The National Strategies
Secondary

Assessing pupils' progress in mathematics at Key Stage 3: Standards File

Pupil B

department for
children, schools and families

QCA Qualifications and Curriculum Authority

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Pupil B – Year 7 – Secure level 4

Assessing pupils' progress in mathematics at Key Stage 3

Assessment summary

Pupil B's attainment across mathematics is judged to be secure level 4. Her performance is strongest in number and algebra, although it is still securely within level 4 in the other attainment targets.

Using the Standards Files

- The current Standards Files are based on work planned and assessed in relation to the 1999 National Curriculum programme of study. A new set of Standards Files based on the 2008 National Curriculum are currently in production, but the current set will provide useful guidance on making APP assessments against national standards in the transition period as the new programmes of study are introduced.
- The commentaries in the Standards Files are provided for guidance and reference, and are much more extensive than any teacher would be expected to make when carrying out APP assessments. It is also important to remember that APP encourages and enables a broader overview of current learning, and that there is no need to collect special portfolios of pupils' work. Evidence from pupils' written and oral work, backed up by brief teacher's notes where necessary, is all that is required.
- The evidence base presented in each Standards File is necessarily partial, as it would of course be impractical to reproduce all of each pupil's work. Examples of each pupil's work have been selected to provide evidence to support judgements against APP criteria. This evidence should be considered in conjunction with the teacher's notes, which will provide a broader context and further justification for the assessments that are made.

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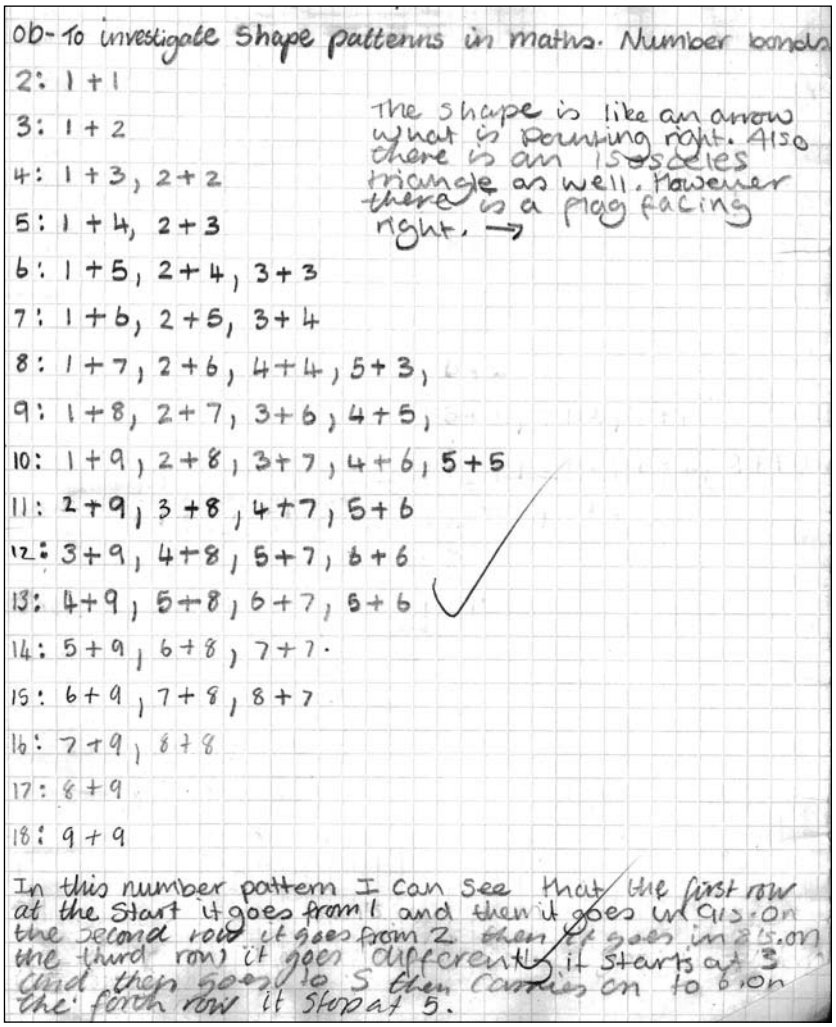
Assessment focus

Using and applying mathematics; Number and the number system

Context

Classwork: During a unit on solving problems and investigating numbers, pupils investigated how many ways different number sums could be made by adding any two numbers from 1 to 9.



Teacher's notes

- recognises the least number that can be made is 2 and the greatest is 18
- works systematically to list all possible addition pairs for each total
- describes patterns in the columns of numbers she has recorded

Next steps

- investigate a 'race' for 'runners' 1–12: two 1–6 dice are thrown, the total called and the 'runner' with that number moves one space along a track
- estimate the likelihood that each runner has of winning the race and justify the estimates
- reflect on how the two activities are related
- extend to throwing three and four dice

