Lewisham

Key Stage 3 Medium-term plans

Year 9: Core (Pupils that have achieved levels 5c – 5a) Spring term

Teaching objectives for the oral and mental activities

• Order, add, subtract, multiply and divide integers. • Find products of small integer powers. • Know and use squares, cubes, roots and index notation. • Know or derive quickly the prime factorisation of numbers to 30 and factor pairs for a given number. • Find highest common factors (HCF) and lowest common multiples (LCM), e.g. the HCF of 36 and 48. • Convert between improper fractions and mixed numbers. Simplify fractions by cancelling. • Find the outcome of a given percentage increase or decrease. • Know or derive complements of 0.1, 1, 10, 50, 100, 1000. • Use jottings to support addition, subtraction, multiplication and division. • Recall multiplication and division facts to 10 × 10. Derive products and quotients of multiples of 10, 100, 1000. • Use known facts to derive unknown facts, e.g. derive 36 × 24 from 36 × 25. • Use knowledge of place value to multiply and divide decimals by multiples of 0.1 and 0.01, e.g. 0.24 × 0.4, 720 ÷ 0.03.	• Use approximations to estimate the answers to calculations, e.g. 39 × 2.8. • Solve equations, e.g. $n(n - 1) = 56$, $\square + \square = {}^{-}46$, $(3 + x)^2 = 25$. • Visualise, describe and sketch 2-D shapes, 3-D shapes and simple loci. • Estimate bearings. • Use metric units (length, area and volume) and units of time for calculations. • Use metric units for estimation (length, area and volume). • Convert between metric units, including area, volume and capacity measures. • Recall and use formulae for areas of rectangle, triangle, parallelogram, trapezium and circle. • Calculate volumes of cuboids and prisms. • Discuss and interpret graphs. • Solve simple problems involving probabilities. • Apply mental skills to solve simple problems.

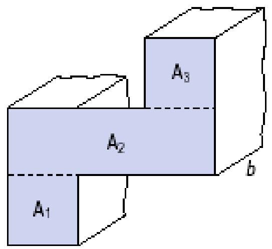
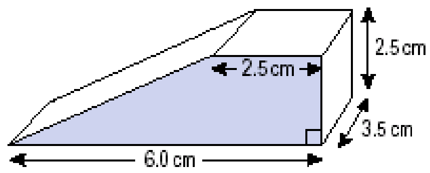
Shape, space and measures 2 (2 weeks)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
Measures and mensuration (pages 228–231, 234–241) • Use units of measurement to calculate, estimate, measure and solve problems in a variety of contexts; convert between area measures (mm2 to cm2, cm2 to m2, and vice versa) and between volume measures (mm3 to cm3, cm3 to m3, and vice versa).	**Convert between metric units, including area, volume and capacity measures.** For example: • Change 45 000 square centimetres (cm^2) into square metres (m^2). • Change 150 000 square metres (m^2) into hectares; • Change 5.5 cubic centimetres (cm^3) into cubic millimetres (mm^3); • Change 3.5 litres into cubic centimetres (cm^3). Solve problems involving length, area, volume, capacity, mass, time, speed, angle and bearings, rounding measurements to an appropriate degree of accuracy. • Mr Green sells apples at 40p per kilogram. Mrs Ball sells apples at 24p per pound. Who sells the cheaper apples? Explain how you worked it out. • A plank of wood weighed 1.4 kg. 25 centimetres of the plank were cut off its length. The plank then weighed 0.8 kg. What was the length of the original plank?	SCIENCE GEOGRAPHY

Shape, space and measures 2 (continued)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
• **Know and use the formulae for the circumference and area of a circle.**	**Calculate the circumference of circles** *and arcs of circles.* For example: • A circle has a circumference of 120 cm. What is the radius of the circle? • The diameter of King Arthur's Round Table is 5.5 m. A book claims that 50 people sat round the table. Assume each person needs 45 cm round the circumference of the table. Is it possible for 50 people to sit around it? • The large wheel on Wyn's wheelchair has a diameter of 60 cm. Wyn pushes the wheel round exactly once. Calculate how far Wyn has moved. The large wheel on Jay's wheelchair has a diameter of 52 cm. Jay moves her wheelchair forward 950 cm. How many times does the large wheel go round? • A Ferris wheel has a diameter of 40 metres. How far do you travel in one revolution of the wheel? • A touring cycle has wheels of diameter 70 cm. How many rotations does each wheel make for every 10 km travelled?	

