

The assessments included sixteen tasks investigating students' understandings, processes and skills in the area of mathematics called geometry. Geometry is concerned with geometrical relations in two and three dimensions, and their occurrence in the environment. It also involves recognition of the geometrical properties of everyday objects and the use of geometric models as aids to solving problems.

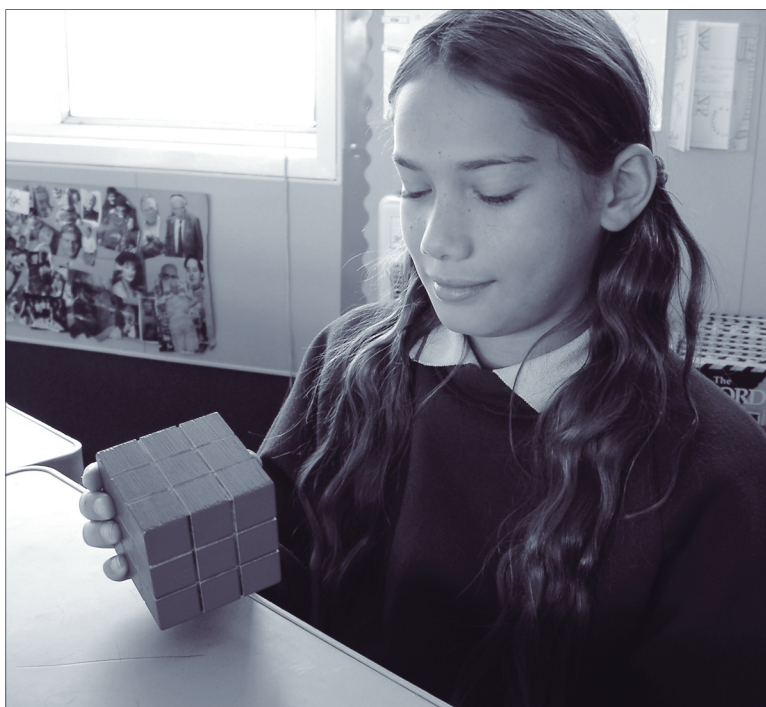
Eleven tasks were identical for both year 4 and year 8. One task had overlapping versions for year 4 and year 8 students, with some parts common to both levels. Four tasks were attempted only by year 8 students. Three are trend tasks (fully described with data for both 1997 and 2001), seven are released tasks (fully described with data for 2001 only), and six are link tasks (to be used again in 2005, so only partially described here).

The tasks are presented in the three sections: trend tasks, then released tasks and finally link tasks. Within each section, tasks attempted (in whole or part) by both year 4 and year 8 students are presented first, followed by tasks attempted only by year 4 students and then tasks attempted only by year 8 students.

Averaged across 41 task components administered to both year 4 and year 8 students, 23 percent more year 8 than year 4 students succeeded with these components. Year 8 students performed better on all components.

There was little evidence of change between 1997 and 2001 for year 4 students, but a small decline for year 8 students. Averaged across 13 trend task components attempted by year 4 students in both years, 2 percent more students succeeded in 2001 than in 1997. Gains occurred on 10 of the 13 components. At year 8 level, with 22 trend task components included, 5 percent fewer students succeeded in 2001 than in 1997. Gains occurred on 3 of the 22 components.

Many students were able to identify the nets of three-dimensional objects and to mirror a shape in a line of symmetry. Students had less success with visualising the internal structure and cross sections of three-dimensional objects, and with other spatial relationships tasks in three dimensions. Many year 8 students had limited capability to use and interpret angle measurements expressed in degrees.



TREND



Hedgehog

Approach: One to one **Level:** Year 4 and year 8

Focus: Understanding rotation and angles.

Resources: Garden picture with metal washer in the middle; model hedgehog to fit washer; recording book.

Questions/instructions:

Here is a hedgehog and its garden.

Hand student the hedgehog.

Put the hedgehog in the centre of the garden so it is facing the tree. I want you to move the hedgehog the way I tell you.

