


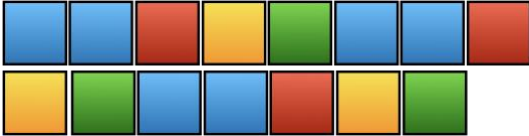
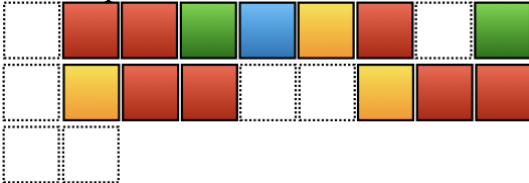
DEVELOPING MATHEMATICAL INQUIRY COMMUNITIES

Number and Algebra: Patterns
and Relationships
Level 2 (Year 3/4)
Teacher Booklet

Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

<p>Task 1</p>	<p>Litea has a giant bag of M & Ms. She likes to eat her favourite colours of M & Ms in a specific order: red, blue, green, yellow</p> <p>What will be the colour of the 83rd M & M that she eats?</p> <p>Find two different ways of solving the task and representations to prove your solutions.</p>
<p>Big ideas</p>	<p>Patterns are sequences (repeating or growing) made of numeric or spatial elements governed by a rule.</p> <p>Patterns exist both in the world and in mathematics. The same pattern structure can be found in many different forms (e.g., numbers, shapes, colours, and rhythm).</p> <p>A pattern can be described using a rule or you can create a pattern from a rule. To find the rule for a pattern, you need to identify the unit of the pattern (what is repeated or what grows).</p> <p>In a pattern, the relationship between the ordinal position (e.g., first, second, and third) and the corresponding element is more useful for finding the pattern's rule than the relationship between successive elements. Identifying the rule of a pattern brings predictability and allows generalisations to be developed.</p> <p>Generalisations can be expressed with both words and symbols.</p> <p>Variables are symbols that take the place of numbers, or ranges of numbers. They have different meanings depending on whether they are being used as representations of quantities that vary or change, representations of specific unknown variables, or placeholders in a generalised expression or formula.</p>
<p>Curriculum links</p>	<p>NA-1-6: Create and continue sequential patterns.</p> <p>NA-2-2: Know forward and backward counting sequences while whole numbers to at least 1000.</p> <p>NA-2-8: Find rules for the next member in a sequential pattern.</p>
<p>Learning Outcomes: Students will be able to:</p>	<ul style="list-style-type: none"> • Reproduce a pattern using objects, drawings, or symbols. • Continue repeating patterns. • Explain and justify the pattern in relation to ordinal aspects of counting. • Identify the element for a repeating pattern for far terms. • Explain that a pattern has consistency. • Develop generalisations expressed in words related to a repeating pattern.
<p>Mathematical language</p>	<p>Sequence, element, rule, unit of repeat.</p>
<p>Sharing back/Connect</p>	<p>Select students to share who use a grouping strategy to solve the task. For example, students might notice that a yellow M & M is always a multiple of 4 and use this to get close to 83 by stating that 80 would be yellow and then using the pattern structure.</p> <p>Connect: What do you notice about all of the yellow M & Ms in relation to their pattern position? How could you find the location of every yellow M & M? What about the green M & Ms?</p>

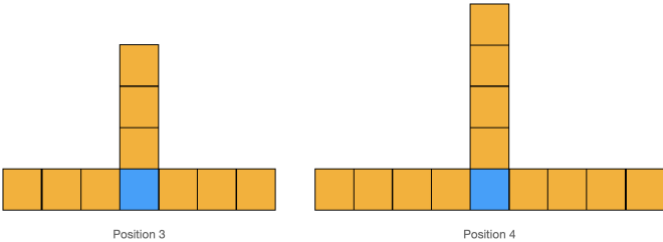
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<p>Teacher Notes</p>	<ul style="list-style-type: none"> • During the launch, ask students to share where they see patterns in their lives. Reinforce discussion that patterns have repeating elements. • Have multilink cubes available for the students to model the pattern. • Facilitate the students to model the pattern in a way that highlights the structure of the pattern.  <p>Use the model to support students to notice that certain elements align with specific numbers or multiples.</p> <ul style="list-style-type: none"> • Use the term unit of repeat for the pattern base. • Notice students who use grouping or identify multiples to solve the task. • Expect students to represent using blocks and numbers and to identify the number patterns associated with the specific colours (similar to choral counting). • For the connect, students might notice that the yellow M & Ms are all multiples of 4 so the rule for yellow M & Ms would be multiply by 4. Ask the students for the rule in words and then model writing the rule using variables or informal variables (e.g., $4 \times a$ or $4 \times \star$). For the green M & M, you could multiply by 4 and add 3 or multiply by 4 and subtract 1. • For the independent task, have multi-link cubes available.
<p>Independent Tasks</p>	<p>Tane is making a snake with cubes. This is his first snake:</p>  <p>Copy the pattern. What is the unit of repeat? How many cubes in the unit of repeat? How many cubes are there altogether?</p> <p>Draw a picture of the snake and colour it.</p>  <p>What colours would the missing cubes be?</p> <p>Tane continues making his pattern.</p>

