APP mathematics standards file: Kate (Year 5, secure level 4)

Table of Contents

Ma1 Using and applying mathematics

Ma2 Number

Ma3 Shape, space and measures

Ma4 Handling data

Subject level	Ma1	Ma2	Ma3	Ma4
Level 4	Secure level 4	High level 4	High level 4	High level 4

Node information
Publication date:
Jul 2009

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Ma1 Using and applying mathematics

Mind the gap

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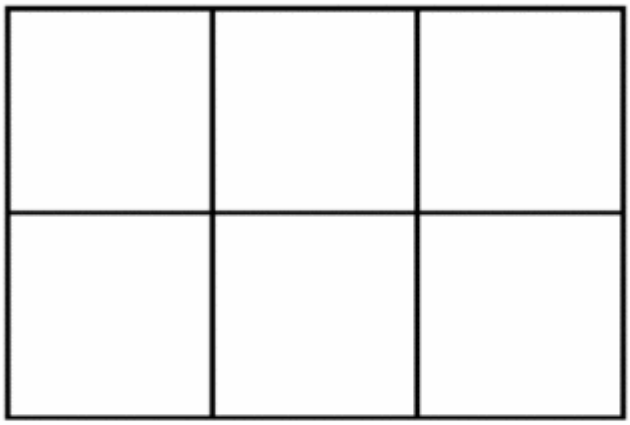
Mind the gap

Arrange cubes on a grid like this.



There must always be one gap.
In how many different ways can the cubes be arranged?

Try grids of different sizes. Can you find a rule for the number of ways?

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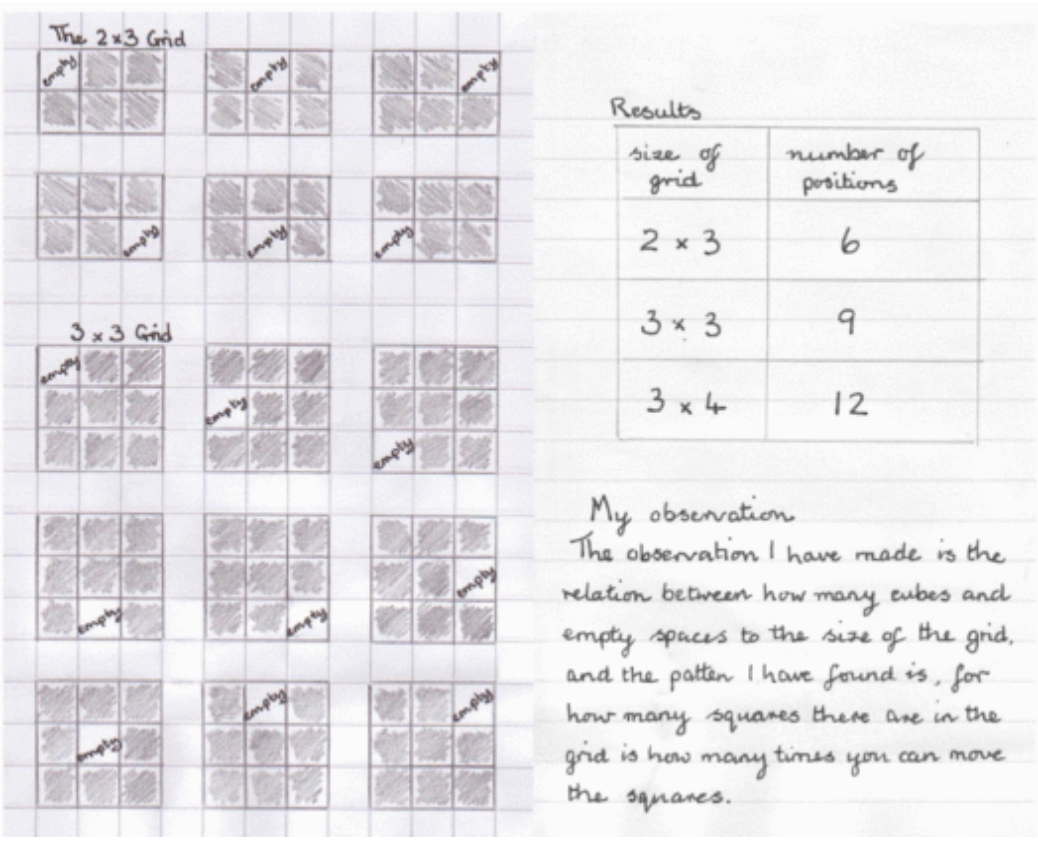