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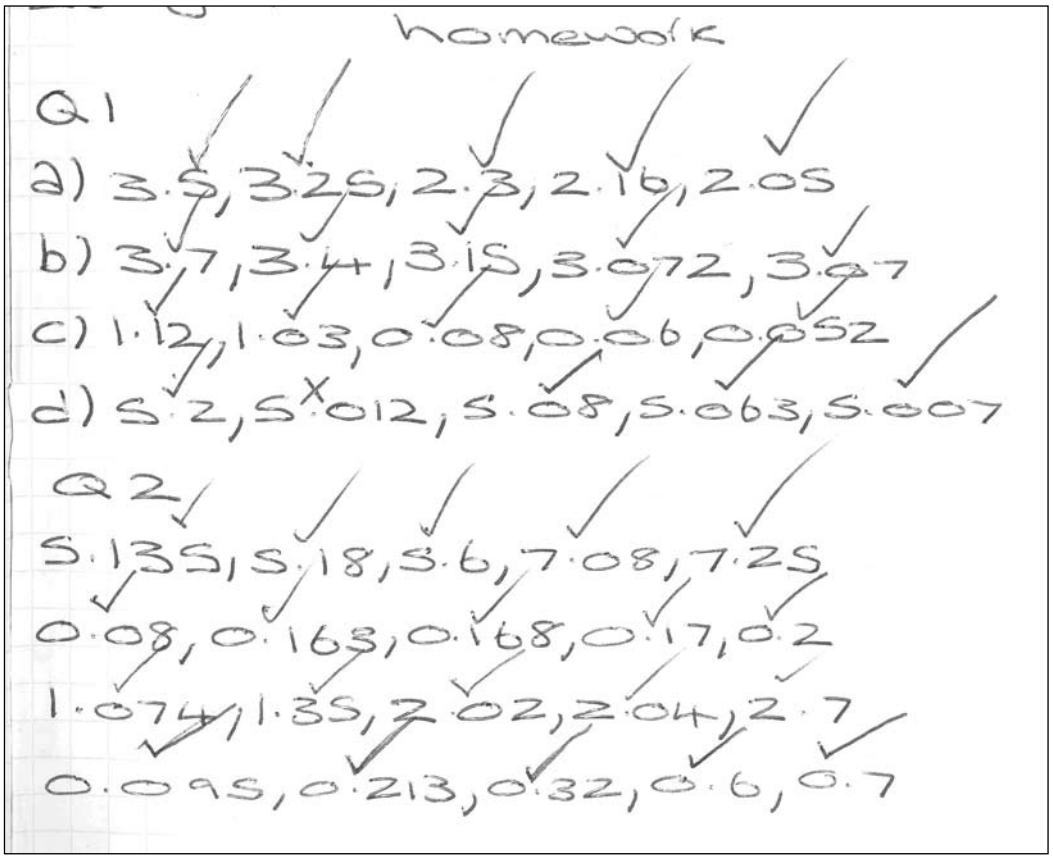
Assessment focus

Numbers and the number system

Context

In a lesson, pupils measured and compared everyday objects. They weighed items and measured lengths. They used kilograms, metres and centimetres as their units and recorded measurements using decimals. As follow-up homework, pupils ordered decimals with up to three decimal places.



Teacher's notes

- draws on experience of interpreting scales on measuring instruments
- uses understanding of place value to order decimals with one, two or three decimal places
- orders decimals from the greatest value to the least and vice versa

Next steps

- relate understanding of decimals to other measures such as units of capacity
- round to a given number of decimal places

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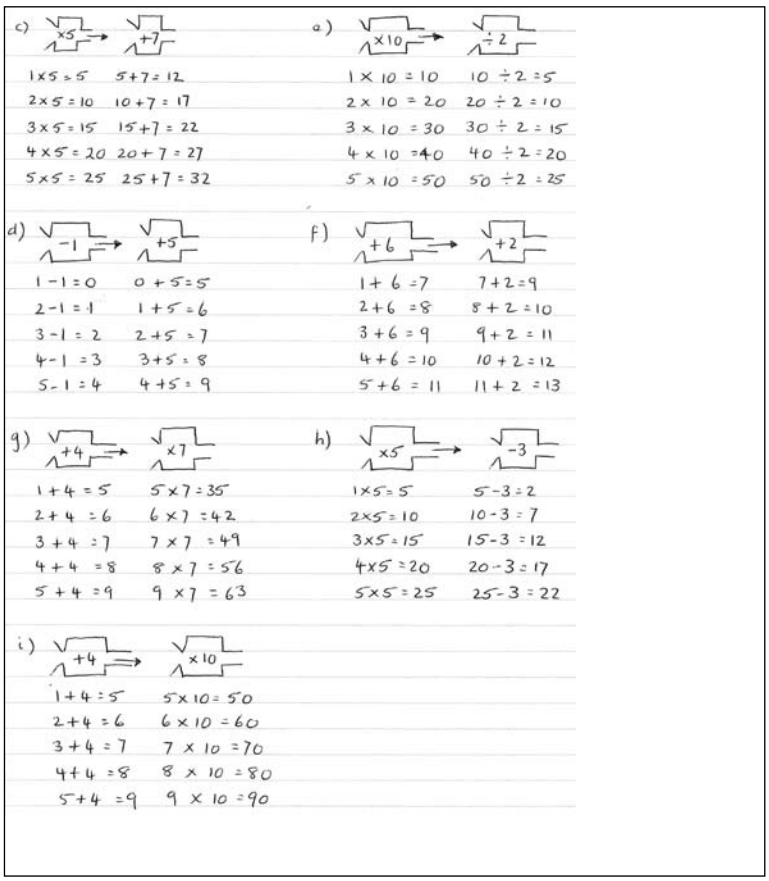
Assessment focus

Algebra

Context

Classwork: At the beginning of a unit on generating and analysing number patterns, pupils created sequences by inputting numbers into two-step function machines.



