Mathematics

WORK SAMPLE PORTFOLIOS

These work sample portfolios have been designed to illustrate satisfactory achievement in the relevant aspects of the achievement standard.

The December 2011 work sample portfolios are a resource to support planning and implementation of the Foundation to Year 10 Australian Curriculum in English, Mathematics, Science and History during 2012. They comprise collections of different students' work annotated to highlight evidence of student learning of different aspects of the achievement standard.

The work samples vary in terms of how much time was available to complete the task or the degree of scaffolding provided by the teacher.

There is no pre-determined number of samples required in a portfolio nor are the work samples sequenced in any particular order. These initial work sample portfolios do not constitute a complete set of work samples - they provide evidence of most (but not necessarily all) aspects of the achievement standard.

As the Australian Curriculum in English, Mathematics, Science and History is implemented by schools in 2012, the work sample portfolios will be reviewed and enhanced by drawing on classroom practice and will reflect a more systematic collection of evidence from teaching and learning programs.

THIS PORTFOLIO – YEAR 5 MATHEMATICS

This portfolio comprises a number of work samples drawn from a range of assessment tasks, namely:

Sample 1	Enlarging and reducing two-dimensional objects
Sample 2	Multiplication strategies – Thinkboard
Sample 3	Cubed house
Sample 4	Units of measurement – A day in my life
Sample 5	Fractions – Let's talk about fractions
Sample 6	Chance and data investigation
Sample 7	Units of measurement – Perimeter and area investigation
Sample 8	Numbers – Multiplication and division webs
Sample 9	Location – Treasure island
Sample 10	Geometry in buildings
Sample 11	Numbers – Helping Silvana with division
Sample 12	Numbers – Missing digits

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This portfolio of student work shows comparison of the sizes of fractions by diagrams and calculation and their representation on a number line (WS5). The student solves problems using the four operations (WS2, WS11, WS12) and makes spinners to assist in carrying out simple probability experiments before evaluating the results (WS 6). The student investigates the areas and perimeters of different rectangles (WS3, WS7) and uses calculators to check calculations when multiplying numbers (WS8). The student explains the effect of transformations (WS1), locates axes of symmetry of shapes and describes the features of three dimensional objects using two dimensional representations (WS3, WS10). The student creates maps, locates landmarks and describes directions to locations (WS9). The student converts between 12 and 24 hour time (WS4).

The following aspects of the achievement standard are not evident in this portfolio:

- *identify and describe factors and multiples*
- *explain plans for simple budgets*
- *compare and interpret different data sets*
- *add and subtract fractions with the same denominator*
- *find unknown quantities in number sentences*
- *use appropriate units of measurement for volume, capacity and mass*
- *measure and construct different angles*
- *assign probabilities between 0 and 1*
- *pose questions to gather data.*

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Work sample 1:
Enlarging and reducing two-dimensional objects

Relevant parts of the achievement standard

By the end of Year 5, students solve simple problems involving the four operations using a range of strategies. They check the reasonableness of answers using estimation and rounding. Students identify and describe factors and multiples. They explain plans for simple budgets. Students connect three-dimensional objects with their two-dimensional representations. They describe transformations of two-dimensional shapes and identify line and rotational symmetry. Students compare and interpret different data sets.

Students order decimals and unit fractions and locate them on number lines. They add and subtract fractions with the same denominator. Students continue patterns by adding and subtracting fractions and decimals. They find unknown quantities in number sentences. They use appropriate units of measurement for length, area, volume, capacity and mass, and calculate perimeter and area of rectangles. They convert between 12 and 24 hour time. Students use a grid reference system to locate landmarks. They measure and construct different angles. Students list outcomes of chance experiments with equally likely outcomes and assign probabilities between 0 and 1. Students pose questions to gather data, and construct data displays appropriate for the data.

Summary of task

Students have been studying two dimensional representations.

Students were given drawings of a variety of two-dimensional shapes on grid paper. Students enlarged or reduced the shapes onto another piece of grid paper. They were asked the following questions:

- What features change when a two-dimensional shape is enlarged or reduced?
- What features remain the same?
- Do properties change or remain the same? Why?

Students explained the process they used to enlarge and reduce two-dimensional shapes.

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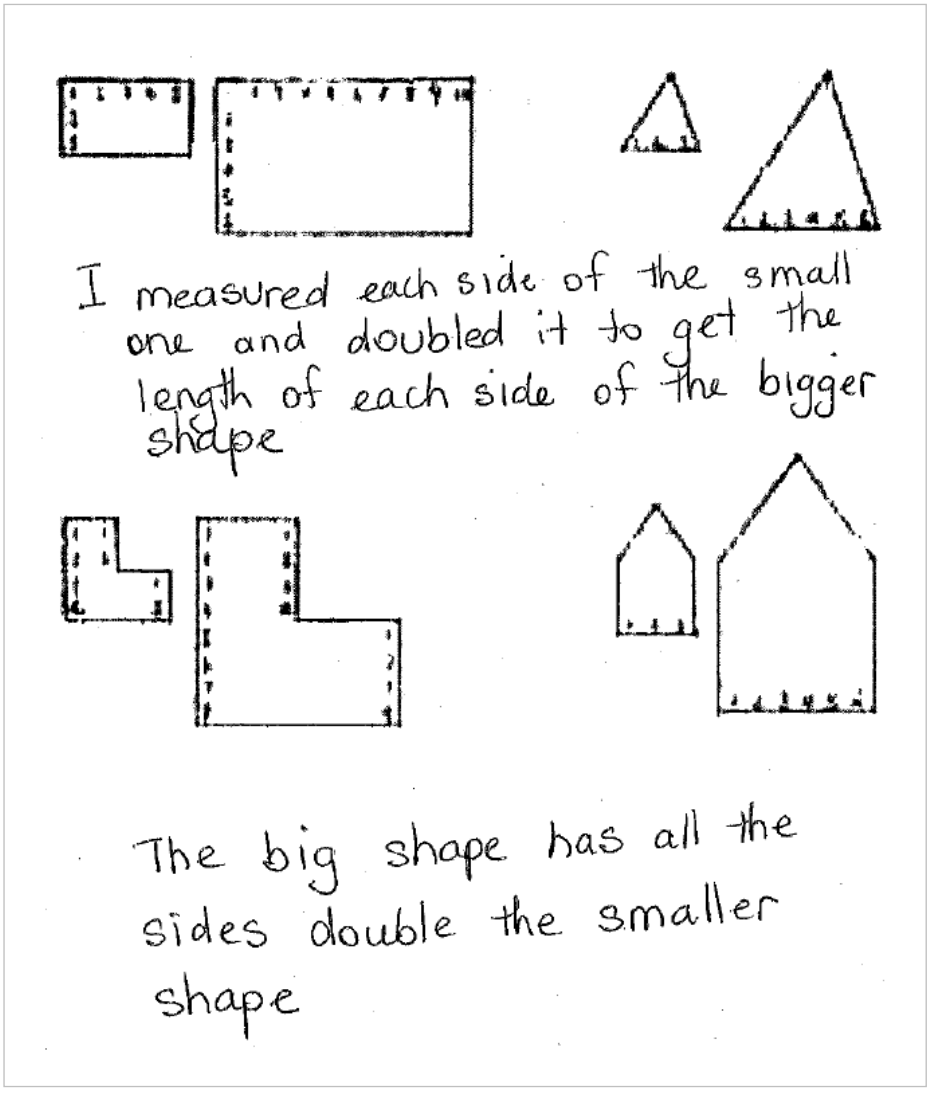
Work sample 1:
Enlarging and reducing two-dimensional objects



Annotations

Applies an enlargement and reduction transformation.

Demonstrates an understanding of proportion and scale factor.

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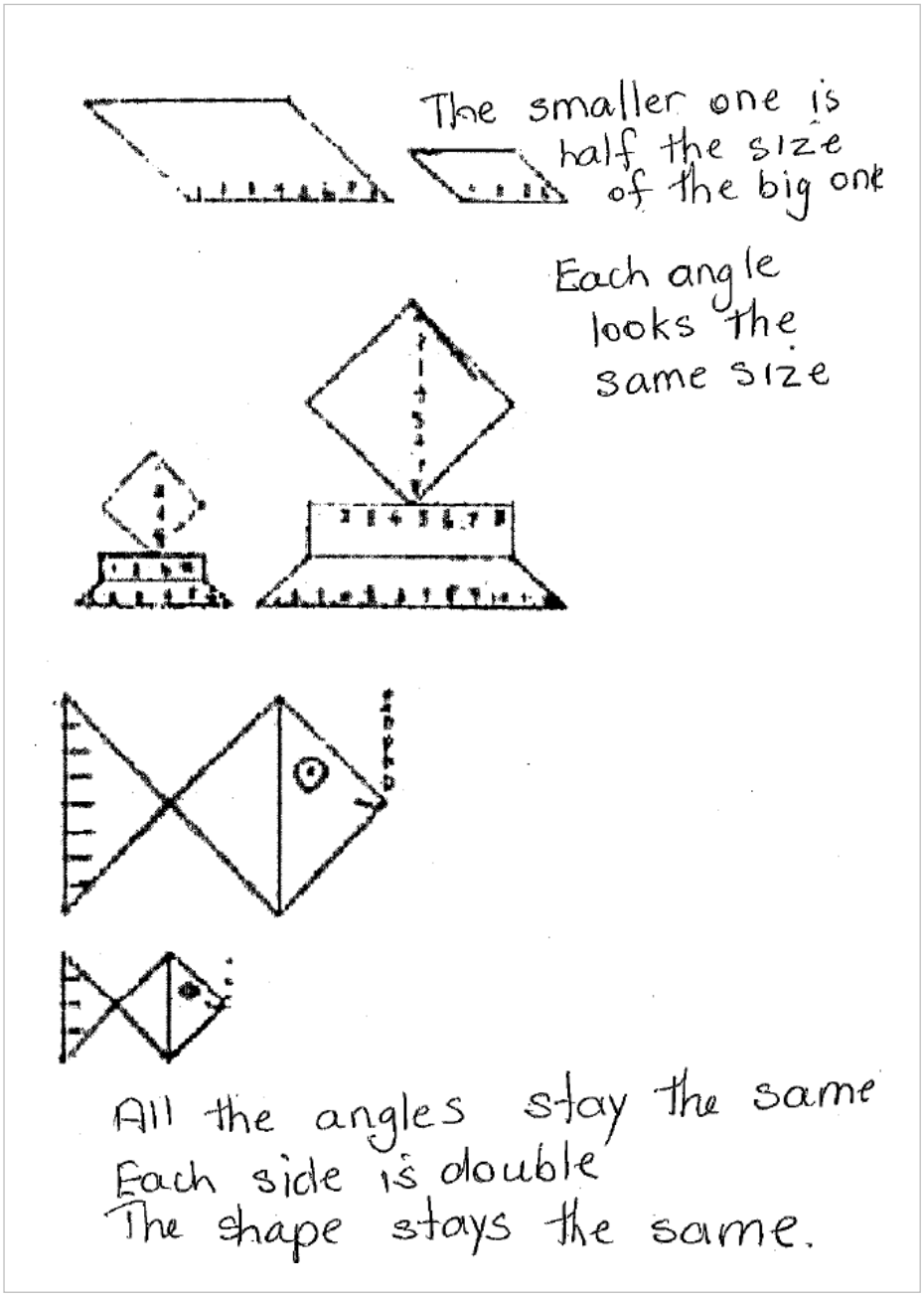
Work sample 1:
Enlarging and reducing two-dimensional objects



Annotations

Demonstrates an understanding of the relationship between the sides of the image and the enlargement.