Write each student response on the recording sheet. After every turn, ask student to turn the hedgehog to face the tree again.



	% responses	
	2001 ('97)	2001 ('97)
1. First turn the hedgehog clockwise a quarter-turn. What is it facing?	year 4	year 8
flowers	63 (56)	92 (89)
2. Now turn the hedgehog clockwise a one-third turn. What is it facing?	cat	18 (13) 40 (40)
3. Now turn the hedgehog anti-clockwise a half-turn. What is it facing?	ladybird	65 (58) 85 (91)
turned anti-clockwise	77 (74)	94 (95)
4. Now turn the hedgehog anti-clockwise a three-quarters turn. What is it facing?	flowers	39 (38) 63 (77)

YEAR 8

5. Now turn the hedgehog 90° to the left. What is it facing?	spider	•	60 (67)
6. Now turn the hedgehog 360° to your left. What is it facing?	tree	•	74 (84)
turned left	•	91 (93)	
7. Turn the hedgehog 30° to the right. What is it facing?	butterfly	•	53 (58)
8. Turn the hedgehog 270° to the right. What is it facing?	spider	•	38 (44)
9. What directions could you give me if I wanted to turn the hedgehog to face the frog?	appropriate directions	•	35 (39)

PROMPT: Could you be more specific?

YEAR 4

	% responses		
	2001 ('97)	2001 ('97)	
10. Now turn the hedgehog 1/12 to the right. What is it facing?	year 4	year 8	
butterfly	17 (16)	•	
11. Now turn the hedgehog three-quarters around to the left. What is it facing?	flowers	37 (41)	•
12. What directions could you give me if I wanted to turn the hedgehog to face the frog?	appropriate directions	48 (45)	•

Commentary

Students were much more successful with 1/4 and 1/2 turns than others such as 1/3, 3/4, and 1/12. Year 4 students did equally well or slightly better in 2001 than in 1997, but year 8 students did a little worse in 2001 than in 1997.

Cut Cube

TREND

Approach: One to one **Level:** Year 4 and year 8
Focus: Spatial relationships.
Resources: Cube marked to be cut into 27 smaller cubes, and painted red, recording book.

Questions/instructions:**Hand student the red cube.**

Have a look at this wooden cube that has been painted red. Someone has started cutting it. Imagine that they are going to finish cutting along the lines so there would be many smaller cubes.

Write down the numerical answers you're given.

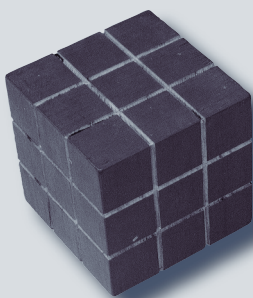
		% responses	
		2001 ('97) year 4	2001 ('97) year 8
1. How many smaller cubes would there be?	27	13 (13)	47 (58)
2. How many of the smaller cubes would have only one side or face that is painted red?	6	19 (18)	40 (49)
3. How many of the smaller cubes would have two sides that are painted red?	12	11 (7)	25 (28)
4. How many of the smaller cubes would have three sides that are painted red?	8	28 (31)	61 (72)
5. How many of the smaller cubes would have no sides or faces that are red?	1	14 (20)	51 (64)

Show student the answers you've written down for them.

Here are the answers you gave me to write down. Do you want to change any of them?

Write down any changes in the second column on the Recording Sheet.

No. changed: 2-5	15 (12)	22 (20)
1	24 (24)	34 (34)
0	61 (64)	44 (46)
Total score: 4-5	4 (4)	24 (36)
3	6 (7)	22 (20)
2	14 (14)	18 (18)
0-1	76 (75)	36 (26)

**Commentary**

This task proved challenging for most year 4 students and many year 8 students. Compared to the 1997 students, 2001 year 4 students performed very similarly but 2001 year 8 students scored noticeably lower.

Flat Shapes

TREND

Approach: One to one **Level:** Year 8
Focus: Nets of 3D objects.
Resources: Laptop computer with video recording of instructions and example; bottle with label, *Jaffa* packet, ruler, measuring tape.