Teacher's notes

- applies the operations defined for each 'machine' consistently
- inputs numbers 1 to 5 methodically
- adds and subtracts single-digit numbers accurately
- multiplies by 5, 7 and 10 mentally
- generalises patterns in results, 'answers go up in ones if there is no multiplying machine and up in twos if there is a × 2 machine'

Next steps

- investigate the effect of reversing the order of machines, e.g. [× 10] ⟶ [+ 4] instead of [+ 4] ⟶ [× 10]
- use tables to record inputs and final outputs from using one, two or three function machines
- interpret tables of results to identify the number of machines and their functions
- use a spreadsheet to input or guess the formula of another's input

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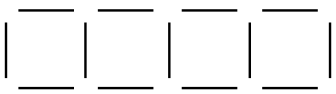
What the teacher knows about Pupil B's attainment in number and algebra

Pupil B creates sequences, for example, in practical investigations of the number of leaves on a twig and growing matchstick patterns based on various polygons. She records results and generalises rules in words. When working with her own and given sequences, including sequences of decimals and negative numbers, she works out missing terms. She continues sequences forwards and backwards and uses her rule to decide if a given number will be in the sequence or not. For example, when growing a row of matchstick squares, Pupil B noticed that the number of matchsticks went up by three as another square was added:



She explained that for a pattern of ten squares, four matches would be needed for the first and then another nine lots of three. She refined the explanation concluding that 'making ten squares needs one match at the start and ten lots of three, 30 more'. She reasoned that 100 matches would make a row of squares because 'you'd start with one and then the 99 would make the threes to add on'.

Reviewing her work with function machines, Pupil B noticed that the sequences produced by inputting 1, 2, 3, etc. fell into two groups. She explained 'the answers go up in 1s if there is no multiplying machine and up in 2s if there is a multiplying by 2 machine'. When given an input/output table for two machines, Pupil B worked out what the functions could have been:

[?] → [?]						
Input	1	2	3	4	5	6
Output	10	13	16	19	22	25

She explained, 'It goes up in threes so the first machine can be "multiply by three". Then you'd still have to add seven. That works!'

Pupil B understands place value in three-digit and four-digit numbers. She uses two decimal places when using money and measuring in metres. In the practical context of kilograms and grams she records decimals with three decimal places. By relating numbers to this practical experience, Pupil B orders decimals with up to three decimal places.

She can also use fractions and percentages to represent proportions of a whole. For example, when using a 100-square she described the column of multiples of 10 as 10% of the whole square. She noted that multiples of 5 occupy 20% of the square and even numbers occupy 50%. She also described these as one tenth, one fifth and half. Pupil B knows the percentage and decimal equivalents of fractions such as $\frac{1}{2}$, $\frac{1}{4}$, $\frac{3}{4}$, $\frac{1}{5}$ and $\frac{1}{20}$.

Pupil B recalls multiplication facts up to 10×10 and quickly derives corresponding division facts. She also uses inverse operations to find missing numbers, for example $\square \div 4 = 5 \times 3$. She understands that brackets enclose a calculation that must be done first.

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She solves word problems that involve two calculations, for example, working out the cost of several items and the change from £20. She solves problems that involve temperature changes around 0°C and time durations that bridge an hour. She has non-calculator methods for adding and subtracting numbers with up to four digits and for multiplying and dividing three-digit numbers by a single digit. When using a calculator, Pupil B interprets the display in the context of the question, recording 15.8 as £15.80 in the context of money, for example. She repeats the calculation to check the accuracy of her answer, uses inverse operations to check subtraction calculations and also considers the context of the problem.

Summarising Pupil B's attainment in number and algebra

Pupil B's attainment in number and algebra is best described as high level 4. She demonstrates aspects of level 5, for example in her understanding of place value in whole numbers and decimals and her developing use of inverse operations. To consolidate level 4 and progress into level 5, Pupil B needs to extend mental and written calculation to decimals and written methods for multiplying by a two-digit number. She needs to begin to solve problems involving simple ratio.