Shape, space and measures 2 (continued)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
• (Know and use the formula for the volume of a cuboid; calculate volumes and surface areas of cuboids and shapes made from cuboids.) • **Calculate the surface area and volume of right prisms.**	Know that a prism is a polyhedron of uniform cross-section throughout its length. A cuboid is a common example. Use knowledge of prisms made up of cuboids to write an expression for the total volume of such a prism. For example: • A prism has cross-section areas A_1, A_2, A_3, …, all of length b.  $V = A_1b + A_2b + A_3b + \ldots$ $= (A_1 + A_2 + A_3 + \ldots)b$ $=$ total area of cross-section × length This door wedge is in the shape of a prism.  The shaded face is a trapezium. Calculate its area. Calculate the volume of the door wedge.	

Number 2 (3 weeks)

<table>
<tr><th>Learning objectives – what should the pupils be able to do?</th><th>Outcomes – what will success look like?</th><th>Resources</th></tr>
<tr><td>

Place value (36–47) and Fractions, decimals, percentages, ratio and proportion (60–65)

- Extend knowledge of integer powers of 10; multiply and divide by any integer power of 10.
- Use rounding to make estimates; round numbers to the nearest whole number or to one or two decimal places.
- Know that a recurring decimal is an exact fraction.

</td><td>

Know that:

$10^0 = 1$ $10^{-1} = 1/10^1 = \frac{1}{10}$
$10^1 = 10$ $10^{-2} = 1/10^2 = \frac{1}{100}$

Know the prefixes associated with powers of 10. Relate to commonly used units. For example:

10^9 giga 10^{-2} centi
10^6 mega 10^{-3} milli
10^3 kilo 10^{-6} micro
10^{-9} nano
10^{-12} pico

- The population of the world is about 5300 million.

  The approximate populations of the four largest cities are:

  Mexico City 21.5 million
  Sao Paulo 19.9 million
  Tokyo 19.5 million
  New York 15.7 million

  The tenth largest city is Rio de Janeiro with a population of 11.9 million.

  Estimate the percentage of the world's population which lives in the ten largest cities.

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</table>

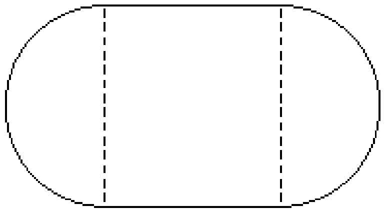
Number 2 (continued)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
Calculations (104–107, 110–111) • Add and subtract integers and decimals of any size, including a mixture of large and small numbers with differing numbers of decimal places; multiply and divide by decimals, dividing by transforming to division by an integer. • Check results using appropriate methods.	Use a standard column procedure for addition and subtraction of numbers of any size, including a mixture of large and small numbers with differing numbers of decimal places. For example: • 6543 + 590.005 + 0.0045 • 5678.98 – 45.7 – 0.6 Use a standard column procedure for multiplications equivalent to three digits by two digits. Understand where to put the decimal point for the answer. Consider the approximate size of the answer in order to check the magnitude of the result. For example: • $64.2 \times 0.43 \approx 60 \times 0.5 = 30$, and is equivalent to $642 \times 43 \div 1000$. Use a standard procedure for divisions involving decimals by transforming to an equivalent calculation with a non-decimal divisor. Consider the approximate size of the answer in order to check the magnitude of the result. For example: • $361.6 \div 0.8$ is equivalent to $3616 \div 8$. • $547.4 \div 0.07$ is equivalent to $54\,740 \div 7$. • $0.048 \div 0.0035$ is equivalent to $480 \div 35$. • $0.593 \div 6.3$ is equivalent to $5.93 \div 63$.	