Explains what remains the same and what changes

Acknowledgment
ACARA acknowledges the contribution of trial schools teachers and students for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

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Work sample 2:
Multiplication strategies – Thinkboard

Relevant parts of the achievement standard

By the end of Year 5, students solve simple problems involving the four operations using a range of strategies. They check the reasonableness of answers using estimation and rounding. Students identify and describe factors and multiples. They explain plans for simple budgets. Students connect three-dimensional objects with their two-dimensional representations. They describe transformations of two-dimensional shapes and identify line and rotational symmetry. Students compare and interpret different data sets.

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Summary of task

Students had previously used graphic organisers (for example, a thinkpad). These organisers permitted students to model and discuss strategies to show thinking in solving algorithms including:

- multiplication, place value to three digits
- formal operations
- estimation as a summative assessment.

Students were required to calculate 356 x 6 using:

- an algorithm
- concrete materials
- a pictorial representation.

They were then required to explain their process.

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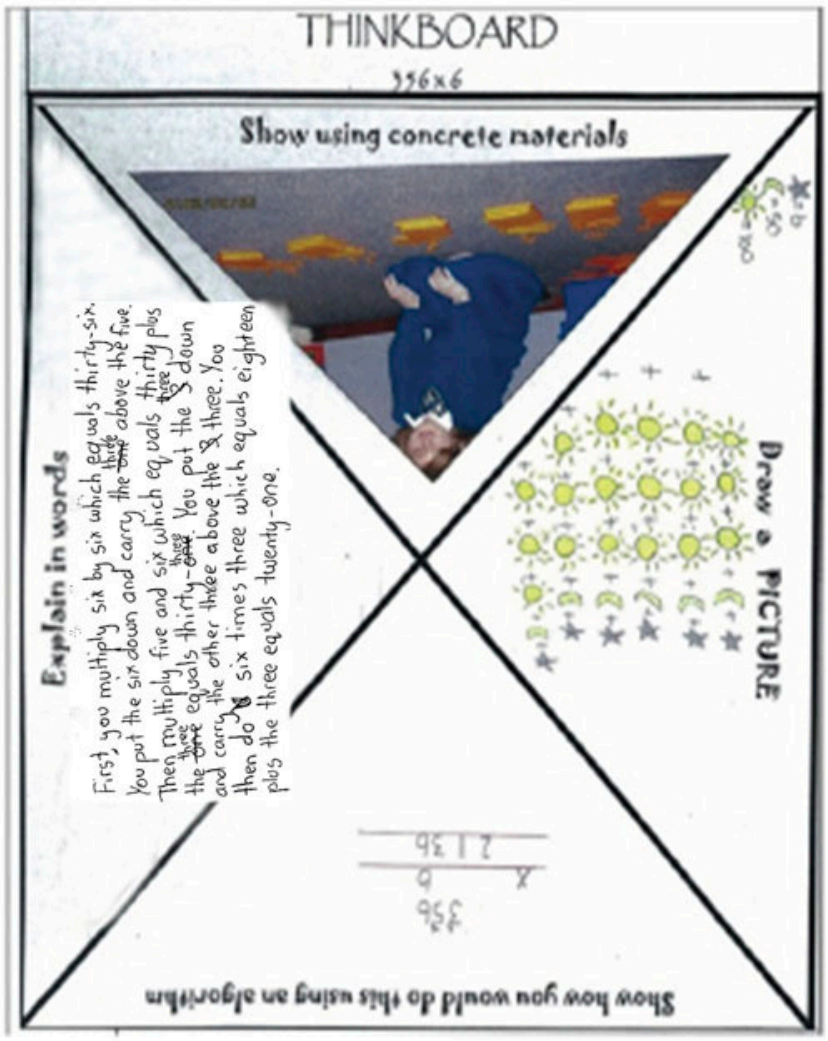
Work sample 2:
Multiplication strategies – Thinkboard



Annotations

Solves a 3 digit by 1 digit multiplication using a range of strategies, including calculation and explanation.

Uses words and models including a pictorial representation to explain their process.

Acknowledgment
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Work sample 3:
Cubed house

Relevant parts of the achievement standard

By the end of Year 5, students solve simple problems involving the four operations using a range of strategies. They check the reasonableness of answers using estimation and rounding. Students identify and describe factors and multiples. They explain plans for simple budgets. Students connect three-dimensional objects with their two-dimensional representations. They describe transformations of two-dimensional shapes and identify line and rotational symmetry. Students compare and interpret different data sets.

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Summary of task

Students were given cube blocks to construct and build houses. They had explicit practice at drawing three-dimensional representation and two-dimensional side and top views of structures.

Students were required to work in pairs to design as many cube houses as possible using four or five cubes. They were given the following instructions:

- Draw each house on isometric/square dot paper.
- Work out the number of squares each house covers on dot paper (each square = 1 square centimetre)
- Show evidence of estimation
- Work out the construction cost of each design using these figures:
  - $10,000 for each square unit of land covered
  - $4,000 for each square unit of external wall
  - $6,000 for each square unit of roof (the cost must be written, showing correct decimal places)
  - Show evidence of re-checking calculation
- Draw the front, left, back right and top views of one of the houses drawn.

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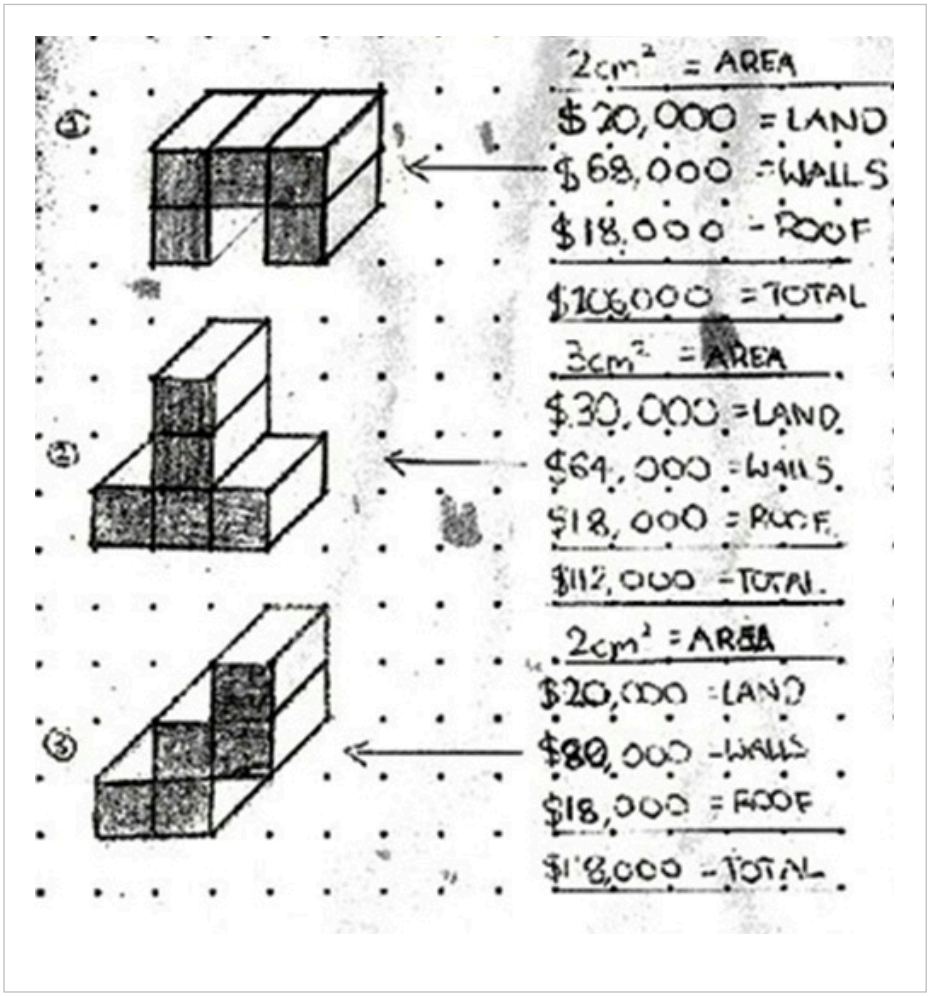
Work sample 3:
Cubed house



Annotations

Draws three-dimensional representations of three different five cubed houses on square dot paper.

Accurately calculates the area of each house.

Accurately calculates the construction costs of each house.

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Work sample 3:
Cubed house

Annotations

Draws and names a representation of one of the five cubed houses from side, front, back and top views.

Acknowledgment
ACARA acknowledges the contribution of trial school teachers and students for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

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Work sample 4:
Units of measurement – A day in my life

Relevant parts of the achievement standard

By the end of Year 5, students solve simple problems involving the four operations using a range of strategies. They check the reasonableness of answers using estimation and rounding. Students identify and describe factors and multiples. They explain plans for simple budgets. Students connect three-dimensional objects with their two-dimensional representations. They describe transformations of two-dimensional shapes and identify line and rotational symmetry. Students compare and interpret different data sets.

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Summary of task

Students' prior learning included:

- Conversion between 12hr time and 24hr time
- Conversion between analogue, digital time
- Constructing timelines using appropriate scaling
- Scale
- Number line modelling.

This is a summative assessment task of 50 minutes.

Students listed activities they did in a week and recorded these in analogue, digital and 24 hour time. They created a timeline of events listing in order at least eight things they did on a particular day of the week, indicating the starting time for each activity. They recorded these times on the set of clock faces and digital displays. Students converted the times to 24 hour time. They used times to draw a timeline on a black strip of paper to represent the day. Students were asked to use scale on their timeline.

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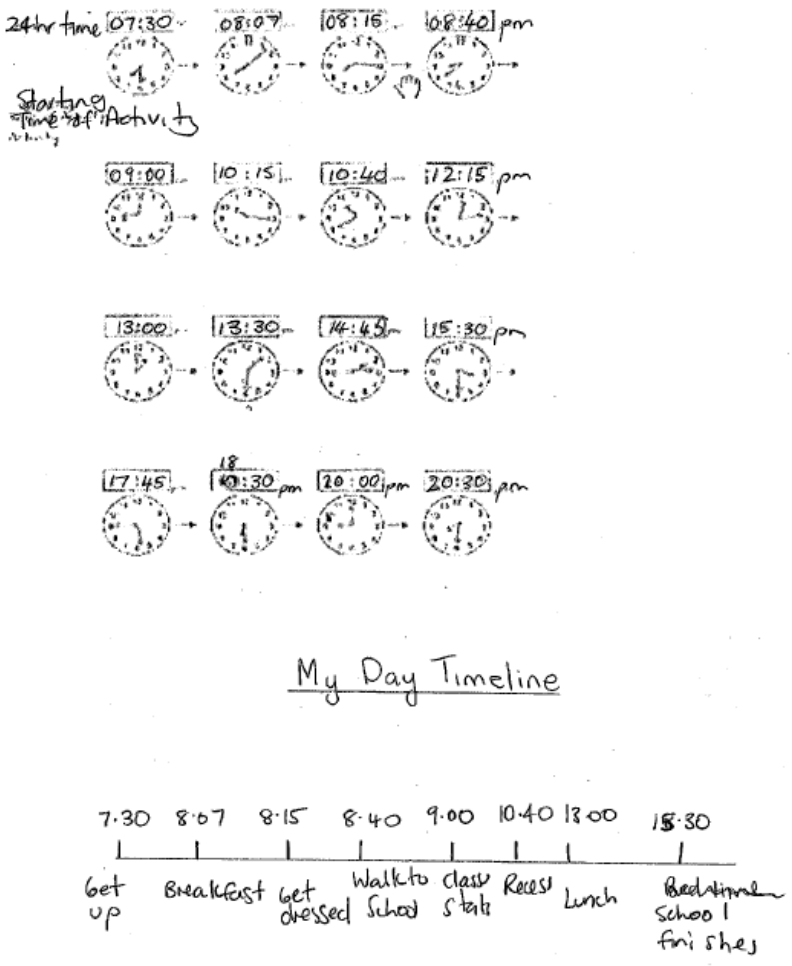
Work sample 4:
Units of measurement – A day in my life



Annotations

Records times in analogue and digital formats.