Teacher's notes

- From a selection of materials, chooses to use squared paper and cubes.
- Begins by drawing a 2×3 grid, arranging five cubes on it.
- Records each arrangement.
- Positions the 'gap' systematically.
- Finds all arrangements.
- Investigates a 3×3 grid with eight cubes.
- Records findings on results table.
- Predicts results for a 3×4 grid with 11 cubes.
- Writes general statement about the relationship.

Next steps

- With a partner, discuss how the general statement could be expressed more clearly.
- Generate 'What if…?' questions, for example 'What would happen if you had to leave two gaps on the grid?'
- Investigate further.

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What the teacher knows about Kate's attainment in Ma1

When problem solving Kate makes connections to previous work, suggests her own strategies, and checks answers for reasonableness. She works systematically, but generally finds it difficult to articulate her thinking clearly. In solving word problems, she breaks into the problem by identifying key facts, decides on appropriate calculations and estimates the answer. She calculates and compares the result with her estimation. Finally, she states her answer in a sentence. She identifies patterns as she works and justifies her answers when prompted.

Summarising Kate's attainment in Ma1

In Ma1 Kate is best described as working at the middle of level 4. She is developing her own strategies for solving problems and uses them across a range of contexts. She searches for a solution by trying out ideas of her own. To make further progress within this level, she needs to have more experience of articulating her methods to a partner and of making independent decisions about how to organise her written work for a range of problems. She needs to develop her use of precise mathematical language.

Ma2 Number

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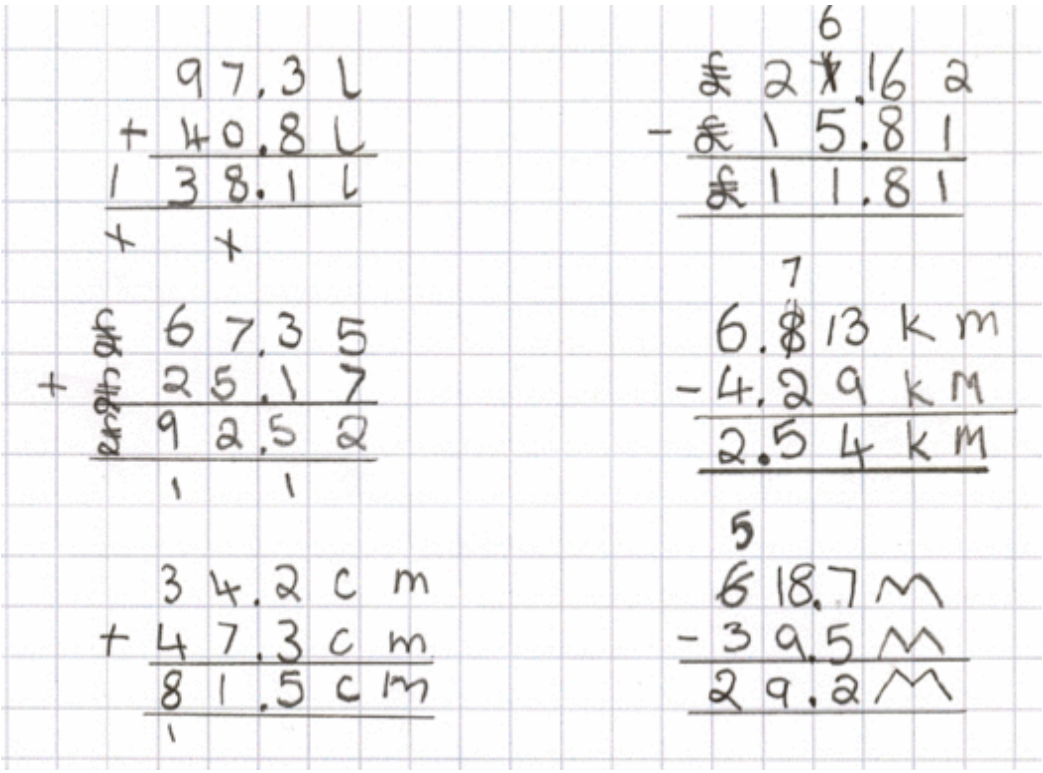
Addition and subtraction of decimals