Number 2 (continued)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
Calculator methods (108–109) • **Use a calculator efficiently and appropriately to perform complex calculations with numbers of any size, knowing not to round during intermediate steps of a calculation; use the constant, π and sign change keys, function keys for powers, roots and fractions, brackets and the memory.** • **Enter numbers into a calculator and interpret the display in context (negative numbers, fractions, decimals, percentages, money, metric measures, time).**	Know how to: • Use the constant, π, sign change, power (x^y), root and fraction keys to evaluate expressions. • *Use the reciprocal key ($^1/_x$).* For example: • Add on 101 repeatedly using the constant key. How long is the digit pattern maintained? Explain why. • Find the circumference of a circle with radius 8 cm to two decimal places. • Calculate 6^7, $\sqrt[4]{625}$, $\sqrt{(57.6/\pi)}$, $\sqrt{(15.5^2 - 3.7^2)}$. • Use a calculator to work out the answer as a fraction for $^{12}/_{19} + {^{17}/_{22}}$. Use a **calculator** to evaluate more complex expressions such as those with nested brackets or where the memory function could be used. For example: • Use a calculator to work out: a. $\dfrac{45.65 \times 76.8}{1.05 \times (6.4 - 3.8)}$ c. $\{(4.5)^2 + (7.5 - 0.46)\}^2$ b. $4.6 + (5.7 - (11.6 \times 9.1))$ d. $\dfrac{5 \times \sqrt{(4.5^2 + 6^2)}}{3}$	MONEY FINANCE BUSINESS STUDIES

Number 2 (continued)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
Solving problems (28–29) • **Solve substantial problems by breaking them into simpler tasks, using a range of efficient techniques, methods and resources, including ICT; use trial and improvement where a more efficient method is not obvious.**	• Running track Design a running track to meet these constraints: – The inside perimeter of the track has this shape.  – Both straights must be at least 80 metres. – Both ends must be identical semicircles. – The total inside perimeter must be 400 m. What is the greatest area the running track can enclose? What if the track has to be 8 metres wide? What is the smallest rectangular field needed to contain it?	PHYSICAL EDUCATION

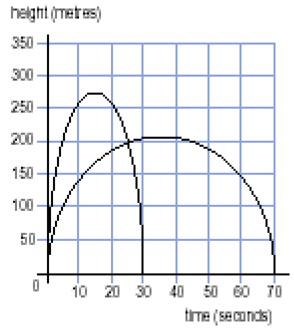
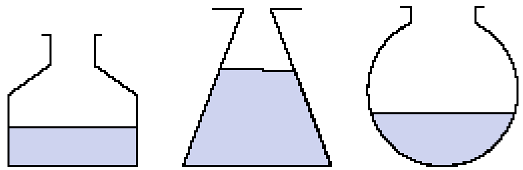
Algebra 4 (3 weeks)

<table>
<tr><th>Learning objectives – what should the pupils be able to do?</th><th>Outcomes – what will success look like?</th><th>Resources</th></tr>
<tr><td>Integers, powers and roots (52–59)
Use the prime factor decomposition of a number.
Use ICT to estimate square roots and cube roots.
Use index notation for integer powers and simple instances of the index laws.</td><td>Use prime factor decomposition to find the lowest common multiple of denominators of fractions in order to add or subtract them efficiently.
For example:
$\frac{31}{56} + \frac{29}{70} = \frac{155 + 116}{280}$
because $56 = 2^3 \times 7$ and $70 = 2 \times 5 \times 7$ so
LCM = $2^3 \times 5 \times 7 = 280$.
$\frac{17}{28} - \frac{12}{38} = \frac{323 - 168}{532}$
because $28 = 2^2 \times 7$ and $38 = 2 \times 19$ so
LCM = $2^2 \times 7 \times 19 = 532$.
Use ICT to estimate square roots or cube roots to the required number of decimal places. For example:
Estimate the solution of $x^2 = 70$.