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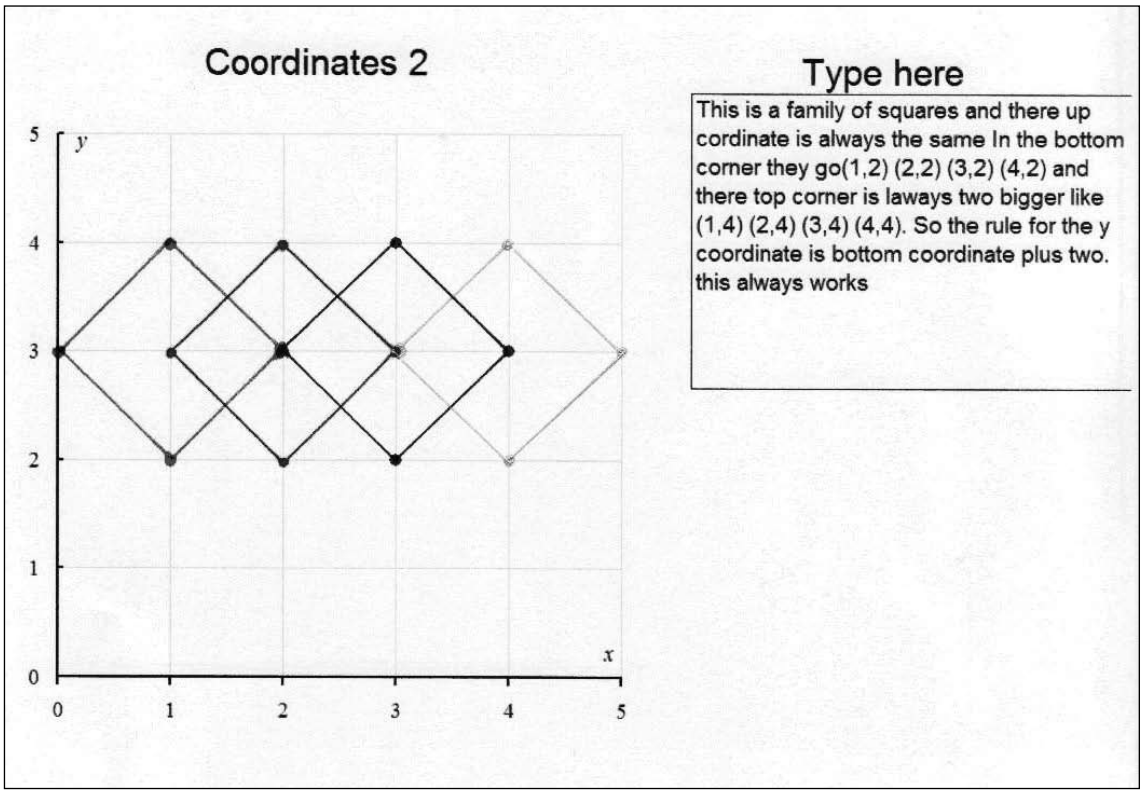
Assessment focus

Algebra; Shape, shape and measures; Using and applying mathematics

Context

Classwork: During a unit on the properties of 2-D and 3-D shapes, pupils were given an interactive spreadsheet and found families of squares, describing the patterns and relationships in the coordinates in words.



Teacher's notes

- creates squares in different orientations on grids
- uses coordinates in the first quadrant
- finds families of squares, for example, those with a vertex at (0, 0)
- searches for pattern in the coordinates of vertices in a row of overlapping, congruent squares
- identifies a pattern in the coordinates of one of the pairs of opposite vertices

Next steps

- refer to coordinates using (*x*, *y*) convention
- discuss how coordinates of all vertices change as the square is translated
- refine the general statement

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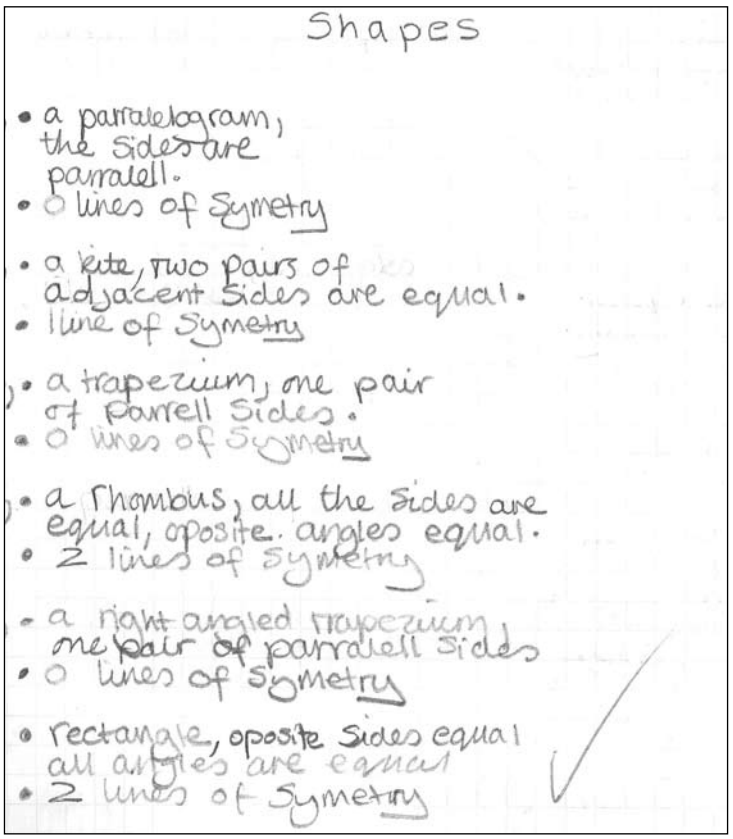
Assessment focus

Shape, space and measures

Context

Classwork: At the start of a unit on the properties of 2-D and 3-D shapes, pupil pairs were given a set of cards. They were asked to match statements about properties to shape names and record their solutions.