Questions/instructions:

This activity is done on the computer. Click the button that says *Flat Shapes Part 1*. Click the *Play* button and watch the video that plays. Then:

1. Draw the shape of the label before it was put on the bottle (to the nearest centimetre). Label the length of each line.

	% responses 2001 ('97) year 8
label shape is rectangular	87 (89)
label size recorded accurately with or without units (8.5–8.9cm x 3.5–4.5cm)	21 (27)
recorded but incomplete or inaccurate	28 (23)

2. Write the name of the shape.

Answer: rectangle or oblong 68 (75)

Click the button that says *Flat Shapes Part 2*. Click the *Play* button and watch the video that plays. The video tells you what to do with the *Jaffa* packet.

3. Remember: you need to draw what the *Jaffa* packet looked like before it was made (to the nearest centimetre).
 - Draw dotted lines to show where you would fold it.
 - Label the parts of your drawing.
 - Label the length of each line.

Drawing of Jaffa box:

4 sides, 2 ends, 3 glueing flaps, 4 small flaps appropriately proportioned	10 (8)
as above, except not including 4 small flaps	7 (11)
4 sides and 2 ends, appropriately proportioned	30 (34)
basic idea correct but significant distortions	27 (18)

Measurements given and accurate:

(12–13cm, 3.1–3.9cm, 1.6–2.4cm)	all major	4 (20)
	most major	27 (17)

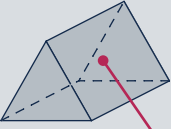
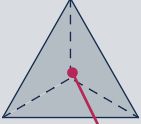
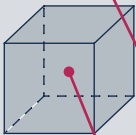




Commentary

Finer details and dimensions were often omitted. With the exception of recording dimensions (done better in 1997), the 2001 and 1997 results were similar.

Shapes and Nets

Approach: One to one **Level:** Year 4 and year 8
Focus: Matching 3D objects and their nets.
Resources: None.

Questions/instructions: Draw a line from each 3D shape to the net that would make the shape.

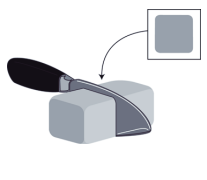
	% responses		
	y4	y8	
	68	85	
	58	83	
	56	83	
	73	88	
	39	67	
	42	65	
	60	86	
Total score:	7	22	54
	5-6	29	27
	3-4	18	8
	1-2	17	2
	0	14	9

Commentary
 On average, about 25 percent more year 8 than year 4 students correctly identified the net for each 3D object.

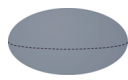
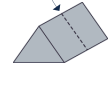
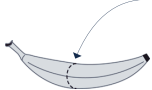
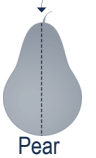

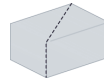
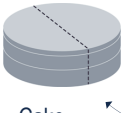
One Cut

Approach: One to one **Level:** Year 4 and year 8
Focus: Identifying shapes of cross-sections.
Resources: None.

Questions/instructions: The block of cheese has been cut through with one straight cut. The cut made a square cross section.



Draw the cross section for each of these items of food:

	% responses		
	y4	y8	
 oval	38	62	
 triangle	32	60	
 circle hexagon or similar	18	48	
 pear shaped 2D image	3	4	
	24	54	
 rectangle	16	41	
 rectangle	14	41	
Total score:	12	2	14
	9-11	9	25
	6-8	10	13
	3-5	11	9
	1-2	16	12
	0	52	27

Commentary
 Students found it hardest to identify the rectangular cross-sections for the cheese and cake. One quarter of the year 8 students and half of the year 4 students got none correct.

Paper Folds

Approach: Station

Level: Year 4 and year 8

Focus: Spatial relationships.

Resources: Folded, stapled paper with hole punched.