Completes the timeline but omits some activities.

Acknowledgment
ACARA acknowledges the contribution of trial school teachers and students for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

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Work sample 5:
Fractions – Let's talk about fractions

Relevant parts of the achievement standard

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Summary of task

Students chose their own fractions to compare the size of one against another. They used diagrams to support their explanations. Students were required to:

a) identify common fractions
b) model common unit fractions
c) locate common fractions on number line (with appropriate scale)
d) label given diagrams of fractions and/or represent a fraction on a diagram
e) order fractions on a number line
f) compare the size of given fractions using diagrams and explanations
g) generalise the size of fractions related to their common fraction symbol (a/b notation)
h) order fractions on a number line and compare the size of fractions using diagrams to support their explanations.

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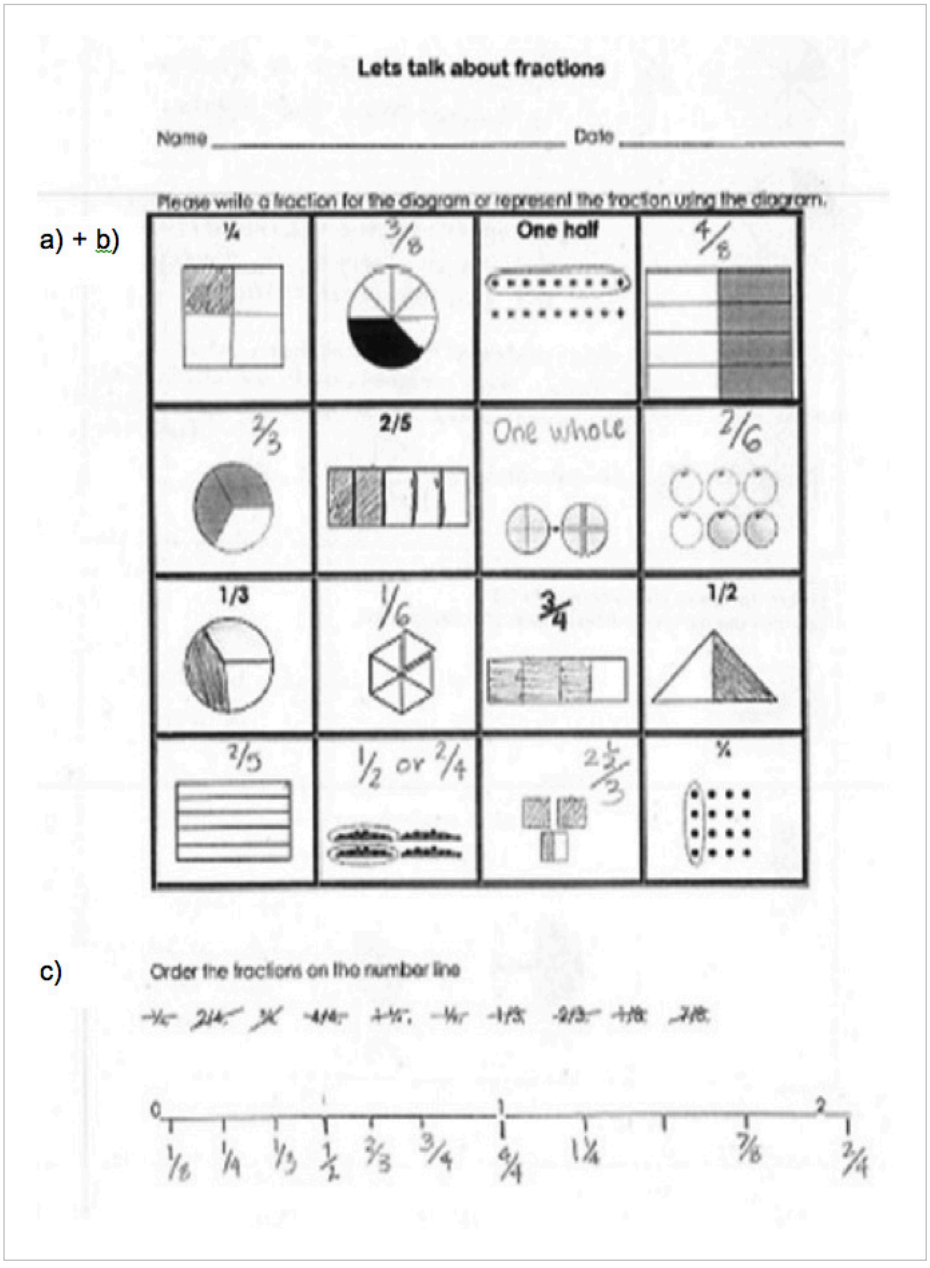
Work sample 5:
Fractions – Let's talk about fractions



Annotations

Demonstrates an understanding of locating unit fractions on a number line and also demonstrates an emerging understanding of locating non-unit fractions on a number line.

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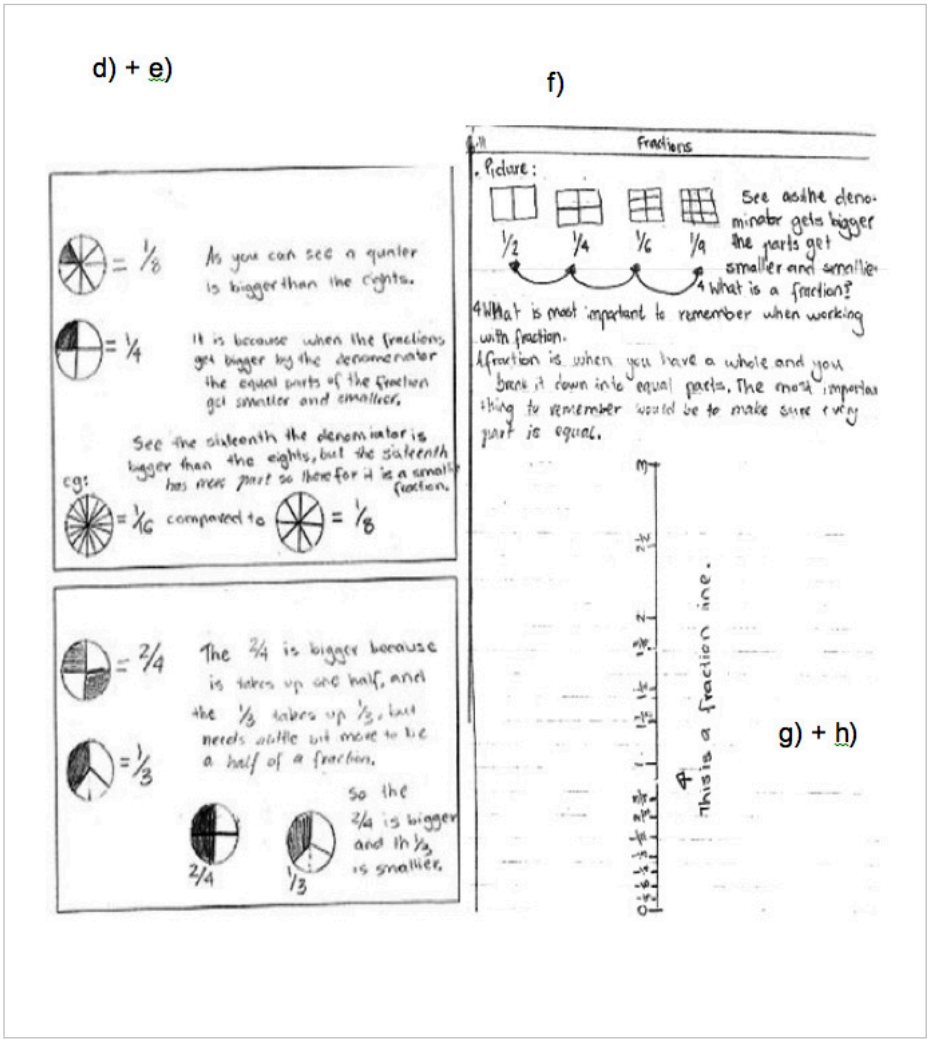
Work sample 5:
Fractions – Let's talk about fractions



Annotations

Demonstrates an understanding of locating unit fractions on a number line and also demonstrates an emerging understanding of locating non unit fractions on a number line.

Acknowledgment
ACARA acknowledges the contribution of trial school teachers and students for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

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Work sample 6:
Chance and data investigation

Relevant parts of the achievement standard

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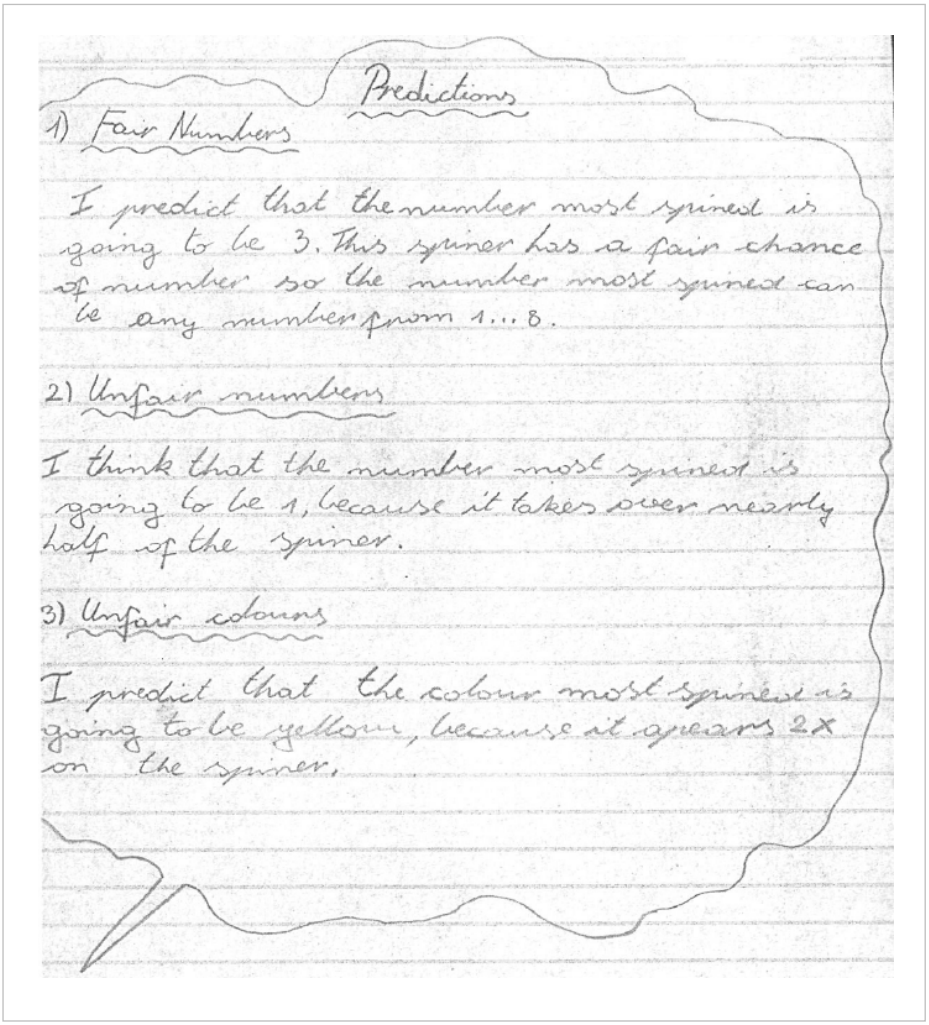
Summary of task

This task was the culmination of a series of activities dealing initially with the language of chance and then conducting simple chance experiments. The students had discussed fair and unfair spinners and the numerical chance of a particular result happening, for example 2 out of 6.