Teacher's notes

- uses geometric language correctly
- matches some statements about properties to the names of shapes
- identifies shapes with one or two pairs of parallel sides correctly
- identifies some other properties of a kite and a rhombus

Next steps

- identify additional properties including equal length sides and equal pairs of angles
- develop understanding of symmetry properties to include rotational symmetry
- test and correct statements about reflection symmetry by working with paper shapes and folding 'in half'
- make connections between properties, for example, 'a square is a type of rectangle'

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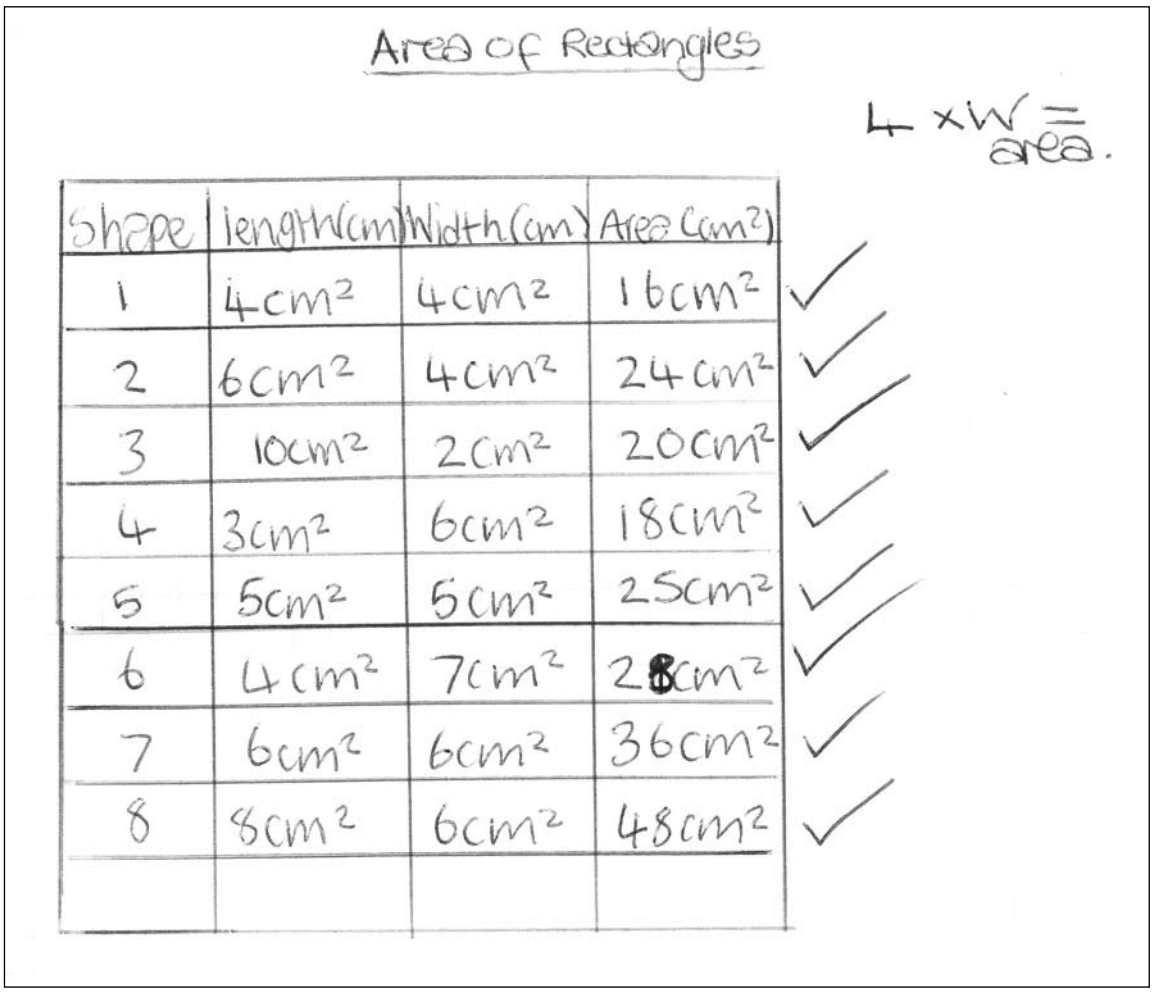
Assessment focus

Shape, space and measures

Context

Classwork: Pupils were set the task of finding a rule for the area of a rectangle. They used a geoboard and recorded width and length and counted squares to find the area.



Area of Rectangles

L x W = area.

Shape	length (cm)	Width (cm)	Area (cm²)	
1	4cm²	4cm²	16cm²	✓
2	6cm²	4cm²	24cm²	✓
3	10cm²	2cm²	20cm²	✓
4	3cm²	6cm²	18cm²	✓
5	5cm²	5cm²	25cm²	✓
6	4cm²	7cm²	28cm²	✓
7	6cm²	6cm²	36cm²	✓
8	8cm²	6cm²	48cm²	✓

Teacher's notes

- uses a geoboard to create a range of rectangles
- finds areas by counting squares
- creates a table of results
- draws on knowledge of multiplication facts to relate area to the length and width
- records the formula for the area of a rectangle

Next steps

- start to calculate areas of rectangles using the formula
- find areas of compound shapes that can be divided into rectangles

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What the teacher knows about Pupil B's attainment in shape, space and measures

Pupil B draws 2-D shapes in different orientations on grids and uses coordinates to label vertices. She also recognises families of shapes, identifying which triangles presented in different orientations on a grid were isosceles, for example. Pupil B recognises and names different quadrilaterals. She is beginning to use properties such as equal sides or angles and numbers of pairs of parallel sides.