Questions/instructions:

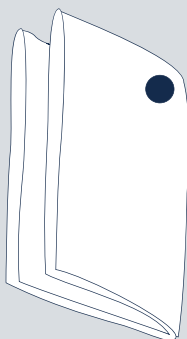
Look at the folded piece of paper.

DON'T take the staples out.

It was folded into 4 like this:

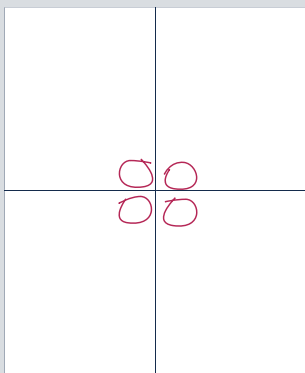


A hole was punched in it like this:



Where would the holes be when the paper was unfolded?

Draw your answer here:



% responses

y4 **y8**

**Drew 4 (and only 4) holes in correct places
(near centre fold) (as illustrated)**

25 **74**

Whetu's Frame

Boats

Approach: Independent **Level:** Year 4 and year 8

Approach: Station **Level:** Year 8

Focus: Edges and corners of 3D object.

Focus: Measuring angles.

Resources: None.

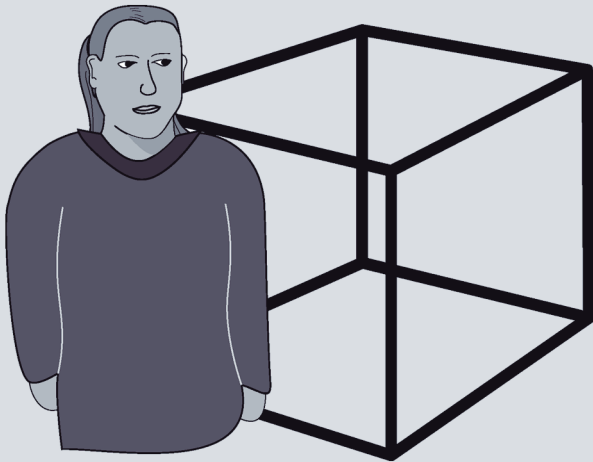
Resources: Protractor.

Questions/instructions:

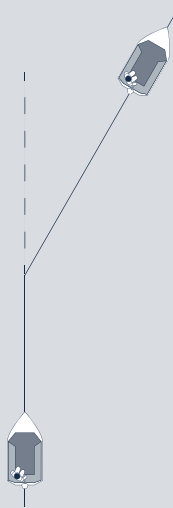
Questions/instructions:

Whetu wants to make a cube shaped frame. She will make it with plastic piping. Each edge will be 1 metre long.

How many degrees did the boats turn as they changed course?

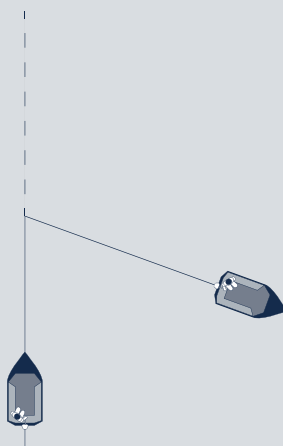


White boat



30±2	50
X 150±2	13

Black Boat



110±2	33
X 70±2	32

1. How much pipe does she need?

12 metres	14	43
12	31	30

2. What is the smallest number of corners she needs to use to make the frame?

8	44	73
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% responses
y4 y8

% responses
y8

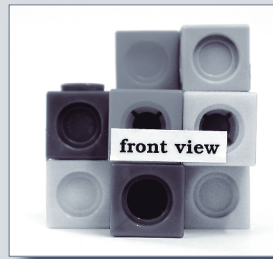
Grid Plans

Approach: One to one **Level:** Year 8

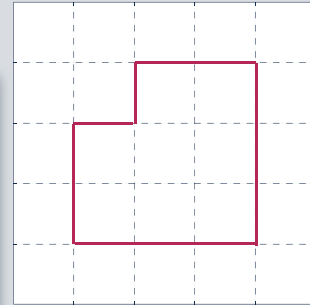
Focus: Different views (plans) of a 3D object.