Teacher's notes

- Uses vertical written method for numbers with either one or two decimal places, with a range of units, for example £, cm, g, l.
- Carries/decomposes across the decimal point.

Next steps

Add or subtract numbers which have a different number of decimal places.

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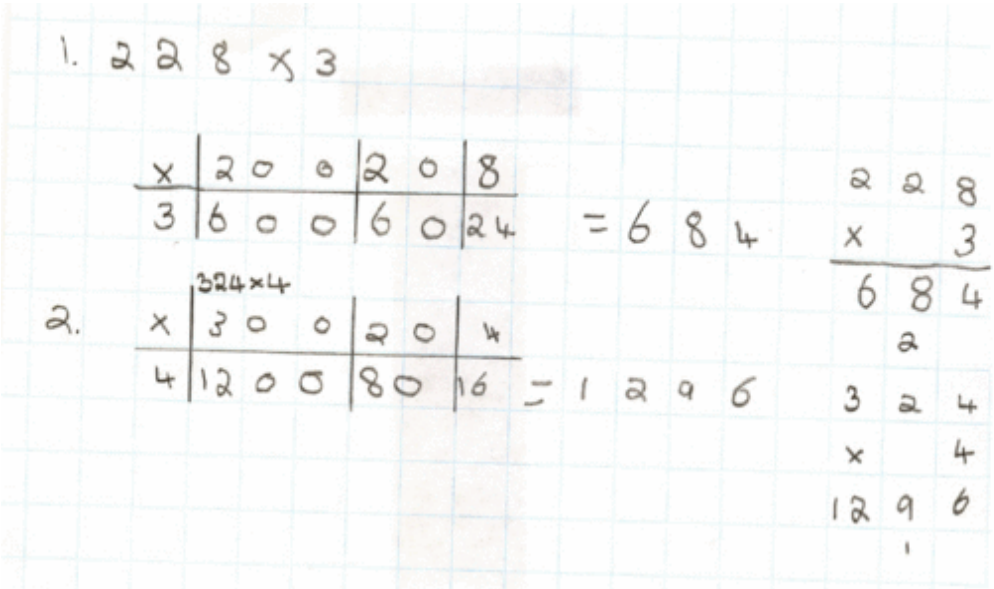
Multiplication



Teacher's notes

- Multiplies three-digit numbers by a single digit using both grid and vertical methods.
- Uses knowledge of place value and of multiplication facts.
- Uses brackets and understands that 12 × 6 can be represented as (10 × 6) + (2 × 6), that is, that multiplication is distributive over addition.

Next steps

Use the grid method to multiply two-digit and three-digit numbers by a two-digit number.

