

The following examples of student work illustrate achievement at the mathematics standards for years 5 and 6.

## Interlocking Photo Frames

The task used in this illustration relates to achievement objectives for Number and Algebra from the mathematics and statistics learning area in *The New Zealand Curriculum*. It was adapted from an activity in *Figure It Out, Algebra: Book One*, Link (years 7–8), pages 12–13.

### Interlocking Photo Frames

Nikki's mum is on the organising committee for the new community centre. They want to hang photos of local people, community activities, and historical places around the walls.

Nikki's mum suggests that they use a series of interlocking photo frame pieces. (Each frame has 4 pieces, but two frames "share" a piece when they are joined together.) The committee try this idea with 3 photos and find that they would need 10 frame pieces.



#### Task

1. If 10 frame pieces are needed for 3 photos, how many pieces are needed for 8 photos?
2. Can you find a rule for the number of frame pieces needed for any number of photos? Apply your rule to different numbers of photos.
3. How many frame pieces are needed for 99 photos?

Some features of students' work used to make judgments in relation to the mathematics standards are described below.

### Interlocking Photo Frames

#### New Zealand Curriculum: Level 3

In solving problems and modelling situations, students will:

##### Number and Algebra

- use a range of additive ... strategies with whole numbers ... (number strategies)
- know basic multiplication ... facts (number knowledge)
- ... use ... diagrams to find relationships between successive elements of number ... patterns (patterns and relationships)

#### Mathematics Standard: By the end of year 5

##### Number and Algebra

- apply additive ... strategies ... to:
  - combine or partition whole numbers
- describe ... number patterns, using rules that involve ... repeated addition or subtraction, and simple multiplication



Nikki modelled the problem and described what she discovered. She pointed to the first frame that she made.

I started with the first photo frame – that used 4 – and then I added 3 more sticks for each extra photo. So for 8 photos, it would be 4 and 7 lots of 3.

Nikki used an additive strategy (grouping) to work out “4 plus 7 lots of 3”

$4 + 3 + 3 + 3 + 3 + 3 + 3 + 3$   
 $4 + 15 + 6 = 25$  You would need 25 frame pieces for 8 photos.  
 You start at 4 add 3 for each extra photo  
 So for 8 photos it is  $4 + 7 \times 3$   
 So ten would be  $4 + 9 \times 3 = 4 + 27$  so 31

Nikki found a rule for any number of photos. She applied her rule to 10 photos.

Nikki used an additive strategy – rounding and compensation – to solve the problem in question 3.

For 99 photos  $4 + 98 \times 3 = 298$

For 99 photos, the first one will take 4 frame pieces and the rest need 3 each. So that is  $4 + (98 \times 3)$ . I can make two of the 98s into 100 by adding the 4. So  $200 + 98 = 298$ .

### Discussion

This task provides some of the evidence needed to show that Nikki is achieving at early curriculum level 3 and the year 5 standard in Number and Algebra. Nikki has demonstrated that she is able to describe and identify a rule for a pattern. She is able to apply additive strategies to combine whole numbers and to use basic multiplication facts. This suggests that she is working at the Advanced Additive stage of the Number Framework.

## Interlocking Photo Frames

### New Zealand Curriculum: Level 3

In solving problems and modelling situations, students will:

#### Number and Algebra

- use a range of additive and simple multiplicative strategies with whole numbers ... (number strategies)
- know basic multiplication and division facts (number knowledge)
- connect members of sequential patterns with their ordinal position and use tables ... to find relationships between successive elements of number ... patterns (patterns and relationships)

### Mathematics Standard: By the end of year 6

#### Number and Algebra

- apply additive and simple multiplicative strategies flexibly to:
  - combine or partition whole numbers, including performing mixed operations ...
- determine members of sequential patterns, given their ordinal positions
- describe ... number patterns, using:
  - tables ...
  - rules that involve ... repeated addition or subtraction, and simple multiplication

photos	frame pieces
1	4
2	7
3	10
4	13
5	16
6	19
7	22
8	25

Carl used a table to help him find a rule and solve the problem.



Adding 3 each time  
every frame has 3 and you need 1 extra  
for the first one so it is  $8 \times 3 + 1$  for 8 photos

number of photos	rule	frame pieces
10	$10 \times 3 + 1$	31
27	$27 \times 3 + 1$	82
76	$76 \times 3 + 1$	229
83	$83 \times 3 + 1$	250

The number of photos  $\times 3 + 1$  is the rule.

Carl applied his rule to random numbers.

$$27 + 27 = 54$$

$$54 + 27 = 81$$

$$75 \times 3 = 225$$

$$225 + 3 = 228$$

$$80 \times 3 = 240$$

$$3 + 3 = 9$$

Carl used additive and multiplicative strategies to solve expressions generated by his rule.

so for 99 photos  
it would be  $99 \times 3 + 1$  298  
 $3 \times 100 - 3 + 1$

Carl solved question 3 by applying his rule. He used rounding and compensation to get his answer.

## Discussion

This task provides some of the evidence needed to show that Carl is achieving at curriculum level 3 and the year 6 standard in Number and Algebra. He made a table to help identify a rule for a pattern and was able to apply the rule with understanding. He has demonstrated that he can apply additive and simple multiplicative strategies flexibly. This suggests that he is working at the Advanced Additive stage of the Number Framework.