Proficiency strands

The proficiency strands describe the actions in which students can engage when learning and using the content. While not all proficiency strands apply to every content description, they indicate the breadth of mathematical actions that teachers can emphasise.

Understanding

Students build a robust knowledge of adaptable and transferable mathematical concepts. They make connections between related concepts and progressively apply the familiar to develop new ideas. They develop an understanding of the relationship between the 'why' and the 'how' of mathematics. Students build understanding when they connect related ideas, when they represent concepts in different ways, when they identify commonalities and differences between aspects of content, when they describe their thinking mathematically and when they interpret mathematical information.

Fluency

Students develop skills in choosing appropriate procedures, carrying out procedures flexibly, accurately, efficiently and appropriately, and recalling factual knowledge and concepts readily. Students are fluent when they calculate answers efficiently, when they recognise robust ways of answering questions, when they choose appropriate methods and approximations, when they recall definitions and regularly use facts, and when they can manipulate expressions and equations to find solutions.

Problem Solving

Students develop the ability to make choices, interpret, formulate, model and investigate problem situations, and communicate solutions effectively. Students formulate and solve problems when they use mathematics to represent unfamiliar or meaningful situations, when they design investigations and plan their approaches, when they apply their existing strategies to seek solutions, and when they verify that their answers are reasonable.

Reasoning

Students develop an increasingly sophisticated capacity for logical thought and actions, such as analysing, proving, evaluating, explaining, inferring, justifying and generalising. Students are reasoning mathematically when they explain their thinking, when they deduce and justify strategies used and conclusions reached, when they adapt the known to the unknown, when they transfer learning from one context to another, when they prove that something is true or false and when they compare and contrast related ideas and explain their choices.

http://www.australiancurriculum.edu.au/Mathematics/Content-structure

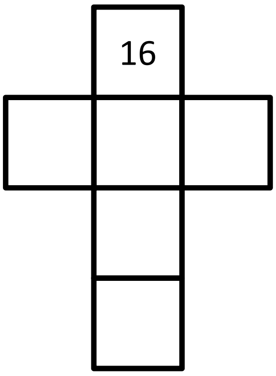
Back-to-Front Maths assessment criteria for parents and students

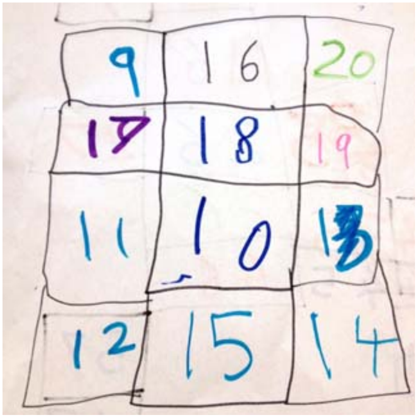
Assessment criteria	A	B	C	D	E
Problem Solving (Thinking and Reasoning)	Students solved a problem they hadn't seen before by using their own invented strategies and thinking, rather than using a formula they have memorised. Teacher may have made suggestions to help the student get started and to help them evaluate their ideas carefully.	Students adapted strategies they had used before to solve a problem that was new, rather than using a formula they had memorised. Teacher may have prompted, guided, or lead throughout the problem as long as this involved asking questions rather than telling the student what to do.	Students competently solved problems similar to ones they had completed previously, using rehearsed strategies that they had memorised. Teacher may have prompted, guided and lead throughout the problem solving process.	Students sometimes solved problems that were similar to ones they had completed in class but this was inconsistent. Teacher may have provided substantial guidance throughout the problem solving process.	Students did not solve many problems successfully even when they were similar to those completed previously, and with substantial teacher guidance.
Reasoning (Communicating)	Students clearly proved how they got their answer. This included detailed working, drawings or explanations.	Students proved how they got their answer. This included working, drawings or explanations, but may have skipped some details.	Teacher could interpret how the student obtained their answer.	Teacher had difficulty interpreting how the student obtained their answer.	Student did not show how they obtained their answer.
Understanding (Reflecting)	Students demonstrated a deep level of mathematical understanding by making connections between the patterns and principles that underpin mathematics. They showed ability to adapt and manipulate mathematical formulae and algorithms for themselves when solving non-standard problems.	Students made connections between the patterns and principles that underpin mathematics. With some teacher input and guidance, they adapted mathematical formulae and algorithms when solving non-standard problems.	Students explained some patterns and principles that underpin mathematics, but had difficulty making connections between these. They used mathematical formulae and algorithms in routine and application questions, but had difficulty with non-standard problems.	Students had some difficulty explaining patterns and principles that underpin mathematics, and did not make connections between these. They sometimes used mathematical formulae and algorithms in routine questions, but had difficulty with application.	Students had difficulty stating patterns and principles that underpin mathematics.

Student sample: Brittney in grade 2

Brittney is a typical year 2 student. She can count fluently past 100, including counting forwards and backwards in 1s, 2, 5s and 10s. She can count in 10s from any number. Her previous grades have been about a 'B' standard for maths.