Students were required to make 3 spinners, one of the spinners had 4 colours but there was not an equal chance of spinning up each colour. The second spinner had 6 or 8 numbers on it with an equal chance of spinning up each number and the third spinner had 6 numbers on it with an unequal chance of spinning up each of the numbers.

Mathematics

Work sample 6:
Chance and data investigation

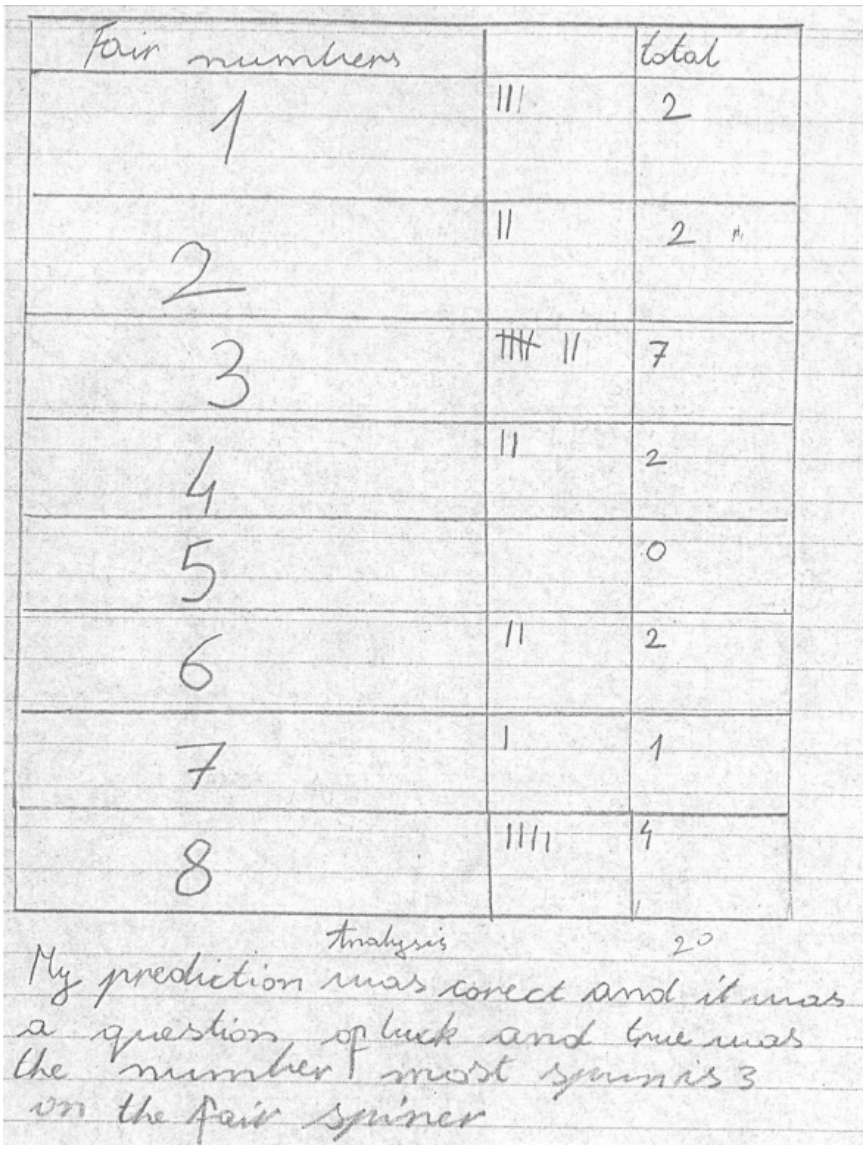


Annotations

Makes predictions of their experimental results.

Mathematics

Work sample 6:
Chance and data investigation



Fair numbers		total
1	III	2
2	II	2
3	⧸⧸⧸⧸ II	7
4	II	2
5		0
6	II	2
7	I	1
8	IIII	4

Analysis 20

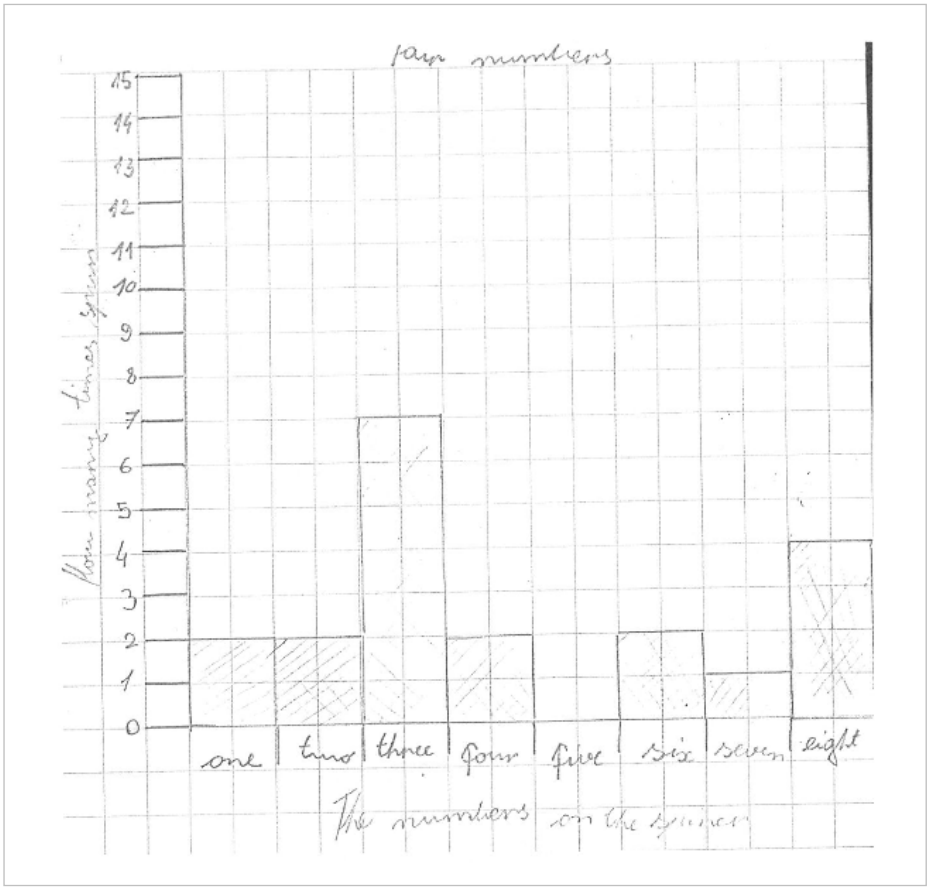
My prediction was corect and it was a question of luck and true was the number most spunis 3 on the fair spiner

Annotations

Lists possible outcomes for the experiment to obtain the data for the data display.

Mathematics

Work sample 6:
Chance and data investigation

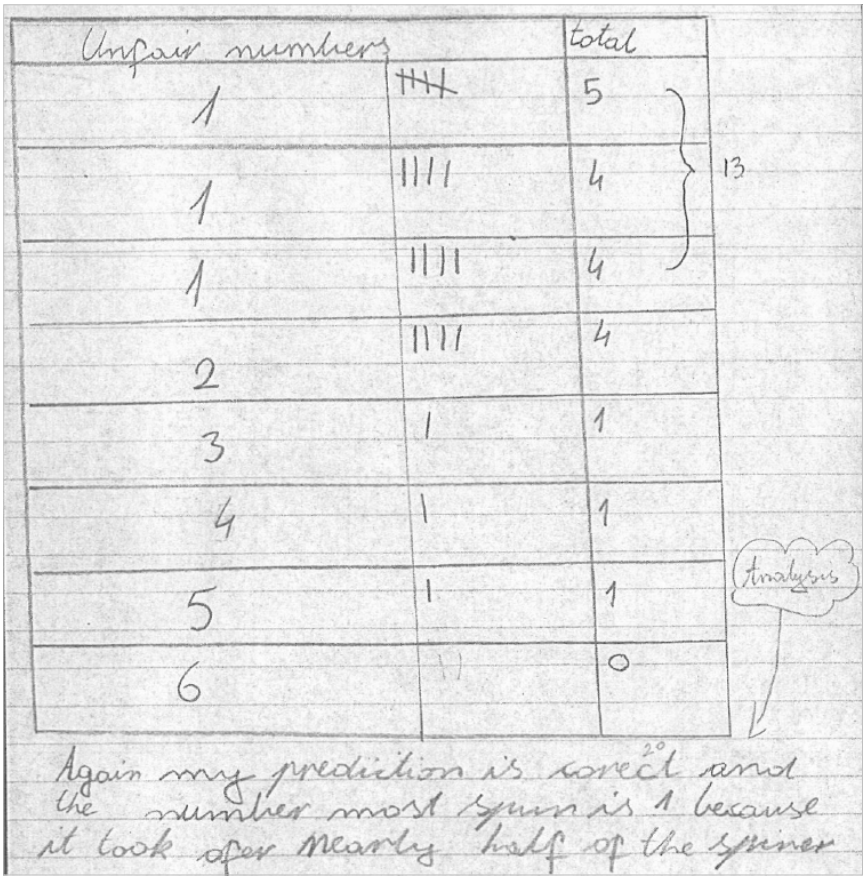


Annotations

Displays information in a column graph.