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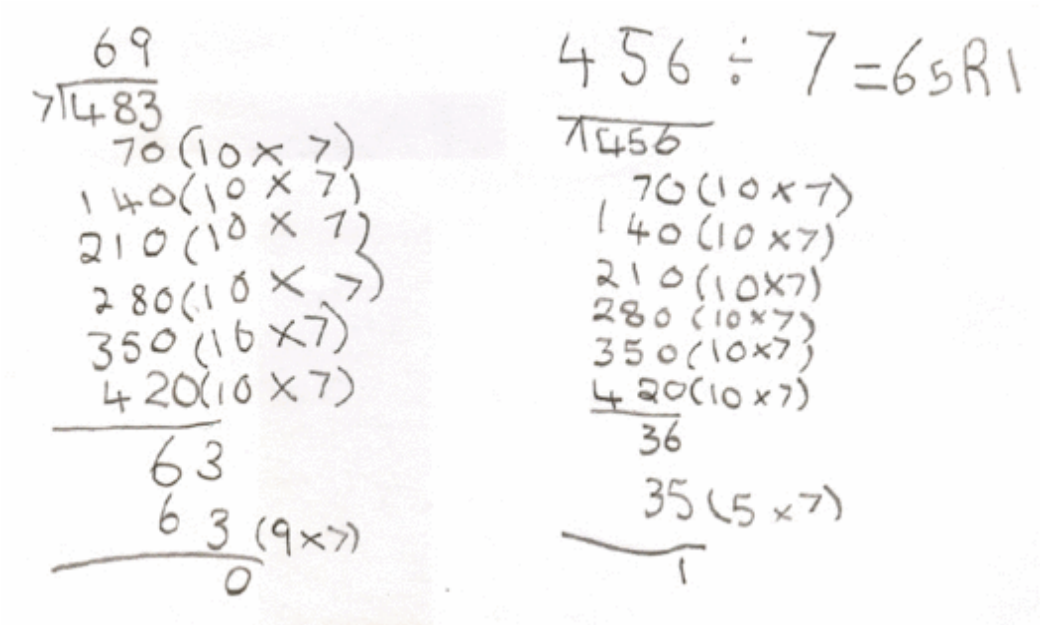
Division



Teacher's notes

- Divides three-digit numbers by a single digit using chunking.
- Recognises that sometimes there is a remainder.
- Is beginning to use chunks that are more than 10 times the divisor, but she needs more work on how to record it.

Next steps

Simplify the recording of chunking to make the subtraction clearer, for example 60 × 7 = 420; 483 - 420.

What the teacher knows about Kate's attainment in Ma2

Kate can continue number sequences, including counting back past zero in negative integers in the context of temperature. She recognises number patterns and describes relationships such as odd and even, multiples, factors and squares. Using her knowledge of place value, she multiplies and divides whole numbers by 10 and by 100. She can round numbers to the nearest 10 or 100.

Kate recognises equivalent fractions, and converts mixed numbers to improper fractions and vice versa. By relating fractions to division, she knows to divide by the numerator for unit fractions of quantities and uses a two-step method to calculate, for example, three-fourths of 16. She knows fraction, decimal and percentage

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equivalents such as one-half = 0.5 = 50%, one-fourth = 0.25 = 25%, three-fourths = 0.75 = 75% and ten-tenths = 1 = 100%. She solves problems involving direct proportion: for example, she uses trial and improvement to find the amount of blue paint required to make one litre of green paint, given that the proportion of blue to yellow is 2: 3.

Kate understands and uses decimal notation for tenths and hundredths in context. She can locate decimals to two places on a number line. She has a secure knowledge of multiplication facts to 10 × 10 and derives the associated division facts quickly. She can double and halve numbers below 50. She understands that the inverse operation can be used to find missing numbers and applies this to all four operations. She finds integer complements up to 1000 using mental methods, for example 340 + 660 (340 arrow pointing right 400 arrow pointing right 1000). With a calculator she can find decimal missing numbers.

She uses efficient written methods for addition and subtraction of three-digit and four-digit numbers and checks her answers using the inverse calculation. In the context of money, length and weight, Kate uses a vertical written method for addition and subtraction of decimals, carrying or decomposing across the decimal point as appropriate. She uses the grid method for multiplication and chunking for division. She can solve a problem that requires two or more operations. She finds differences in temperature involving negative numbers.

Summarising Kate's attainment in Ma2

In Ma2 Kate is best described as working at the top end of level 4. To progress into level 5, she needs to recognise prime numbers to 20, round integers to the nearest 1000, and multiply and divide decimals by 10 and 100. To compare and order fractions, she needs to convert them to fractions with a common denominator. She needs to understand and calculate percentage parts of quantities, using a calculator where appropriate. She needs to consolidate her understanding and use of efficient written methods for multiplication, extending to three-digit by two-digit integer calculations, and for division, including ways of expressing remainders.