The positive value of x lies between 8 and 9, since
$8^2 = 64$ and $9^2 = 81$.
Try numbers from 8.1 to 8.9 to find a first approximation lying between 8.3 and 8.4.
Next try numbers from 8.30 to 8.40.
Square roots and cube roots

Know that:
$\sqrt{a} + \sqrt{b} \neq \sqrt{(a + b)}$</td><td></td></tr>
</table>

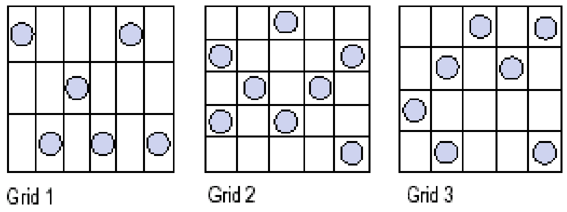
Algebra 4 (continued)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
Sequences, functions and graphs **(164–177)** • **Given values for *m* and *c*, find the gradient of lines given by equations of the form *y* = *mx* + *c*.** • **Construct functions arising from real-life problems and plot their corresponding graphs; interpret graphs arising from real situations,** including distance–time graphs.	• This graph shows how high two rockets went during a flight. Rocket A reached a greater height than rocket B.  Estimate how much higher rocket A reached than rocket B. Estimate the time after the start when the two rockets were at the same height. Estimate the number of seconds that rocket A was more than 200 m above the ground. • Sketch a graph of the depth of water against time when water drips steadily from a tap into these bottles.  Sketch graphs for other shapes of bottle. Predict the bottle shape from the shape of a graph. • Sketch a graph of the number of hours of daylight at different times of the year.	SCIENCE GEOGRAPHY

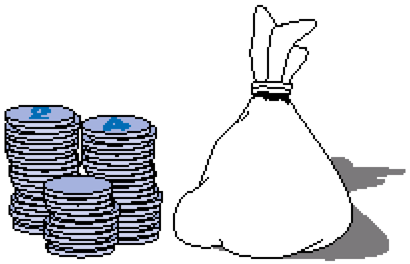
Algebra 4 (continued)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
Solving problems (26–27) • **Represent problems and synthesise information in algebraic, geometric or graphical form; move from one form to another to gain a different perspective on the problem.**	• Five coins A game involves tossing five coins for a 10p stake. If you score exactly two heads you win 20p and get your stake back; otherwise you lose. Give mathematical reasons to justify whether this is a sensible game to play. Related objectives: Present a proof, making use of symbols, diagrams and graphs and related explanatory text; *justify generalisations and choice of presentation, explaining selected features.*	

Handling data 2 (1.5 weeks)

Learning objectives – what should the pupils be able to do?	**Outcomes – what will success look like?**	**Resources**
Probability **(276–283)** Use the vocabulary of probability in interpreting results involving uncertainty and prediction. Identify all the mutually exclusive outcomes of an experiment; **know that the sum of probabilities of all mutually exclusive outcomes is 1 and use this when solving problems.**	In a computer 'minefield' game, 'mines' are hidden on grids. When you land randomly on a square with a mine, you are out of the game. a. The circles indicate where the mines are hidden on three different grids.  On which of the three grids is it hardest to survive? b. On which of these grids is it hardest to survive? X. 10 mines on an 8 by 8 grid Y. 40 mines on a 16 by 16 grid Z. 99 mines on a 30 by 16 grid Explain your reasoning.	