Mathematics

Work sample 6:
Chance and data investigation

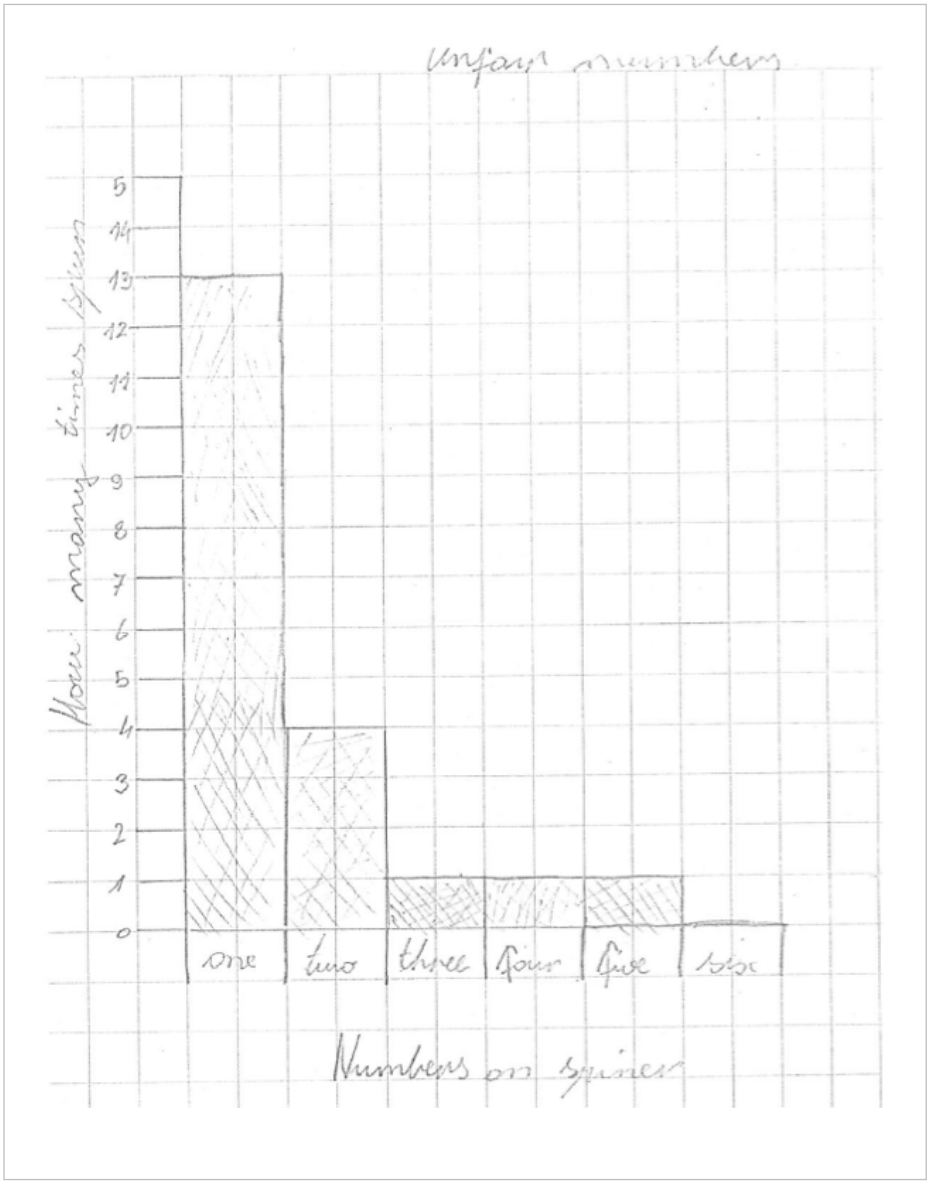


Annotations

Displays collected data in a table.

Mathematics

Work sample 6:
Chance and data investigation

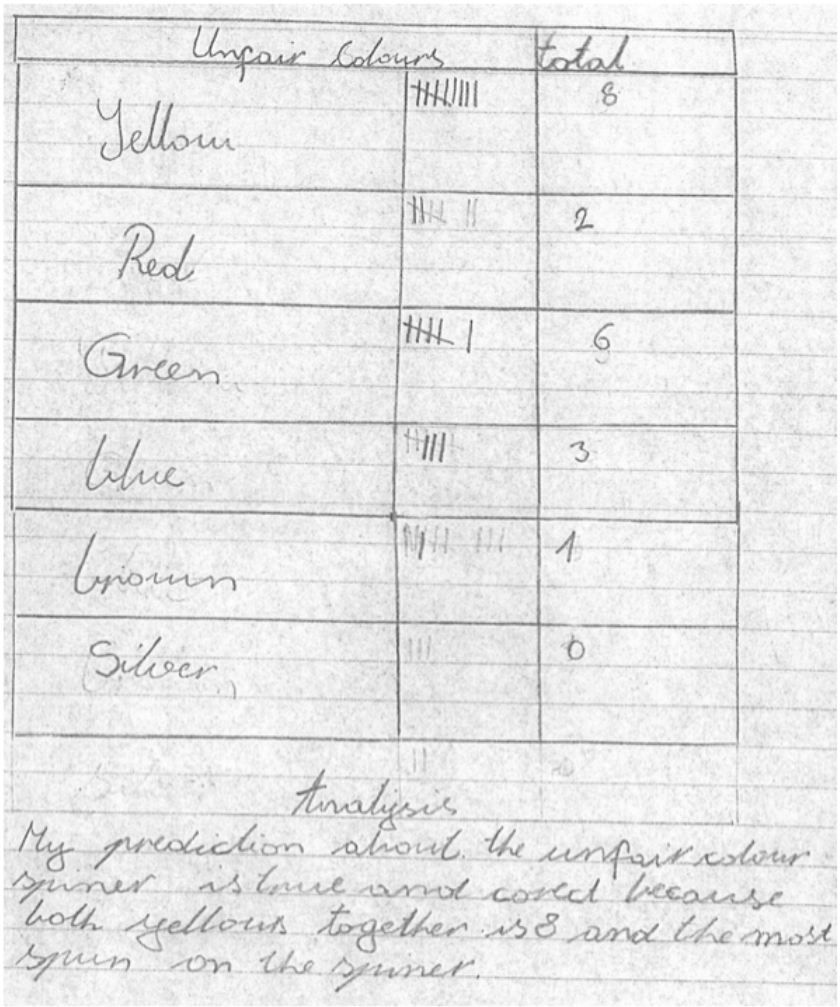


Annotations

Displays data correctly in a column graph.

Mathematics

Work sample 6:
Chance and data investigation



Unfair Colours		total
Yellow	HHHIIII	8
Red	HHH II	2
Green	HHH I	6
blue	HHH	3
brown	HHH III	1
Silver	III	0

Analysis

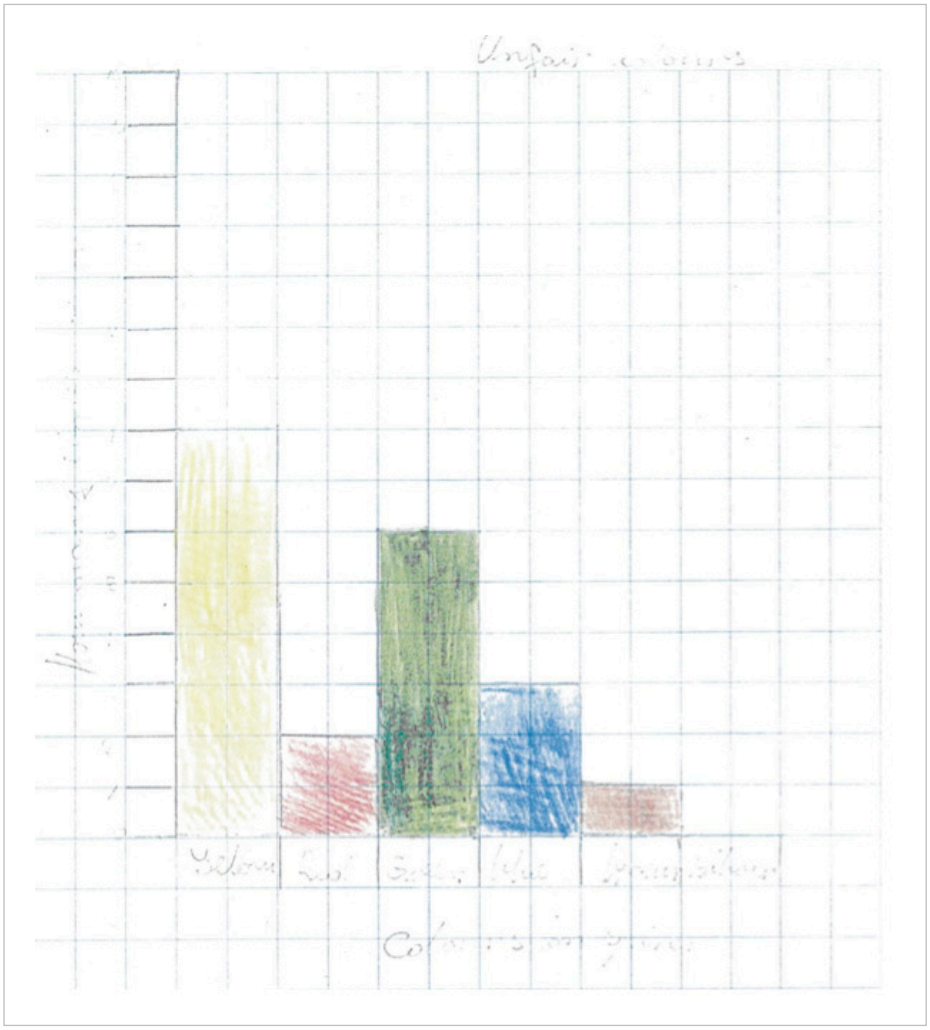
My prediction about the unfair colour spiner is true and corect because both yellows together is 8 and the most spun on the spiner.

Annotations

Displays collected data in a table.

