

## Patterns and Algebra 1

### Stage 3 Outcome

A student:

- › describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions MA3-1WM
- › selects and applies appropriate problem-solving strategies, including the use of digital technologies, in undertaking investigations MA3-2WM
- › gives a valid reason for supporting one possible solution over another MA3-3WM
- › analyses and creates geometric and number patterns, constructs and completes number sentences, and locates points on the Cartesian plane MA3-8NA

**Language:** Students should be able to communicate using the following language: pattern, **increase**, **decrease**, missing number, number sentence, number line.

### Teaching and Learning Activities

### Notes/ Future Directions/Evaluation

### Date

#### Ignition Activities

#### Think, Pair, Share.

Students think of a number between 1 and 100 and write 10 facts about that number. They then share their facts with a partner and note any common patterns. Finally, they share patterns with another pair. The groups of four create number sentences using the four initial numbers.

#### What's This Table?

Draw tables such as the ones below, leaving out the title and row or column headings. For example, draw the first table below and explain to students that you want them to think about what the missing table title and row headings could be.

Ask students to suggest a title and row headings, and give explanations for their suggestions. Note how they describe the relationships between the sets of numbers, and support them to express the relationships appropriately.

	1	2	3	4	5	6	7	8	9	10
	7	14	21	28	35	42	49	56	63	70

Possible row headings in the above table include:

**Number of weeks** and **Number of days**,

**Number of heptagons** and **Number of sides**,

**Number** and **Number multiplied by 7**,

**Number of houses** and **Number of windows** (if they have drawn some houses to accompany the table).

Here is another table with missing title and column headings. This table is drawn on a poster and over several days students write their suggested title and column headings

under the table.

1	10
2	20
3	30
4	40
5	50
6	60

The column headings in this table could be:  
**Number of people** and **Number of toes**, or  
**Number of decagons** and **Number of angles**, or  
**Number** and **Number multiplied by 10**.

**Painting Cubes**

Students investigate:

- Tell students that a class has made some wooden cubes. They have decided to paint the faces of the cubes. They are going to group their cubes starting with one cube in a group, two cubes stuck together in the next group, three stuck together in the next and so on. The cubes are always stuck together to form a line.  
 How many faces will they have to paint when four cubes are stuck together? How many when eight are stuck together? Etc  
 Discuss the differences between different placements, eg, 1 x 4 array
- Record in a table (see below)

Cubes				
Painted sides				

**Regular Polygons**

- Have students draw the regular polygons from a triangle up to an octagon on a sheet of paper. Complete a table showing the number of equal sides, diagonals and axes of symmetry.
- What is the pattern you can see?
- Students predict, then calculate, how many axes of symmetry and diagonals a decagon has
- Get the students to record the pattern of sides, diagonals, axes of symmetry in a table of values.

### Number Squares With Missing Numbers

This activity presents a number sequence in a concrete context. Show one of the number square cards such as the one below and ask students to work out which sequence of numbers is formed by the missing numbers. They label the sequence, not simply list the missing numbers.

1	2	3	4	5	6
7	8	9	10	11	
13	14	15	16	17	18
19	20	21	22	23	
25	26	27	28	29	30
31	32	33	34	35	

The missing numbers can be described as the multiples of 12, every twelfth whole number, or count-by-12 numbers. Ask questions such as: *If the rows of numbers continued, what would be the missing number in the tenth row? What would be the twentieth missing number?*

1	2		4	5		7	8	
10	11		13	14		16	17	
19	20		22	23		25	26	
28	29		31	32		34	35	
37	38		40	41		43	44	
46	47		49	50		52	53	
55	56		58	59		61	62	
64	65		67	68		70	71	
73	74		76	77		79	80	

Students write questions about these number squares.