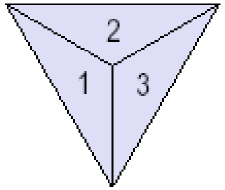
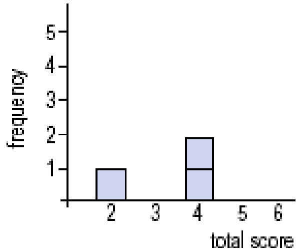
Handling data 2 (continued)

<table>
<tr><th>Learning objectives – what should the pupils be able to do?</th><th>Outcomes – what will success look like?</th><th>Resources</th></tr>
<tr><td>Identify all the mutually exclusive outcomes of an experiment; know that the sum of probabilities of all mutually exclusive outcomes is 1 and use this when solving problems.</td><td>A number of discs are placed in a bag.

Most are marked with a number 1, 2, 3, 4 or 5.
The rest are unmarked.
The probabilities of drawing out a disc marked with a particular number are:

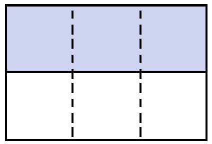
p(1) = 0.15
p(2) = 0.1
p(3) = 0.05
p(4) = 0.35
p(5) = 0.2

What is the probability of drawing a disc:
a. marked 1, 2 or 3?
b. not marked with a number?</td><td></td></tr>
</table>

Handling data 2 (continued)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
• Estimate probabilities from experimental data.	• Use an equilateral triangular spinner with three equal sections labelled 1, 2 and 3. Spin it twice. Add the two scores. Repeat this 40 times.  As the experiment progresses, record results in a frequency diagram.  Using the results: a. Which total is most likely? b. What is the estimated probability of a total of 5? How could you make a more accurate estimate? c. If the experiment were repeated 2000 times, how many times would you expect to get a total of 3? Justify your answers. What happens if the numbers on the spinner are changed, e.g. to 1, 2, 2 or 3, 2, 2 or 1, 1, 3 or 2, 2, 2?	

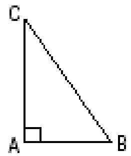
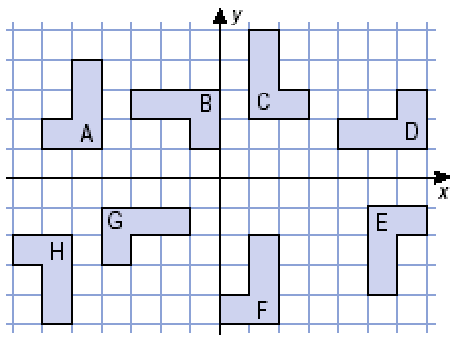
Handling data 2 (continued)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
Fractions (66–69) • Use efficient methods to **add, subtract, multiply and divide fractions**, interpreting division as a multiplicative inverse; cancel common factors before multiplying or dividing.	• In a survey of 24 pupils, $\frac{1}{3}$ liked football best, $\frac{1}{4}$ liked basketball, $\frac{3}{8}$ liked athletics. The rest liked swimming. How many liked swimming? • Brian used $\frac{1}{3}$ of a 750 g bag of flour to make scones. Claire used $\frac{2}{5}$ of the flour that remained to make a cake. How many grams of flour were left in the bag? • In a bag of 20 coloured beads, $\frac{2}{5}$ are red, $\frac{1}{4}$ are blue, $\frac{1}{10}$ are yellow and 3 are green. The rest are black. What fraction are black? Use the inverse rule to divide fractions, first converting mixed numbers to improper fractions. For example: • Look at one half of a shape.  How many sixths of the shape can you see? (Six.) So, how many sixths in one half? (Three.) So $\frac{1}{2} \div \frac{1}{6} = \frac{1}{2} \times \frac{6}{1} = \frac{6}{2} = 3$ • $\frac{2}{3} \div \frac{4}{7} = \frac{2}{3} \times \frac{7}{4} = \frac{14}{12}$ or $\frac{7}{6}$ • $2\frac{1}{3} \div \frac{4}{5} = \frac{7}{3} \times \frac{5}{4} = \frac{35}{12}$ or $2\frac{11}{12}$	