Resources: Model made with multilink cubes.

Questions/instructions:



Front



% responses
y8

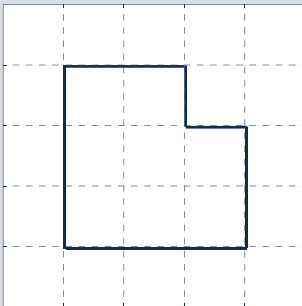
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In front of you is a model made with blocks.

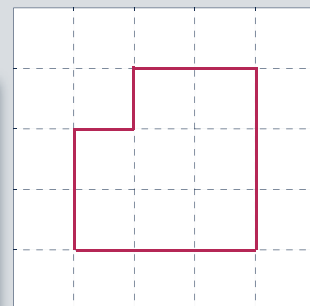
On the grids below, draw the shape of each view.

The first one has been done for you.

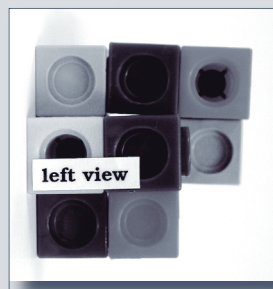
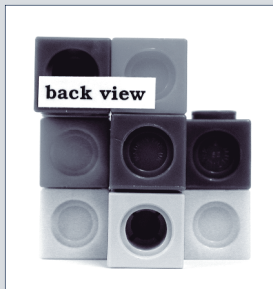
Back



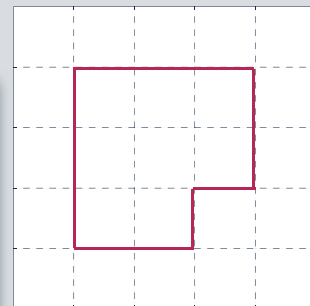
Right



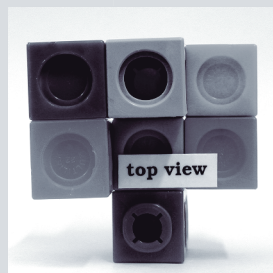
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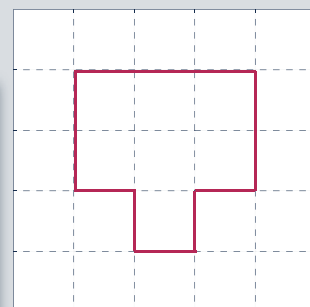
Left



46



Top



73

Link Tasks 24 - 29

			% responses						% responses								
			y4	y8				y4	y8								
LINK TASK 24						LINK TASK 26						LINK TASK 28					
<i>Approach:</i> One to one						<i>Approach:</i> Station						<i>Approach:</i> Independent					
<i>Level:</i> Year 4 and year 8						<i>Level:</i> Year 4 and year 8						<i>Level:</i> Year 4 and year 8					
<i>Focus:</i> Describing 3D objects.						<i>Focus:</i> Spatial relationships.						<i>Focus:</i> Drawing 2D objects.					
Total score:	12-27	9	13				Total score:	5	29	38				Item:	1	22	57
	9-11	14	26					4	22	30					2	77	88
	6-8	31	35					3	13	10					3	84	94
	3-5	38	22					2	8	5					4	25	41
	0-2	8	4					1	9	4							
								0	19	13							
LINK TASK 25						LINK TASK 27						LINK TASK 29					
<i>Approach:</i> Independent						<i>Approach:</i> Station						<i>Approach:</i> Independent					
<i>Level:</i> Year 4 and year 8						<i>Level:</i> Year 4 and year 8						<i>Level:</i> Year 8					
<i>Focus:</i> Nets of 3D objects.						<i>Focus:</i> Lines of symmetry.						<i>Focus:</i> Angles.					
Item:	1	32	61				Item:	1	66	75				Item:	1	51	
	2	74	88					2	47	69					2	50	
	3	25	40												3	71	
	4	80	91														
	5	44	77														
	6	79	94														