Node information
Publication date:
Jul 2009

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Ma3 Shape, space and measures

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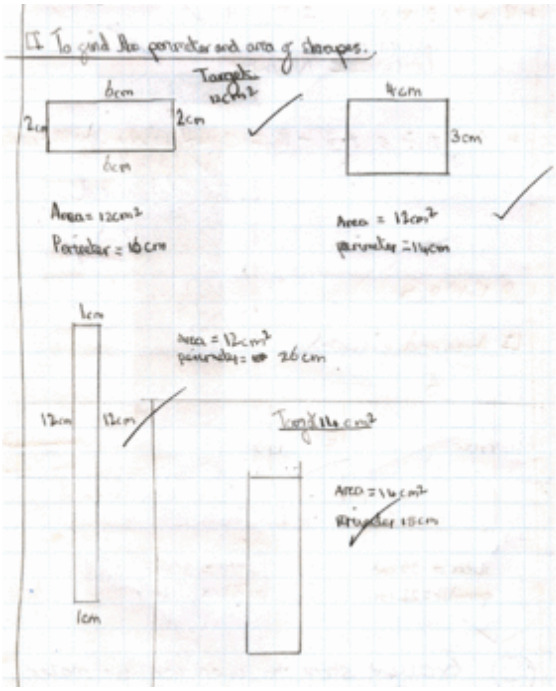
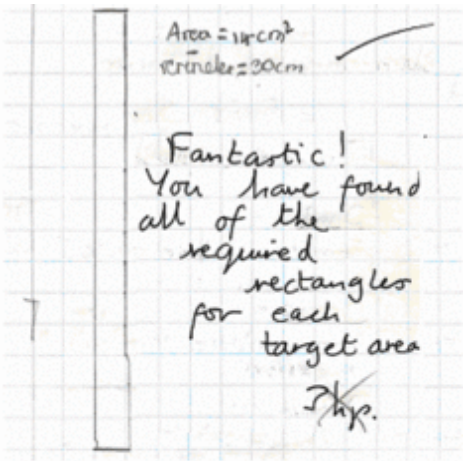
Perimeter and area





Teacher's notes

- For a fixed area of 12 cm^2, finds three different rectangles and gives their perimeters.
- For a fixed area of 14 cm^2, finds two different rectangles and gives their perimeters.
- Is beginning to use *length* × *breadth* for calculating area mentally as dimensions are small.
- Expresses area in cm^2 and perimeter in cm.

Next steps

- For a range of fixed areas, investigate the rectangles for each one to find the rectangle with the smallest perimeter.
- For a fixed perimeter, find the range of areas that can be enclosed.

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What the teacher knows about Kate's attainment in Ma3

Kate is able to identify a range of regular and irregular 2-D and 3-D shapes. She is becoming familiar with the mathematical vocabulary to describe their properties, for example *parallel*, *perpendicular*, *congruent*, *right angles*. She recognises the nets of cubes and cuboids.

Kate interprets coordinates in the first quadrant and uses them to plot points. She gives the coordinates of the vertices of shapes drawn on a grid. She is developing understanding of shape, position and movement on a grid and is beginning to translate simple shapes using appropriate computer software. She reflects shapes in horizontal, vertical and oblique mirror lines. Where a shape is not touching the mirror line, she uses the distance of vertices from the mirror line to position the reflection. She can draw a simple shape after it has been rotated through 180°.

Kate measures the length of classroom objects to the nearest millimetre. She can read scales with fewer labelled increments, such as on bathroom scales with intervals of 50 g labelled every 500 g, on kitchen scales with intervals of 50 g labelled every 100 g, and on a thermometer with intervals of 1° labelled every 10° Celsius and including negative numbers. When measuring angle, she sometimes needs reminding which scale on the protractor she should use. She can read analogue clocks and calculate time durations that go over the hour. Kate finds areas of shapes by counting the squares and for rectangles she is beginning to use *length* × *breadth*, expressing her answers in square units. She finds the perimeter of shapes by summing the lengths of their sides.