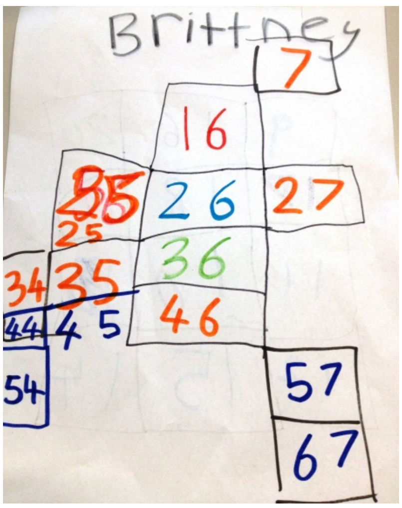
Brittney examined a hundreds chart with other students in her grade. She easily stated the counting patterns horizontally and vertically. Her fluency levels were well up to this task, but the question below clearly involved a lot of new thinking for her as evidenced by her responses:

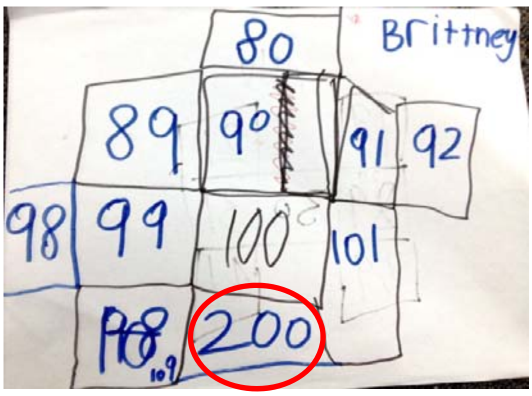


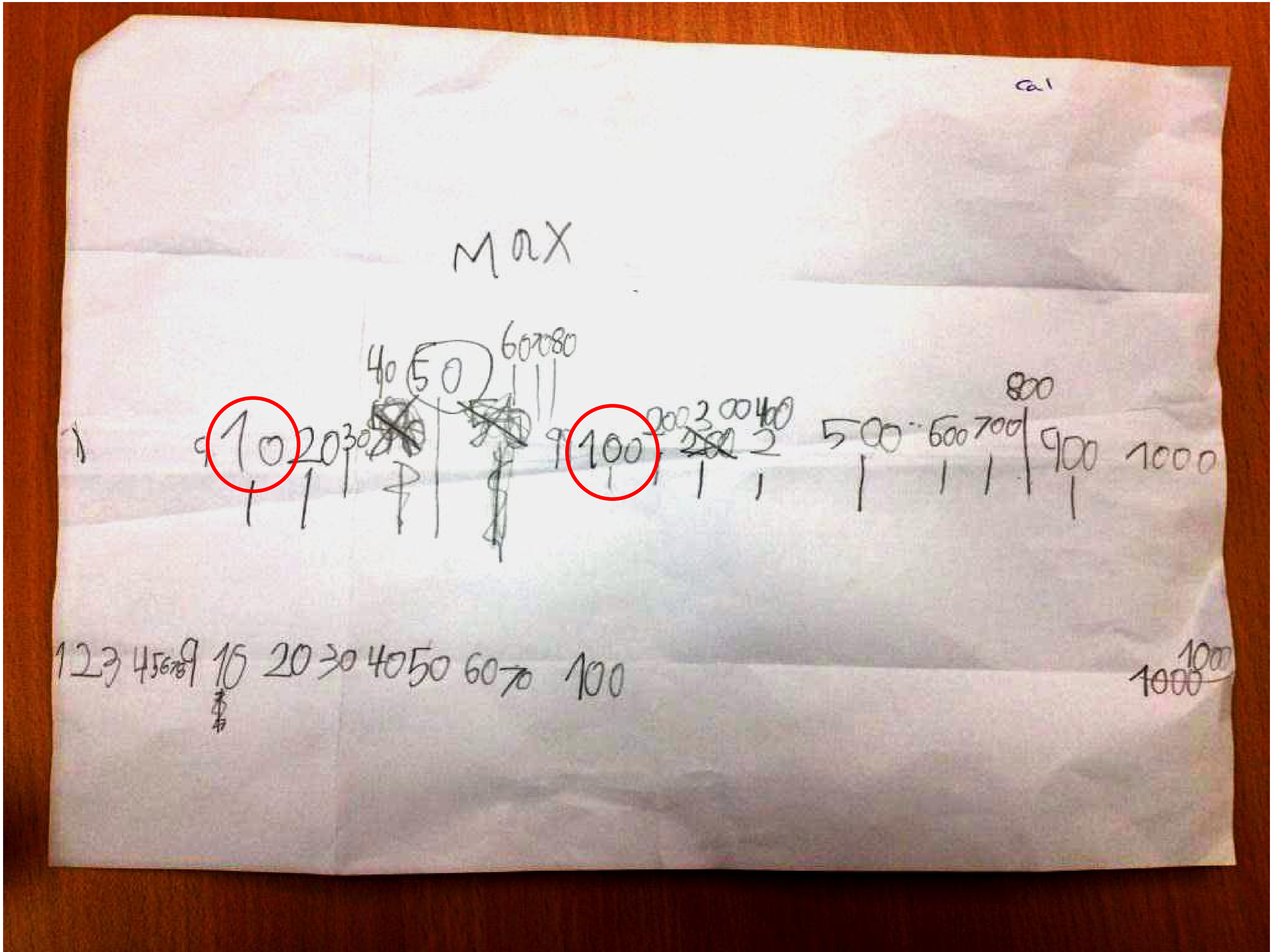


After this initial response, the teacher circled the number underneath the 16 and asked to have a look at that space on the hundreds chart. Brittney stated that it was 26. The teacher then asked how 16 and 26 were "kind of the same", and what the difference between them was. Brittney could identify that they both ended in 6, but not that the difference between them was 10. Brittney was asked to make 16 from