems using compound measures and rates. | Include speed, density and pressure. Convert between compound measures. For example:<br>• *An Olympic athlete runs at 9 m/s. What is his speed in km/h?*<br>• *A piece of aluminium has mass 40·5 g and volume 15 $cm^3$. What is its density?* |

## TRANSFORMATIONS

| Reference | Objective | Notes and guidance |
|---|---|---|
| G9.2A | Work out the scale factor of an enlargement. | Include fractional scale factors. |
| G9.2B | Enlarge shapes using positive, negative and fractional scale factors, about a centre of enlargement. | Use squared paper and a centre of enlargement. |
| G9.2C | Describe an enlargement on a coordinate grid. | Give the scale factor and the coordinates of the centre of enlargement. |
| G9.2D | Understand and use column vectors in translations. | Use column vectors to translate shapes on a coordinate grid.<br>Write the column vector that describes a translation from object to image. |

## CONSTRUCTIONS

| Reference | Objective | Notes and guidance |
|---|---|---|
| G9.3A | Construct perpendicular bisectors and angle bisectors. | Use a ruler and compasses. |
| G9.3B | Construct accurate circles, triangles and quadrilaterals using compasses, ruler and protractor. | For example:<br>*Construct the accurate net for a pyramid.* |

## CONGRUENCE AND SIMILARITY

| Reference | Objective | Notes and guidance |
|---|---|---|
| G9.4A | Use congruent shapes to solve problems about triangles and quadrilaterals. | Recognise that two triangles are congruent if one of these conditions applies:<br>• all three sides are the same length<br>• two sides and the included angle are the same<br>• two angles and one side are the same<br>• in a right-angled triangle, the side opposite the right angle and one other side are the same.<br>Encourage the writing of a reason for an answer. For example:<br>• SSS (side, side, side)<br>• ASA (angle, side, angle). |
| G9.4B | Identify two shapes that are mathematically similar. | Recognise that corresponding sides are in the same ratio and corresponding angles are equal. |
| G9.4C | Solve problems involving similar triangles. | Work out missing lengths in similar triangles. |

## PYTHAGORAS' THEOREM AND TRIGONOMETRY

| Reference | Objective | Notes and guidance |
|---|---|---|
| G9.5A | Identify and name the hypotenuse of a right-angled triangle. | |
| G9.5B | Know and use Pythagoras' theorem. | Find the length of the hypotenuse or a side, given two other sides. |
| G9.5C | Know, understand and use sine, cosine and tangent of acute angles to calculate lengths in a right-angled triangle. | Ensure understanding of the use of a calculator for sine, cosine and tangent. |
| G9.5D | Solve problems involving right-angled triangles. | For example:<br>• *Find the length of a ladder, given the distance the foot of the ladder rests away from a wall, and the height the top of the ladder rests up the wall.*<br>• *Find the angle a ladder rests against a wall, given the length of the ladder, and the distance the foot of the ladder rests away from the bottom of the wall.* |
| G9.5E | Use trigonometry to calculate lengths and angles in a right-angled triangle. | Find a missing side given the length of another side and an angle.<br>Find a missing angle given the length of two sides. |

## STATISTICS

### DATA

| Reference | Objective | Notes and guidance |
|---|---|---|
| S9.1A | Identify sources of primary and secondary data. | Use the terms 'primary' and 'secondary' data. |
| S9.1B | Choose a suitable sample size and what data to collect. | Use the terms 'hypothesis' and 'sample'. Know that too small a sample can be a cause of bias. Give a hypothesis, and decide what data to collect and from where. |
| S9.1C | Identify factors that might affect data collection and plan to reduce bias. | Use the terms 'bias' and 'random sample'. Know that for a random sample each data item must have an equal probability of being chosen. |
| S9.1D | Analyse and write questions for a questionnaire. | Identify bias in questionnaire questions. Use the terms 'leading question' and 'bias'.<br>Write clear questions, with tick boxes for responses as appropriate, avoiding bias. |
| S9.1E | Design and use data collection sheets and tables. | Include two-way tables. |
| S9.1F | Estimate the range from a grouped frequency table. | |
| S9.1G | Calculate an estimate of the mean from a grouped frequency table. | |
| S9.1H | Identify and suggest reasons for outliers in data. | Identify outliers 'by eye', as values that do not fit the pattern or trend of the data. Use a variety of contexts, including science and finance. Suggest possible reasons for outliers, for example, 'measuring errors'. |
| S9.1I | Solve problems by collecting and analysing data. | Collect data or analyse given data to test a hypothesis. Calculate appropriate averages, represent data in appropriate charts and diagrams, write conclusions and identify further lines of enquiry. |
| S9.1J | Know and use correct set language and notation. | Correctly use set notation to list numbers, objects or outcomes. |

### CHARTS AND DIAGRAMS

| Reference | Objective | Notes and guidance |
|---|---|---|
| S9.2A | Draw and use a line of best fit on a scatter graph, to predict data values. | For example, for a scatter graph showing the mass and length of snakes, use the line of best fit to predict the mass of a snake 2 m long. |
| S9.2B | Draw and interpret frequency polygons. | Compare two sets of data from their frequency polygons. |
| S9.2C | Solve problems by drawing or interpreting graphs, charts and tables. | Use scatter graphs and frequency polygons from a variety of subjects and real-life contexts, including science and finance. |

## PROBABILITY

| Reference | Objective | Notes and guidance |
|---|---|---|
| S9.3A | Present the possible outcomes of single events, or two successive events (including in lists, tables, Venn diagrams and sample space diagrams). | Use correct notation and language to communicate the possible outcomes of events. |
| S9.3B | Calculate probabilities from possible outcomes presented in different ways. | Work with tables, two-way tables, Venn diagrams and sample space diagrams. |
| S9.3C | Identify mutually exclusive events. | Decide whether events are mutually exclusive. For example, on a number cube:<br>• rolling a three and rolling an even number<br>• rolling a three and rolling a prime number. |
| S9.3D | Compare probabilities. | Use the term 'Which is more likely?' |
| S9.3E | Compare experimental and theoretical probabilities. | Decide if a game, number cube, or coin is fair or biased, based on experimental and theoretical probabilities. |
| S9.3F | Calculate the probability of two independent events. | Use P(A and B) = P(A) × P(B). |
| S9.3G | Use tree diagrams to calculate the probability of independent events. | Do not include conditional probability. |
| S9.3H | Solve problems involving probability. | For example:<br>• *What is the probability that two socks picked at random from a pile are a pair?*<br>• *What is the most likely score from a pair of spinners?* |