Summarising Kate's attainment in Ma3

In Ma3 Kate is best described as working at the middle of level 4. To progress towards the top of this level, she needs to consolidate her ability to visualise and describe 2-D and 3-D shapes, developing her use of geometrical language. In position and movement, she needs more experience of transforming objects on a grid, positioning a shape after a rotation, reflection or translation, and describing the original and new positions using coordinates. In measures, she needs to recognise the type of angle, such as acute or obtuse, in order to know which of the two scales to use on a protractor.

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Publication date:
Jul 2009

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Ma4 Handling data

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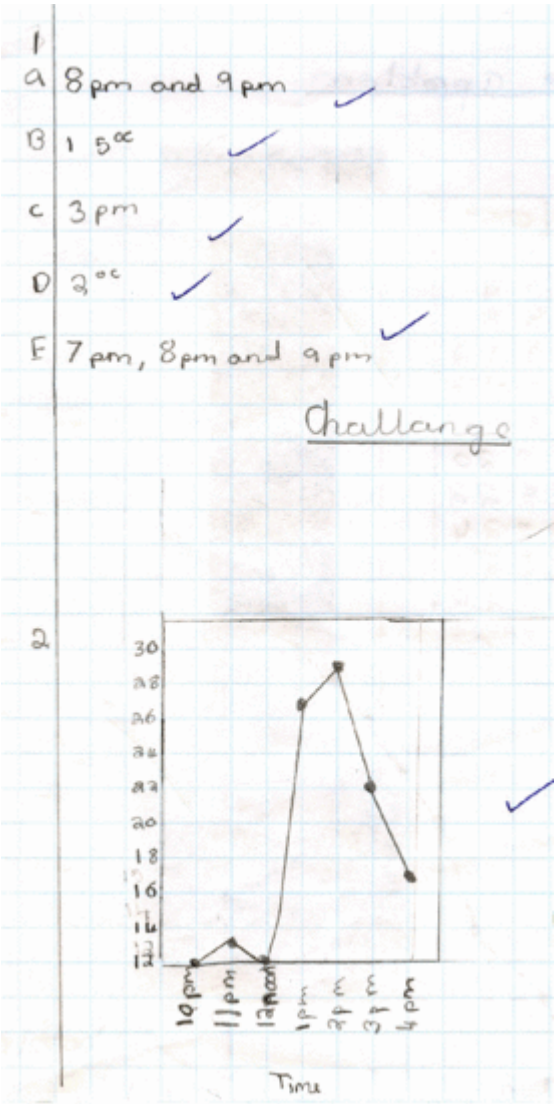
Line graph of temperature over time



Teacher's notes

- Interprets a given line graph, answering such questions as 'At what time was the temperature the same as at 5 pm?', 'When was the temperature lower than 11 degrees?'
- Represents given data drawing her own line graph, but only labels one of the axes.
- Chooses a suitable scale, not necessarily starting on zero on the *y* -axis.

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Next steps

- Use conventional zigzag line to show *y* -axis is not starting from zero.
- Give a suitable title and label both axes.
- Draw other graphs in a range of contexts using different scales.

What the teacher knows about Kate's attainment in Ma4

Kate collects data in an organised way and records them accurately using a frequency table. She constructs bar charts and line graphs, using different scales to fit them onto the paper. In addition, she uses ICT to record her data and select appropriate ways to display them, including pie charts. She can interpret different graphs and charts. Once she has been reminded about the meaning of mode and range, she can use them to describe sets of data. For example, if the highest temperature is 15° Celsius and the lowest temperature is 8° Celsius, she can state that the range is 7° Celsius; in a survey of the colour of cars as they passed the school, she was able to identify that red was the mode because there were more red cars than any other colour. She is beginning to understand some of the terms used for probability such as *impossible*, *unlikely*, *likely*, *certain*, for example in 'It is impossible for me to have 10 birthdays in one year'; 'It is likely to rain in the spring'; 'It is unlikely that it will snow in summer.'

Summarising Kate's attainment in Ma4

In Ma4 Kate is best described as working at the middle of level 4. To make progress towards the top of this level, she needs further experience of interpreting tables, lists and charts. She needs more opportunities to describe sets of data by finding the mode and range to consolidate her understanding of these ideas.

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Publication date:
Jul 2009

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