Pupil B reflects shapes on a grid in vertical and horizontal mirror lines and finds lines of symmetry practically by folding paper shapes. She is less secure when reasoning about lines of symmetry in diagrams of 2-D shapes. She confuses this with dividing a shape into two congruent shapes or into halves and quarters. She makes 3-D shapes by linking polygons. She is beginning to reason about nets of 3-D shapes, working out the edges that will meet and the shape that will be created.

Pupil B has used ICT to explore transformations. As well as reflecting a shape, Pupil B translates shapes horizontally or vertically. She also rotates shapes about one of the vertices or the centre.

When constructing shapes, Pupil B draws lines to within 1mm and angles to within 2°. When measuring mass, length and volume she chooses appropriate units and reads scales on the measuring equipment accurately. She uses decimals to record measurements in kilograms and grams or metres and centimetres, for example.

Pupil B finds the area of rectangles by counting squares and estimates the areas of other shapes by counting squares and half squares. She formulated a rule, $L \times W$ = area, for the area of a rectangle and justified it with an example, 'there are two rows of five so it's 2 times *5*'. Pupil B uses the terms area and perimeter consistently and correctly. Investigating the perimeter of rectangles and L-shapes with a constant area, she observed that the 'rectangles have smaller perimeters than the L-shapes and the squares have smaller perimeters than the rectangles'.

Summarising Pupil B's attainment in shape, space and measures

Pupil B's attainment in shape, space and measures is described as secure level 4. To make further progress within level 4 and into level 5, she needs to develop her understanding of the properties of shapes, and of reflection symmetry. She should begin to use the distance of each vertex from the mirror line to reflect shapes more accurately including reflecting shapes whose sides are not parallel to grid lines or reflecting about the line $y = x$. She should develop her reasoning about reflection symmetry to find all lines of symmetry in a range of shapes.

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Assessment focus

Handling data

Context

Classwork: At the beginning of a unit on statistics, pupils completed a survey of favourite colours in the class. Pupils decided on the colours to offer and then asked the rest of the class to choose one.

Colour	Tally	Frequency
Green	𝍸 |	6
Red	𝍸 ||||	9
blue	𝍸 |||	8
yellow	||||	4
orange	|	1
White	||	2
total.		30

Teacher's notes

- decides on the choice of colours to offer in her survey
- designs a table to record other pupils' choices of favourite colour
- keeps a tally of choices
- describes the most common and least common choices
- identifies the mode of the set of data

Next steps

- compare her results with others' results
- consider how the choice of colours could influence the outcomes
- raise further questions to investigate, for example, 'What would happen if I put purple in my list as well?', 'Would the mode be similar if I asked more people?' or 'Do boys' choices differ from girls' choices?'

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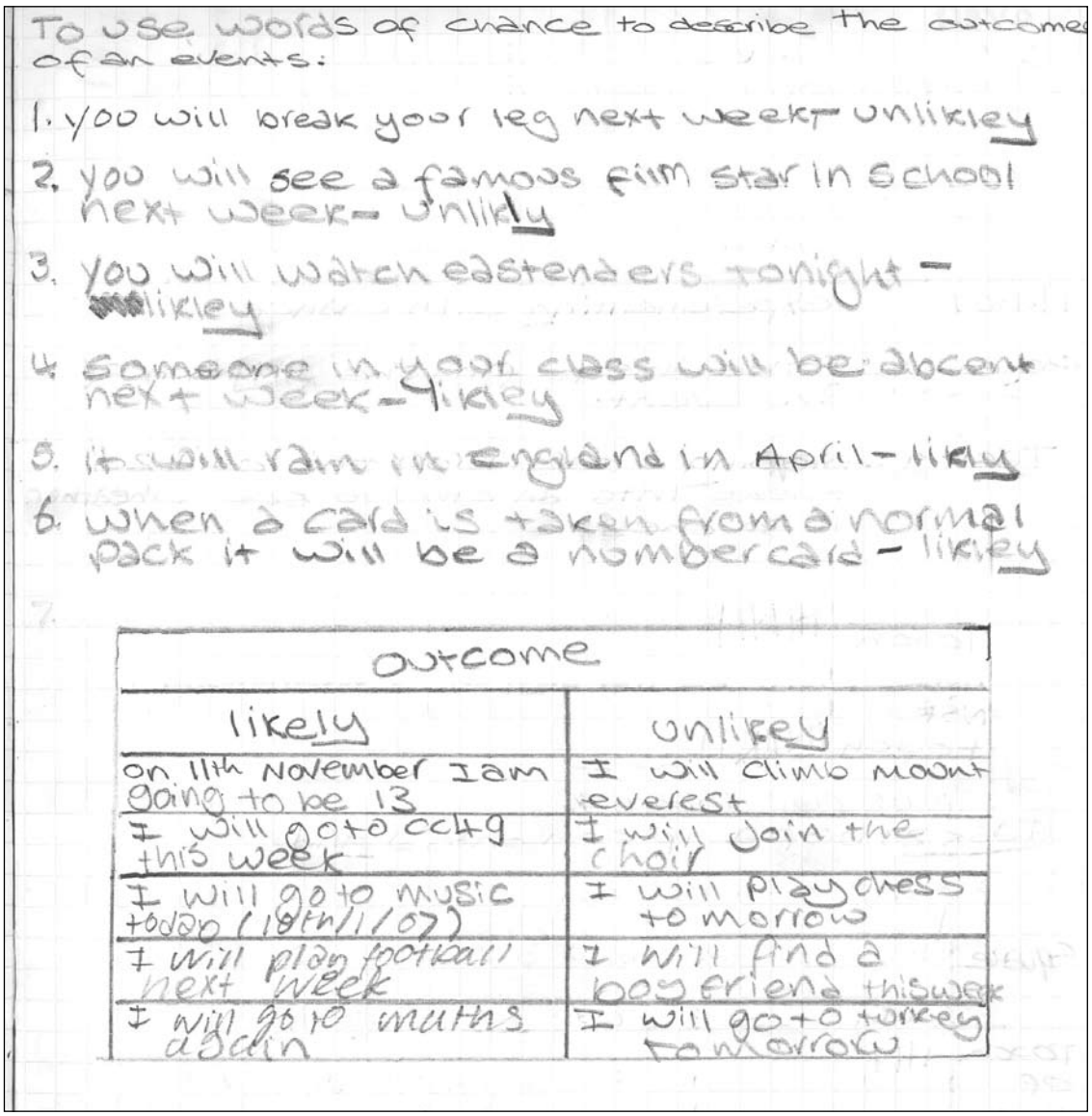
Assessment focus