Mathematics

Work sample 6:
Chance and data investigation

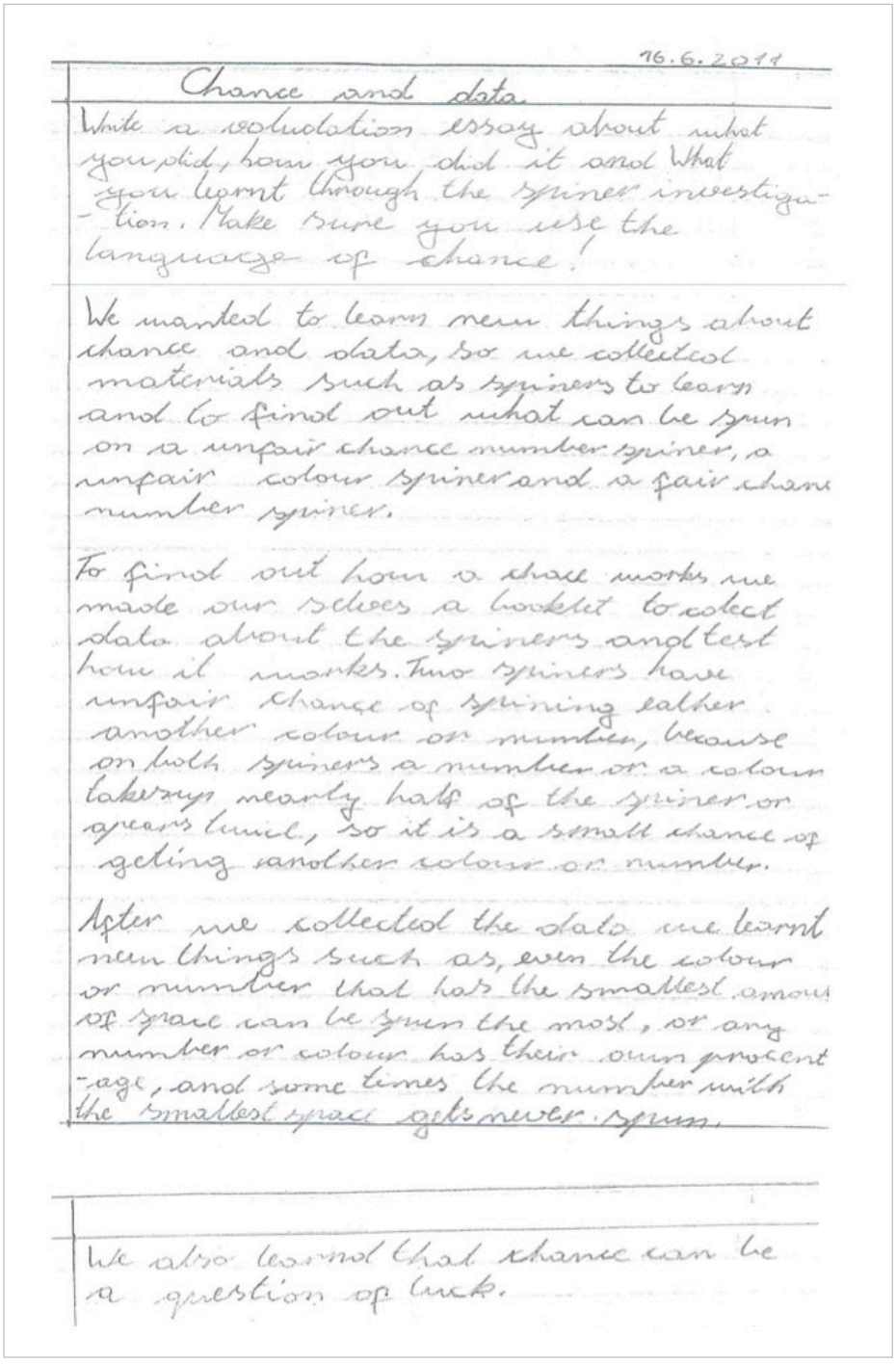


Annotations

Displays data correctly in a column graph.

Mathematics

Work sample 6:
Chance and data investigation



16.6.2011

Chance and data

Write a evaluation essay about what you did, how you did it and What you learnt through the spiner investigation. Make sure you use the language of chance.

We wanted to learn new things about chance and data, so we collected materials such as spiners to learn and to find out what can be spun on a unpair chance number spiner, a unpair colour spiner and a pair chan number spiner.

To find out how a chart works we made our selves a booklet to colect data about the spiners and test how it works. Two spiners have unpair chance of spining either another colour or number, because on both spiners a number or a colour takes up nearly half of the spiner or spears twice, so it is a small chance of geting another colour or number.

After we collected the data we learnt new things such as, even the colour or number that has the smallest amou of space can be spun the most, or any number or colour has their own precent -age, and some times the number with the smallest space gets never spun.

We also learnd that chance can be a question of luck.

Annotations

Reflects on the activity and makes generalised statements about chance.

Acknowledgment
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Work sample 7:
Units of measurement – Perimeter and area investigation

Relevant parts of the achievement standard

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Summary of task

This task was given to students to initiate discussions about efficient methods that they could use when calculating area and perimeter.

This task extended student knowledge of area and perimeter. Students needed to work out how many different 'arrangements' of rectangles could be made from each given area and investigate the relationship between perimeter and area for the different shapes of rectangles they had drawn. Working out was set on grid paper and students completed reflection questions about their learning and the work they had produced.

Mathematics

Work sample 7:
Units of measurement – Perimeter and area investigation

MATHS Name: _____ Date: _____

PERIMETER AND AREA INVESTIGATION

Do all right angled quadrilaterals (squares and rectangles) of the same area have the same perimeter?

If I drew two different rectangles with an area of 12cm², would they both have the same perimeter? No

Explain the maths thinking behind your prediction. Because the shapes can be different.

The task:
You need to prove your answer to the question above: *Do all squares and rectangles of the same area have the same perimeter?*

To do this, you need to investigate the perimeters of different shaped rectangles all with an area of 20cm²
- Draw your diagrams neatly in pencil, with a ruler, on graph paper.
- Label the length of the sides on your diagrams
- Calculate the area and perimeter for each shape
- You could draw a table to include your results

When you have done the 20cm² rectangles, investigate the perimeters of rectangles of two other areas (for example: 24cm², 32cm², 48cm²).

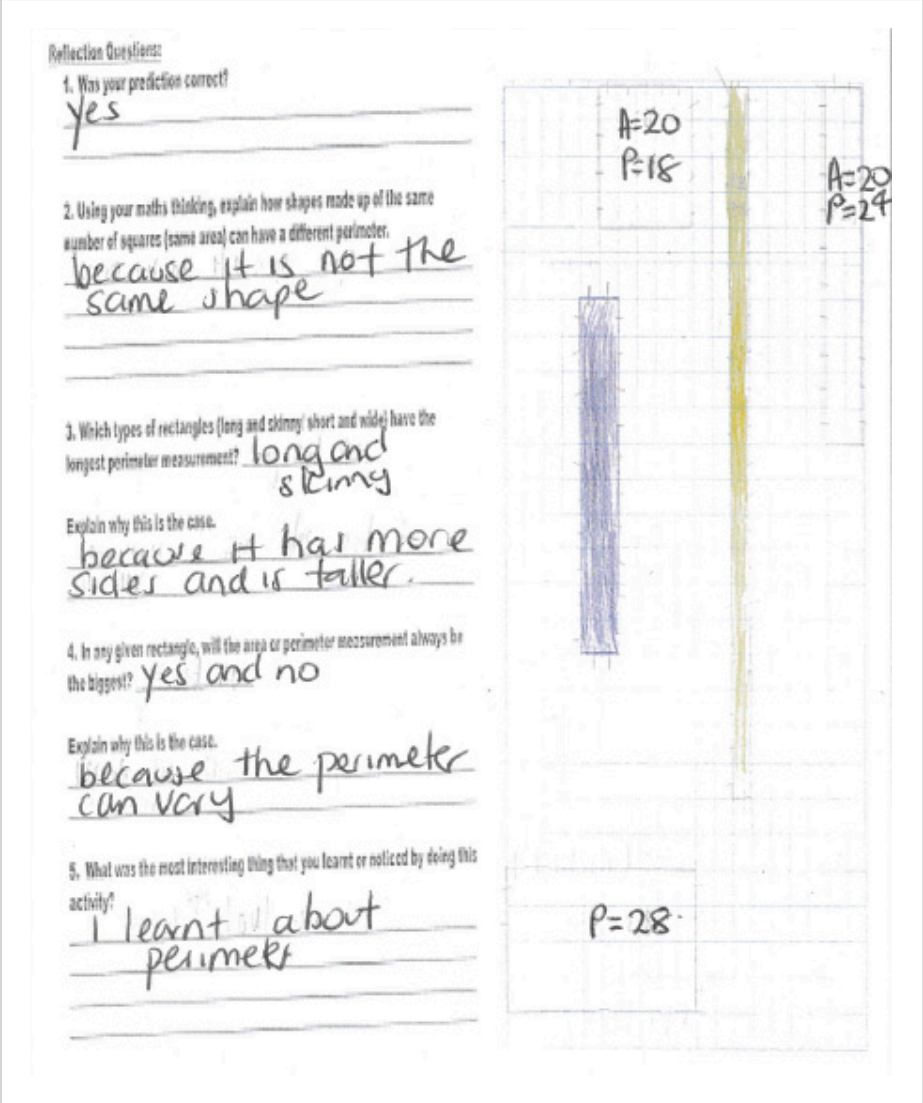
Choose a Challenge:
Draw a 20cm² shape with any arrangement that you wish, to give it the longest perimeter measurement possible.

Annotations

Correctly explains reasons for different perimeters.

Mathematics

Work sample 7:
Units of measurement – Perimeter and area investigation



Reflection Questions:

1. Was your prediction correct?
yes

2. Using your maths thinking, explain how shapes made up of the same number of squares (same area) can have a different perimeter.
because it is not the same shape

3. Which types of rectangles (long and skinny/ short and wide) have the longest perimeter measurement? long and skinny

Explain why this is the case.
because it has more sides and is taller.

4. In any given rectangle, will the area or perimeter measurement always be the biggest? yes and no

Explain why this is the case.
because the perimeter can vary

5. What was the most interesting thing that you learnt or noticed by doing this activity?
I learnt about perimeter

A=20
P=18

A=20
P=24

P=28

Annotations

Calculates area and perimeters of rectangles and begins to consider the properties of a shape which maximises the perimeter for a given area.

Acknowledgment
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Work sample 8:
Numbers – Multiplication and division webs

Relevant parts of the achievement standard

By the end of Year 5, students solve simple problems involving the four operations using a range of strategies. They check the reasonableness of answers using estimation and rounding. Students identify and describe factors and multiples. They explain plans for simple budgets. Students connect three-dimensional objects with their two-dimensional representations. They describe transformations of two-dimensional shapes and identify line and rotational symmetry. Students compare and interpret different data sets.

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Summary of task

Students were required to create web patterns using three or four-digit numbers. They were required to draw the web with multiplication facts on one side and division facts on the back. Students swapped their webs with a partner and wrote the answers in the outer web. They checked the answers with a calculator.

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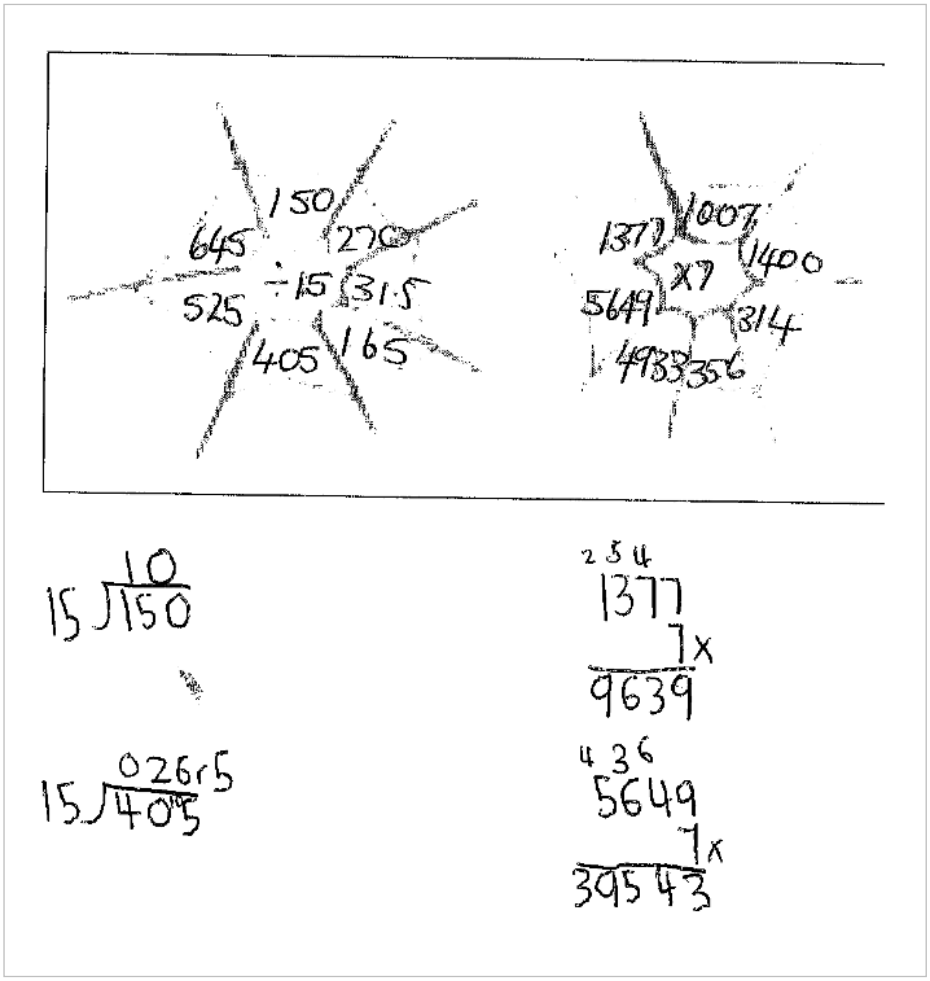
Work sample 8:
Numbers – Multiplication and division webs



Annotations

Selects and applies appropriate strategies for multiplication and division.