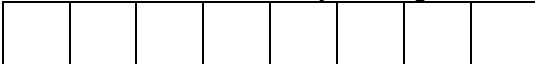
1	2	3	4	5		7	8	9
10	11		13	14	15	16	17	
19	20	21	22	23		25	26	27
28	29		31	32	33	34	35	
37	38	39	40	41		43	44	45
46	47		49	50	51	52	53	
55	56	57	58	59		61	62	63
64	65		67	68	69	70	71	
73	74	75	76	77		79	80	81

### Fibonacci numbers

Discuss History of Fibonacci numbers. On the board write the numbers **1,1,2,3,5,8,13,21** and say that this is the way that number sequence Leonardo wrote about. Invite individuals to write about what they notice and predict the next few numbers.

### A Sticky Problem

- Ask students how many rectangles are in this figure?



- Students suggest strategies for solving the problem
- Establish that a square is a special kind of rectangle
- Draw up a table as below

Drawing	Squares	Rectangles	Total
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ف	1	1	2												
فف	2	3	5												
ففف	3	6	9												
فففف	4	10	14												
<ul style="list-style-type: none"> <li>• Complete first four rows</li> <li>• Discuss findings for first four rows. What patterns are emerging?</li> <li>• Predict what the answer for the problem might be</li> <li>• Complete the table to check prediction</li> </ul>															
<p><b>Guided group/Independent Activities-some suggestions</b></p> <p><b>Identifying Simple Number Patterns</b></p> <p><b>Find My Pattern</b></p> <ul style="list-style-type: none"> <li>• Teacher asks a student for a starting number eg 3</li> <li>• Teacher gives an answer eg 6</li> <li>• Class records the first number and the teacher's response</li> <li>• Teacher asks another student to give a number and gives an answer eg 5-8, 11-14 etc</li> <li>• Continue until someone identifies the rule the teacher is applying</li> </ul>															
<p><b>Picking Apples</b></p> <p>Students are given the problem:</p> <ul style="list-style-type: none"> <li>• At the beginning of the season an apple picker picks: <ul style="list-style-type: none"> <li>○ one ripe apple on the first day</li> <li>○ two on the second</li> <li>○ four on the third and</li> <li>○ eight on the fourth</li> </ul> </li> <li>• How many is he likely to pick on the tenth day?</li> <li>• How many on the fifteenth?</li> </ul>															
<p><b>What is missing?</b></p> <p>Teacher writes a collection of numbers on the board. Students investigate to decide what number is missing eg</p> <table> <tr> <td>17</td> <td>53</td> <td>41</td> <td>11</td> <td>35</td> </tr> <tr> <td>59</td> <td>47</td> <td>5</td> <td>23</td> <td></td> </tr> </table>						17	53	41	11	35	59	47	5	23	
17	53	41	11	35											
59	47	5	23												

**Fool a Friend**

- Students work in pairs
- One student creates a rule and gives some examples of the pattern to their partner
- Their partner uses the clues to discover the rule
- Swap roles

**Investigating Patterns**

Triangular Numbers means numbers that can be represented by a triangular patterns dots. The first three triangular 1,3,6 can be represented by

- Students use grid paper to draw, then cut out the first five triangular numbers eg



- Ask students to describe the patterns in as many ways as possible
- Move the one pattern to the empty space on the pattern for 3. What happens?  $3+1=4$  – which is a square number
- Investigate which other patterns combine. Write about the new pattern that emerges
- Work out the perimeter of each staircase – is there a pattern?
- Investigate the area of each staircase – is there a pattern?
- Predict the perimeter and area of the 20<sup>th</sup> staircase. Explain your thinking.
- How could you work out the 20<sup>th</sup> triangular number without having to work them all out?

**Integrating Technology Into teaching Mathematics**

**Sites2See: Patterns and Algebra**

Selected links to a range of interactive and print resources for the Patterns and Algebra strand for K-6 Mathematics.

[http://lrr.dlr.det.nsw.edu.au/LRRView/10286/10286\\_00.htm](http://lrr.dlr.det.nsw.edu.au/LRRView/10286/10286_00.htm)