Handling data

Context

Homework: At the beginning of a unit on probability, pupils created a list of various events and recorded whether each was likely or unlikely to occur.



To use words of chance to describe the outcomes of an events:

1. yoo will break yoor leg next week- unlikley
2. you will see a famoos film star in school next week- unlikly
3. you will watch eastenders tonight - likley
4. someone in yoor class will be abcent next week - likey
5. it will rain in england in April - likly
6. when a card is taken from a normal pack it will be a nombercard - likley

outcome	
likely	unlikey
on 11th November I am going to be 13	I will climb Mount everest
I will go to ccdg this week	I will join the choir
I will go to music today (18th/1/07)	I will play chess to morrow
I will play football next week	I will find a boy friend this week
I will go to maths again	I will go to turkey tomorrow

Teacher's notes

- creates scenarios of likely and unlikely events

Next steps

- use data from experiments and surveys as a basis for deciding the probability of events
- use a wider range of vocabulary to describe and order probabilities

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What the teacher knows about Pupil B's attainment in handling data

Pupil B decides the data to collect to answer a question such as 'What is the favourite colour of pupils in our class?' She uses tables to record data in various contexts. She uses tallying accurately to record events such as pupils' votes or the number of pupils wearing a jacket as they enter the classroom.

Pupil B sorts numbers into Venn and Carroll diagrams according to their properties and represents data using a bar-line graph. She interprets line graphs, for example, graphs of average monthly rainfall or temperature from a travel brochure. She interprets scales where one interval represents 1, 2, 5 or 10 and reads between labelled divisions. When describing data, Pupil B talks about the most or least common event and sometimes uses the term 'mode'. She calculates the range in a set of data and is beginning to compare sets of data using these measures.

In the context of classroom activity, Pupil B is beginning to use language such as 'certain', 'likely', 'fair', 'equally likely', and impossible to describe probabilities. For example, she recognises that it is impossible to have a total score of 1 when throwing two 1–6 dice and that it is very likely that the next person to enter the room will be wearing dark blue, given the colour of the school uniform.

Summarising Pupil B's attainment in handling data

Pupil B's attainment in handling data is judged to be secure level 4. Although she has learned skills and processes associated with the level, she needs opportunities to apply them to solve problems that are relevant to her. To make further progress within level 4 and into level 5 she needs to consider problems and suggest possible answers. She needs opportunities to decide what data is needed to test her ideas and to collect it. She needs to decide how to present data to support and communicate conclusions, including grouping data where appropriate.

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What the teacher knows about Pupil B's attainment in using and applying mathematics

In group discussion, Pupil B suggests ways to engage with a problem. She makes connections to previous work. For example, she noticed when she began finding possible scores from throwing two dice that this was similar to investigating how many ways different numbers could be made by adding any two numbers from 1 to 9. She suggested that the 'middle numbers are going to have more ways of getting that total'. Pupil B is beginning to pose and answer questions to clarify a problem or decide the parameters for an investigation.

Pupil B works methodically and presents her work in an organised way. This helps her to check her results. When she investigated adding pairs of single-digit numbers, for example, she ordered the calculations and presented them in clear lists. The presentation ensured that all possibilities were recorded and helped her to begin to see patterns in the numbers. In a practical weighing activity she worked out how much more one bag weighed than another. She recognised the need to measure both amounts using the same unit before calculating.

With the support of probing questions Pupil B formulates a general rule in words. When growing a line of matchstick squares, for example, she noticed that the number of matchsticks went up by three as another square was added. She explained that for a pattern of ten squares, four matches would be needed for the first and then another nine lots of three. With some prompting she refined the explanation concluding that 'making ten squares needs one match at the start and ten lots of three, 30 more'. She reasoned that 100 matches would make a row of squares because 'you'd start with one and then the 99 matches can go into threes to add on'.