Uses formal written algorithms for multiplication and division.

Acknowledgment
ACARA acknowledges the contribution of the NSW Department of Education and Communities for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

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Work sample 9:
Location – Treasure island

Relevant parts of the achievement standard

By the end of Year 5, students solve simple problems involving the four operations using a range of strategies. They check the reasonableness of answers using estimation and rounding. Students identify and describe factors and multiples. They explain plans for simple budgets. Students connect three-dimensional objects with their two-dimensional representations. They describe transformations of two-dimensional shapes and identify line and rotational symmetry. Students compare and interpret different data sets.

Students order decimals and unit fractions and locate them on number lines. They add and subtract fractions with the same denominator. Students continue patterns by adding and subtracting fractions and decimals. They find unknown quantities in number sentences. They use appropriate units of measurement for length, area, volume, capacity and mass, and calculate perimeter and area of rectangles. They convert between 12 and 24 hour time. Students use a grid reference system to locate landmarks. They measure and construct different angles. Students list outcomes of chance experiments with equally likely outcomes and assign probabilities between 0 and 1. Students pose questions to gather data, and construct data displays appropriate for the data.

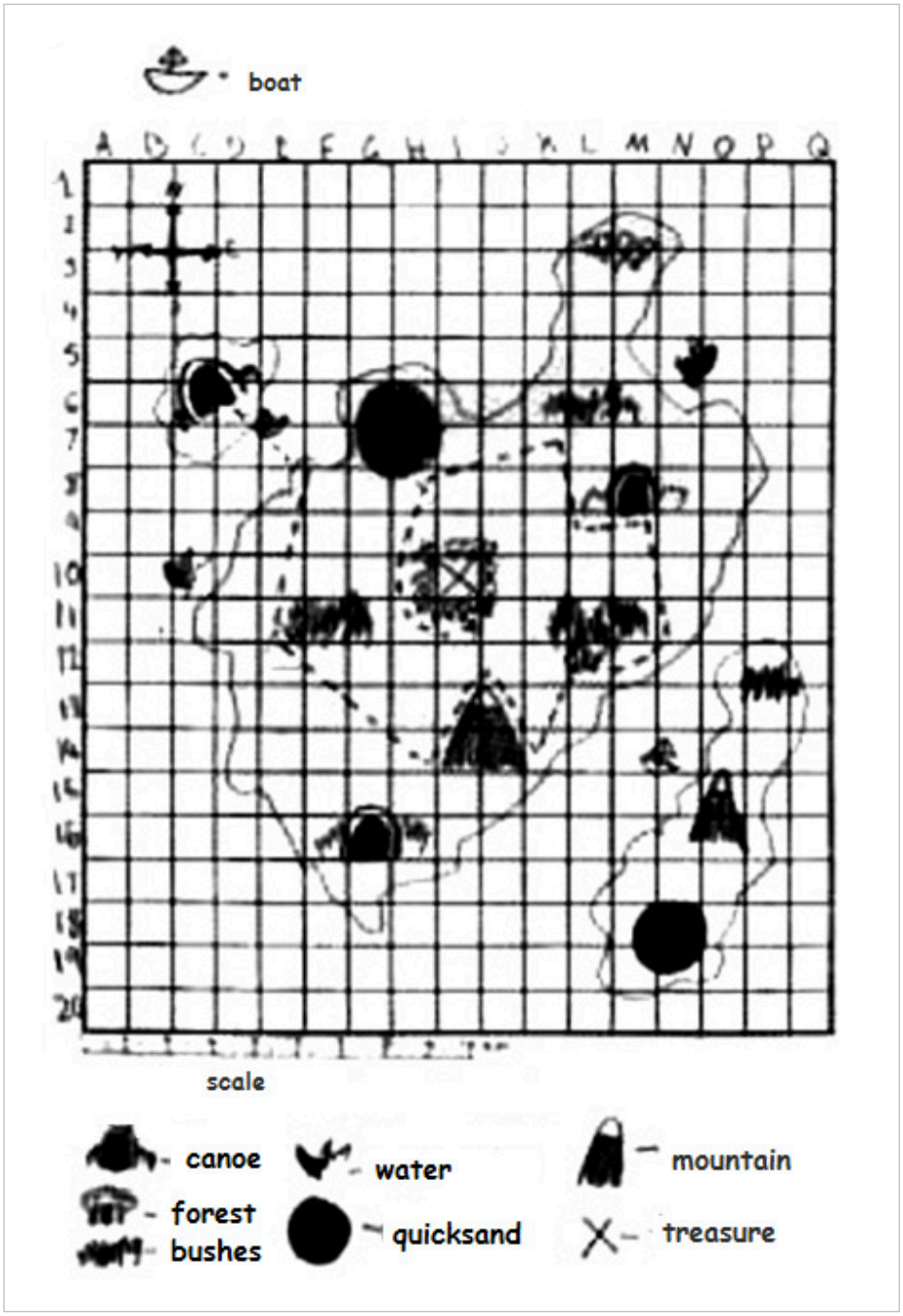
Summary of task

Students have studied maps and used a compass.

Students were asked to draw a treasure island map, creating a scale and compass rose, and imposing a grid and coordinates. They were required to write a set of directions, using compass points or grid coordinates, to the location of a hidden treasure on their map. Students exchanged maps and followed the directions to find the treasure. They were encouraged to comment on the scale used.

Mathematics

Work sample 9:
Location – Treasure island



Annotations

Locates landmarks on a grid and maps out a path to describe direction.

Acknowledgment
ACARA acknowledges the contribution of the NSW Department of Education and Communities for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

Mathematics

Work sample 10:
Geometry in buildings

Relevant parts of the achievement standard

By the end of Year 5, students solve simple problems involving the four operations using a range of strategies. They check the reasonableness of answers using estimation and rounding. Students identify and describe factors and multiples. They explain plans for simple budgets. Students connect three-dimensional objects with their two-dimensional representations. They describe transformations of two-dimensional shapes and identify line and rotational symmetry. Students compare and interpret different data sets.

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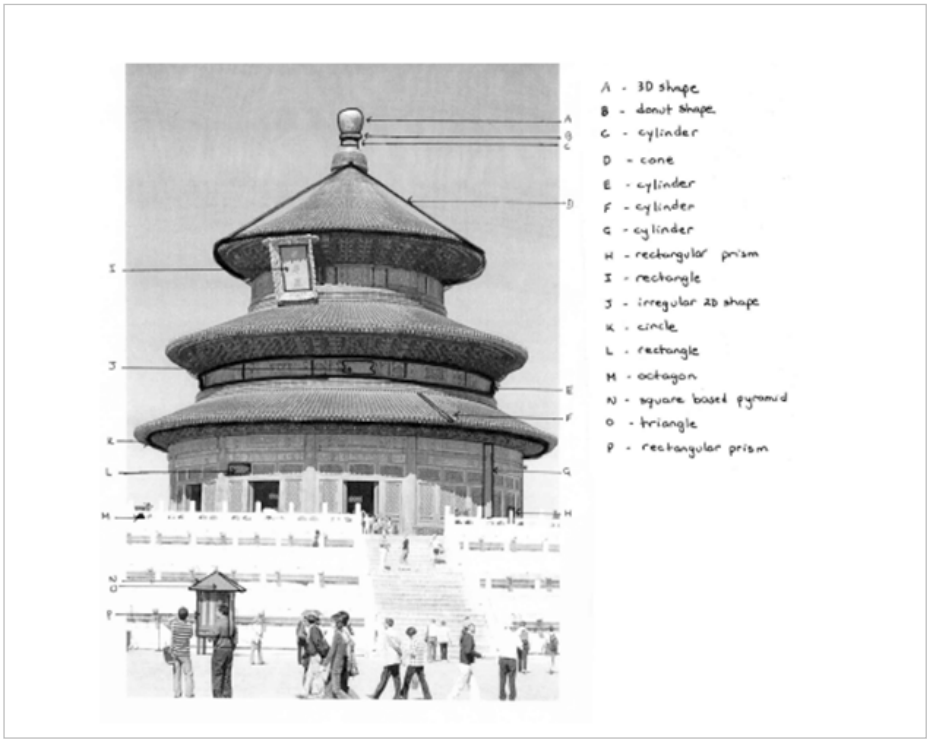
Summary of task

Students were provided with a worksheet and asked to describe different views of three-dimensional objects. They were required to complete a table to describe the properties of two-dimensional shapes and three-dimensional objects.

Mathematics

Work sample 10:
Geometry in buildings



Annotations

Identifies accurately the objects contained in the photograph.