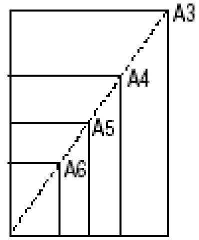
Shape, space and measures 3 (2 weeks)

<table>
<tr><th>Learning objectives – what should the pupils be able to do?</th><th>Outcomes – what will success look like?</th><th>Resources</th></tr>
<tr><td>Geometrical reasoning: lines, angles and shapes (178–179, 190–191)
Distinguish between conventions, definitions and derived properties.
Understand congruence.</td><td>A convention is an agreed way of illustrating, notating or describing a situation. Conventions are arbitrary – alternatives could have been chosen. Examples of geometrical conventions are:
the ways in which letters are used to label the angles and sides of a polygon;
the use of arrows to show parallel lines;
the agreement that anticlockwise is taken as the positive direction of rotation.
A definition is a minimum set of conditions needed to specify a geometrical term, such as the name of a shape or a transformation. Examples are:
A polygon is a closed shape with straight sides.
A square is a quadrilateral with all sides and all angles equal.
A degree is a unit for measuring angles, in which one complete rotation is divided into 360 degrees.
A reflection in 2-D is a transformation in which points (P) are mapped to images (P′), such that PP′ is at right angles to a fixed line (called the mirror line, or line of reflection), and P and P′ are equidistant from the line.
A derived property is not essential to a definition, but consequent upon it. Examples are:
The angles of a triangle add up to 180°.
A square has diagonals that are equal in length and that bisect each other at right angles.
The opposite sides of a parallelogram are equal in length.
Points on a mirror line reflect on to themselves.</td><td></td></tr>
</table>

Shape, space and measures 3 (continued)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
Transformations (202–217) • Transform 2-D shapes by combinations of translations, rotations and reflections, on paper and using ICT; **know that translations, rotations and reflections preserve length and angle and map objects on to congruent images; identify reflection symmetry in 3-D shapes.**	• ABC is a right-angled triangle. ABC is reflected in the line AB and the image is then reflected in the line CA extended. State, with reasons, what shape is formed by the combined object and images.  • Two transformations are defined as follows: – Transformation *A* is a reflection in the *x*-axis. – Transformation *C* is a rotation of 90° centre (0, 0). Does the order in which these transformations are applied to a given shape matter? • Some congruent L-shapes are placed on a grid in this formation.  Describe transformations from shape C to each of the other shapes.	

Shape, space and measures 3 (continued)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
Transformations (202–217) • Enlarge 2-D shapes, given a centre of enlargement and a whole-number scale factor, on paper and using ICT; identify the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments; recognise that enlargements preserve angle but not length, and understand the implications of enlargement for perimeter. **Mensuration (242–247)** • Use and interpret maps and scales drawings.	• Investigate the proportions of metric paper sizes, A6 to A1. For example, start with a sheet of A3 paper and, with successive folds, produce A4, A5 and A6. Demonstrate practically that the different sizes of paper can be aligned, corner to corner, with a centre of enlargement.  Confirm by measurement and calculation that the scale factor of enlargement is approximately 0.7.	

Shape, space and measures 3 (continued)

Learning objectives – what should the pupils be able to do?	Outcomes – what will success look like?	Resources
Ratio and proportion (78–81) • Use proportional reasoning to solve a problem; interpret and use ratio in a range of contexts.	• 8 pizzas cost £16. What will 6 pizzas cost? • 6 stuffed peppers cost £9. What will 9 stuffed peppers cost? **Identify when proportional reasoning is needed to solve a problem.** For example: • A recipe for fruit squash for six people is: 300 g chopped oranges 1500 ml lemonade 750 ml orange juice Trina made fruit squash for ten people. How many millilitres of lemonade did she use? Jim used 2 litres of orange juice for the same recipe. How many people was this enough for?	