base 10 blocks then add extra blocks to turn it into 26. She counted on until she reached 26, then identified that it was 10 blocks that she had added. She then arranged the 10 blocks into a straight line to resemble a "10" block.

Brittney was then asked to predict what number would be underneath the 26. She replied 27. The process was repeated, with "how are 16, 26 and 36 kind of the same?" and "how are the numbers changing?" The picture below shows Brittney's second response. The second picture shows her extension question. These clearly show the growth in her understanding of the underlying patterns and principles. Note the new misconception in the third picture.



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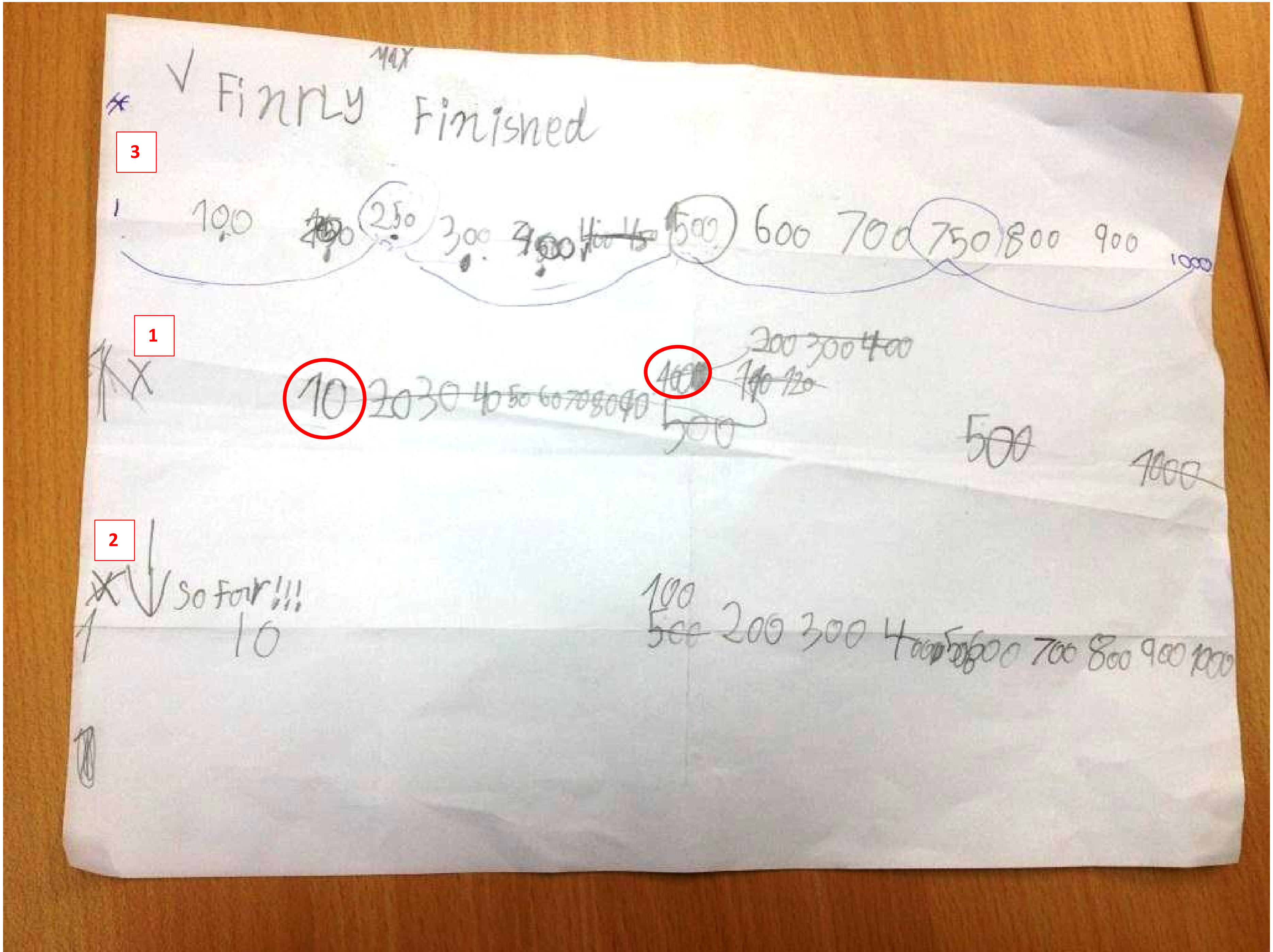
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