Mathematics

Work sample 10:
Geometry in buildings

Worksheet: 2D shapes and 3D objects

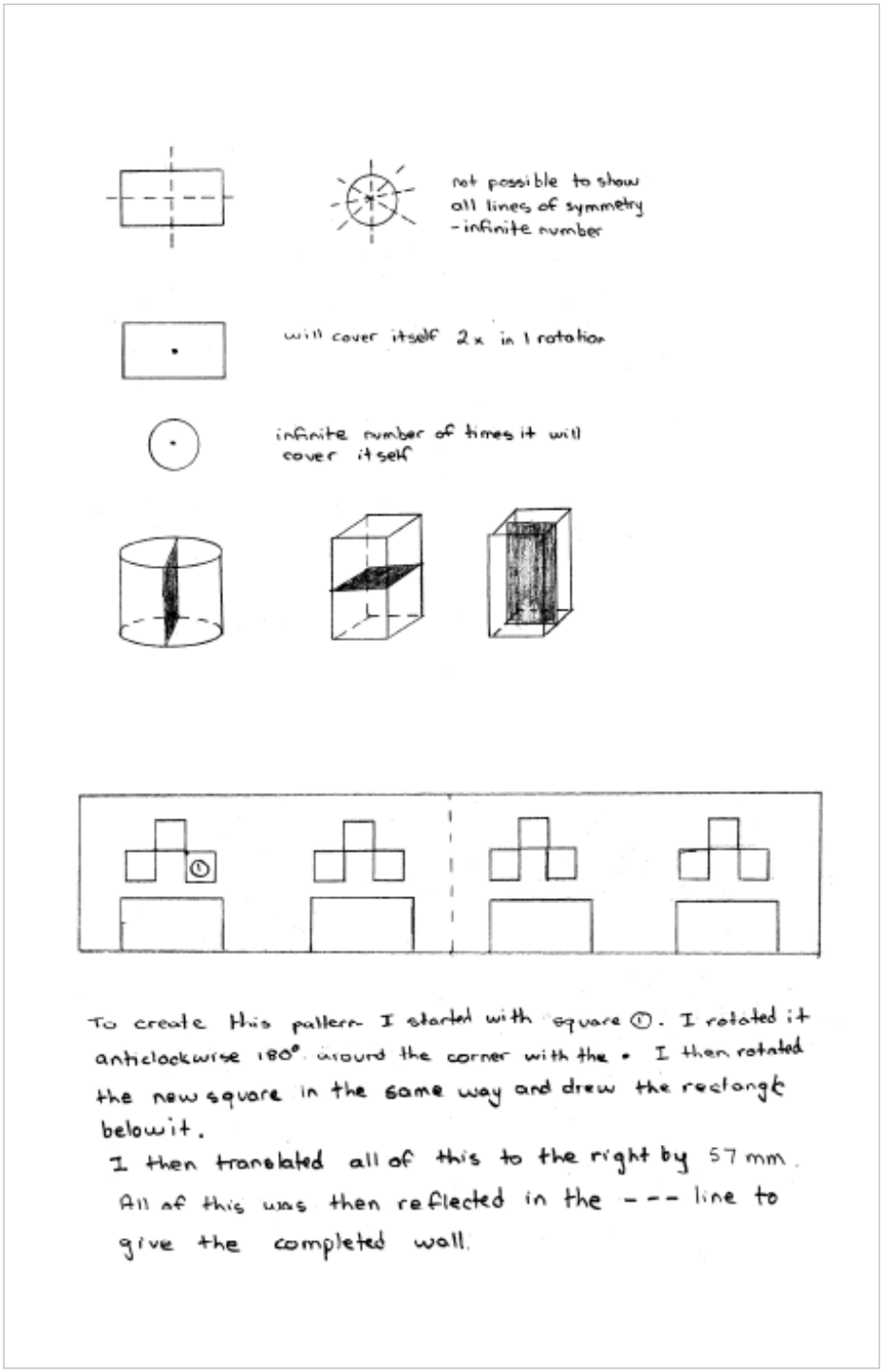
2D shapes		3D objects			
Polygons	**Non-polygons**	**Prisms**	**Pyramids**	**Platonic solids**	**Other**
3. Classify your 2D shapes or 3D objects by writing their names under the correct heading. You can also draw or glue the shapes and objects.					
rectangle octagon triangle	 	cylinder rectangular prism	cone square-based pyramid	 	
5. Write down some properties that each group have in common.					
a closed shape with straight edges	curved sides	top is the same as the base	faces meet at one point- the apex	all edges and faces are congruent	

Annotations

Completes the table to describe features of two-dimensional shapes and three-dimensional objects.

Mathematics

Work sample 10:
Geometry in buildings



Annotations

Correctly identifies line and rotational symmetries.

Acknowledgment
ACARA acknowledges the contribution of the Queensland Studies Authority for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

Mathematics

Work sample 11:
Numbers – Helping Silvana with division

Relevant parts of the achievement standard

By the end of Year 5, students solve simple problems involving the four operations using a range of strategies. They check the reasonableness of answers using estimation and rounding. Students identify and describe factors and multiples. They explain plans for simple budgets. Students connect three-dimensional objects with their two-dimensional representations. They describe transformations of two-dimensional shapes and identify line and rotational symmetry. Students compare and interpret different data sets.

Students order decimals and unit fractions and locate them on number lines. They add and subtract fractions with the same denominator. Students continue patterns by adding and subtracting fractions and decimals. They find unknown quantities in number sentences. They use appropriate units of measurement for length, area, volume, capacity and mass, and calculate perimeter and area of rectangles. They convert between 12 and 24 hour time. Students use a grid reference system to locate landmarks. They measure and construct different angles. Students list outcomes of chance experiments with equally likely outcomes and assign probabilities between 0 and 1. Students pose questions to gather data, and construct data displays appropriate for the data. [Underline aspects of the achievement standard demonstrated by the task]

Summary of task

Students were asked to identify a common mistake in carrying out a division algorithm. Students identified which answers were correct and which were incorrect. They were asked to provide advice on how to avoid the error in the future and explain a suitable checking strategy.

Mathematics

Work sample 11:
Numbers – Helping Silvana with division

Helping Silvana with division

One of your best friends, Silvana, asks you to help her with division. She shows you some division questions which she has done. They look like this:

$4\overline{)628}\,157$ $\quad 5\overline{)7235}\,1447$ $\quad 6\overline{)1248}\,28$ $\quad 3\overline{)4815}\,165$

1. First, check Silvana's answers. If answer is correct, tick it. If not, write the correct answer underneath.
2. Create a very hard question which you think Silvana might be able to answer correctly. Show how she might work out the answer.
3. Write down two questions which you think Silvana might get wrong. Give the answers Silvana might give to the questions, and then show the correct answers.
4. What would you show or tell Silvana to help her when she is doing division questions?
5. Some of Silvana's answers to the problems at the top of the page are far too small. Use one of her answers to explain this to her.

Question 1

$4\overline{)628}\,157$ $\quad 6\overline{)1248}\,28$ ×208

$5\overline{)7235}\,1447$ $\quad 3\overline{)4815}\,165$ ×1605

Question 2

$6\overline{)8682}\,1447$

Question 3

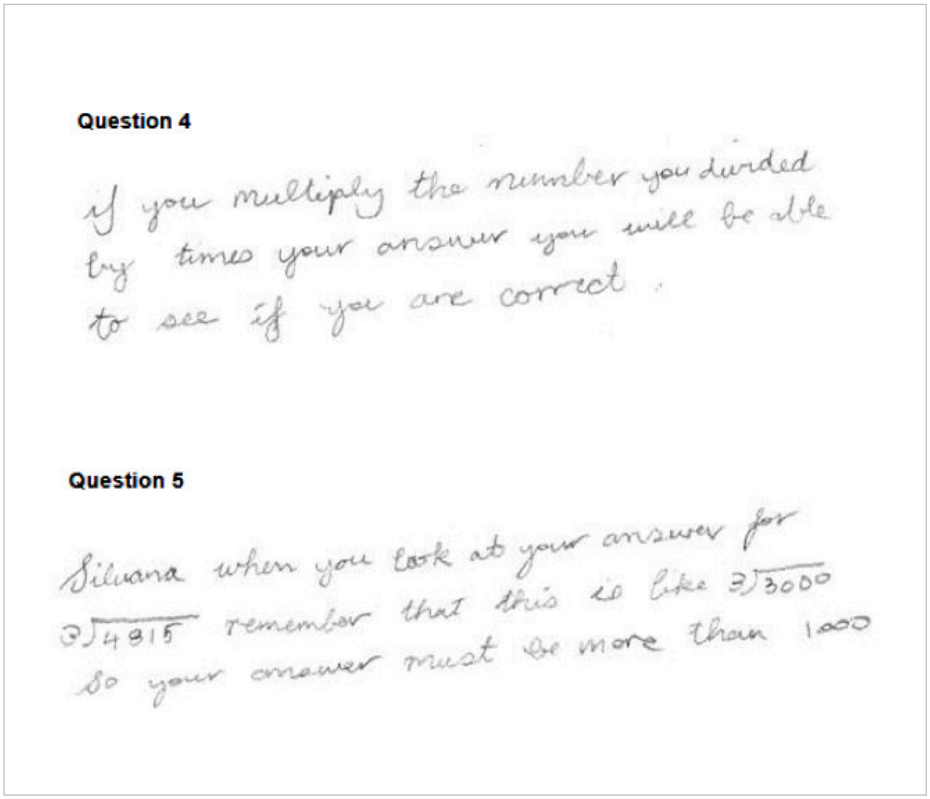
SILVANA'S ANSWER 164 $\quad 5\overline{)8020}\,1604$ $\quad$ SILVANA'S ANSWER 49 $\quad 6\overline{)2454}\,409$

Annotations

Uses mental strategies for the division of positive whole number.

Mathematics

Work sample 11:
Numbers – Helping Silvana with division



Question 4

if you multiply the number you divided by times your answer you will be able to see if you are correct.

Question 5

Silvana when you look at your answer for 3)4815 remember that this is like 3)3000 so your answer must be more than 1000

Annotations

Demonstrates clear understanding of this method for division in creating these examples which take account of the misconception of another student.

Acknowledgment
ACARA acknowledges the contribution of the VELS (Victorian Essential Learning Standards) for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.

Mathematics

Work sample 12:
Numbers – Missing digits

Relevant parts of the achievement standard

By the end of Year 5, students solve simple problems involving the four operations using a range of strategies. They check the reasonableness of answers using estimation and rounding. Students identify and describe factors and multiples. They explain plans for simple budgets. Students connect three-dimensional objects with their two-dimensional representations. They describe transformations of two-dimensional shapes and identify line and rotational symmetry. Students compare and interpret different data sets.

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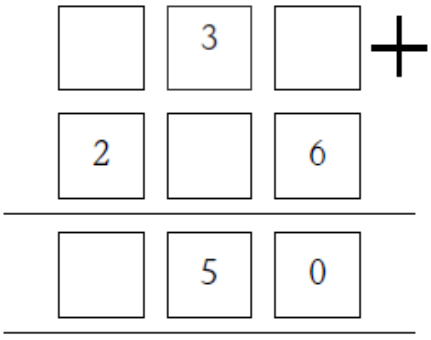
Summary of task

Students have been consolidating their understanding of addition with exchanging. This task builds on that understanding and introduces the concept of identifying unknown quantities.

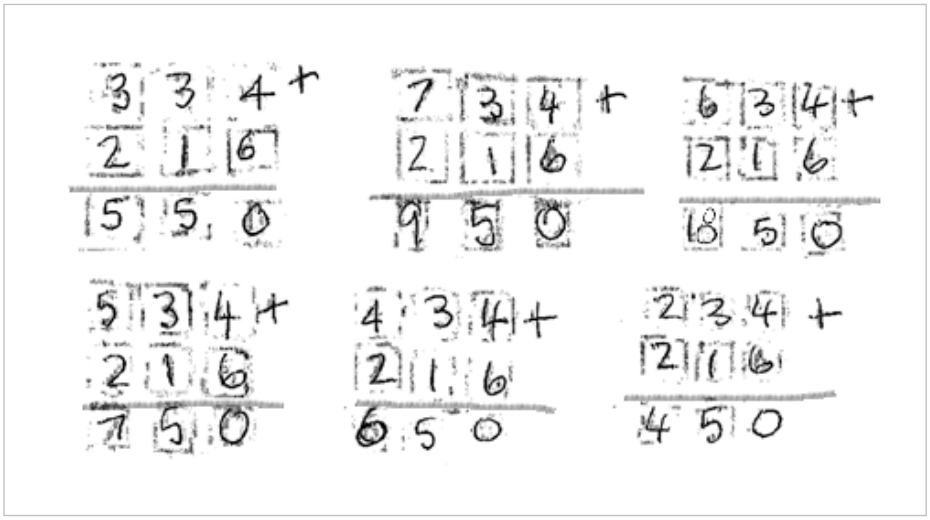
Students were shown a calculation to find the sum of two three digit numbers, with some of the digits missing.

- Students investigated possible solutions for this problem.
- Students were encouraged to design their own 'missing digits' problems.
- This activity was to be repeated using subtraction.



Mathematics

Work sample 12:
Numbers – Missing digits



Annotations

Demonstrates understanding of addition with exchanging and applies that to identifying unknown quantities.

Acknowledgment
ACARA acknowledges the contribution of trial school teachers and students for providing the tasks and work samples. The annotations are referenced to the Australian Curriculum achievement standards.