As a further example, when Pupil B reviewed her work with function machines, she noticed that the sequences produced by inputting 1, 2, 3, etc. fell into two groups. She explained 'the answers go up in ones if there is no multiplying machine and up in twos if there is a multiplying by 2 machine'. When given an input/output table for two machines, Pupil B then used her rule to work out what the function machines could have been:

[?] ⟶ [?]						
Input	1	2	3	4	5	6
Output	10	13	16	19	22	25

She explained, 'It goes up in threes so the first machine can be "multiply by three". Then you'd still have to add…seven. That works!'

She also reasons about shapes and diagrams, for example, when identifying various isosceles triangles presented in different orientations on a square grid. She is beginning to reason about nets of 3-D shapes, working out the edges that will meet and the shape that will be created. Investigating the perimeter of rectangles and L-shapes with a constant area, she observed that the 'rectangles have smaller perimeters than the L-shapes and the squares have smaller perimeters than the rectangles'.

Summarising Pupil B's attainment in using and applying mathematics

Pupil B's attainment in using and applying mathematics is described as secure level 4. To progress further and show evidence for high level 4, Pupil B should apply her mathematics to a wider range of problems, in mathematical and practical contexts. She needs further opportunities to make decisions about the approach to adopt and how to record the work. She needs to develop her reasoning to communicate her conclusions more clearly and begin to express generalisations algebraically.

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Pupil name……B……Class/group……Date……

	Using and applying mathematics	Numbers and the number system	Calculating	Algebra	Shape, space and measures	Handling data
Level 4	• develop own strategies for solving problems • use their own strategies within mathematics and in applying mathematics to practical contexts • present information and results in a clear and organised way • search for a solution by trying out ideas of their own ☑	• recognise and describe number patterns • recognise and describe number relationships including multiple, factor and square • use place value to multiply and divide whole numbers by 10 or 100 • recognise approximate proportions of a whole and use simple fractions and percentages to describe these • order decimals to three decimal places • begin to understand simple ratio ☑	• use a range of mental methods of computation with all operations • recall multiplication facts up to 10 × 10 and quickly derive corresponding division facts • use efficient written methods of addition and subtraction and of short multiplication and division • multiply a simple decimal by a single digit • solve problems with or without a calculator • check the reasonableness of results with reference to the context or size of numbers ☑	• begin to use simple formulae expressed in words • use and interpret coordinates in the first quadrant ☑	• use the properties of 2-D and 3-D shapes • make 3-D models by linking given faces or edges and draw common 2-D shapes in different orientations on grids • reflect simple shapes in a mirror line, translate shapes horizontally or vertically and begin to rotate a simple shape or object about its centre or a vertex • choose and use appropriate units and instruments • interpret, with appropriate accuracy, numbers on a range of measuring instruments • find perimeters of simple shapes and find areas by counting squares ☑	• collect and record discrete data • group data, where appropriate, in equal class intervals • continue to use Venn and Carroll diagrams to record their sorting and classifying of information • construct and interpret frequency diagrams and simple line graphs • understand and use the mode and range to describe sets of data ☑
Level 3	• select the mathematics they use in a wider range of classroom activities • try different approaches and find ways of overcoming difficulties that arise when they are solving problems • begin to organise their work and check results • use and interpret mathematical symbols and diagrams • understand a general statement by finding particular examples that match it • review their work and reasoning ☐	• understand place value in numbers to 1000 • use place value to make approximations • recognise negative numbers in contexts such as temperature • use simple fractions that are several parts of a whole and recognise when two simple fractions are equivalent • begin to use decimal notation in contexts such as money ☐	• derive associated division facts from known multiplication facts • add and subtract two-digit numbers mentally • add and subtract three-digit numbers using written method • multiply and divide two-digit numbers by 2, 3, 4 or 5 as well as 10 with whole number answers and remainders • use mental recall of addition and subtraction facts to 20 in solving problems involving larger numbers • solve whole number problems including those involving multiplication or division that may give rise to remainders ☐	• recognise a wider range of sequences • begin to understand the role of '=' (the 'equals' sign) ☐	• classify 3-D and 2-D shapes in various ways using mathematical properties such as reflective symmetry for 2-D shapes • begin to recognise nets of familiar 3-D shapes, e.g. cube, cuboid, triangular prism, square-based pyramid • recognise shapes in different orientations and reflect shapes, presented on a grid, in a vertical or horizontal mirror line • describe position and movement • use a wider range of measures including non-standard units and standard metric units of length, capacity and mass in a range of contexts • use standard units of time ☐	• gather information • construct bar charts and pictograms, where the symbol represents a group of units • use Venn and Carroll diagrams to record their sorting and classifying of information • extract and interpret information presented in simple tables, lists, bar charts and pictograms ☐
BL	☐	☐	☐	☐	☐	☐
IE	☐	☐	☐	☐	☐	☐

Key: BL-Below Level IE-Insufficient Evidence

Overall assessment (tick one box only) Low 3 ☐ Secure 3 ☐ High 3 ☐ Low 4 ☐ Secure 4 ☑ High 4 ☐

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