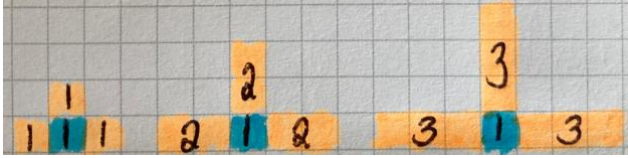
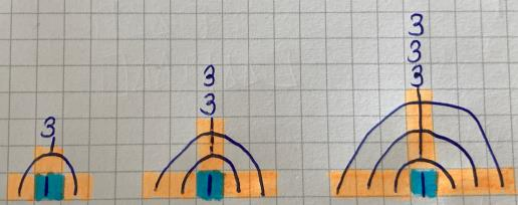
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	<p>What colour would the 42nd block be? What colour would the 50th block be? What colour would the 104th block be?</p> <p>What do you notice about all of the yellow blocks in relation to their pattern position?</p> <p>What do you notice about all of the green blocks in relation to their pattern position?</p>
Anticipations	

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<p>Task 2</p>	<p>Jona is using the shapes to make a pattern:</p>  <p>Position 3 Position 4</p> <p>Make and draw position 1 and 2 and 5.</p> <p>How do you see the pattern growing? Represent this with numbers.</p> <p>How would you draw position 10?</p> <p>Complete the table</p> <table border="1" data-bbox="528 835 1066 1104"> <thead> <tr> <th>Position number</th> <th>Number of blocks</th> </tr> </thead> <tbody> <tr> <td>1</td> <td></td> </tr> <tr> <td>2</td> <td></td> </tr> <tr> <td>5</td> <td></td> </tr> <tr> <td>10</td> <td></td> </tr> <tr> <td>12</td> <td></td> </tr> <tr> <td>15</td> <td></td> </tr> </tbody> </table>	Position number	Number of blocks	1		2		5		10		12		15	
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<p>Curriculum links</p>	<p>NA-1-6: Create and continue sequential patterns.</p> <p>NA-2-8: Find rules for the next member in a sequential pattern.</p> <p>NA-3-8: Connect members of sequential patterns with their ordinal position and use tables, graphs, and diagrams to find relationships between successive elements of number and spatial patterns.</p>														

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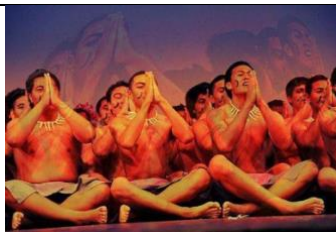
<p>Learning Outcomes: Students will be able to:</p>	<ul style="list-style-type: none"> • Reproduce a pattern using objects, drawings, or symbols. • Continue a growing pattern. • Identify the growing element and constant in a linear growing pattern. • Represent the growing element and the constant using numbers and symbols. • Represent a growing pattern in a table of data. • Develop generalisations expressed in words related to a growing pattern.
<p>Mathematical language</p>	<p>Position, element, rule, unit of repeat, variable.</p>
<p>Sharing back/Connect</p>	<p>Select students to share who have developed different generalisation strategies. This includes the use of a whole object generalisation:</p> <ol style="list-style-type: none"> 1) To find the number of blocks for position 10, they double the number of blocks for position 5 and subtract one block to avoid over-counting the blue block <p>OR explicit generalisation strategies:</p> <ol style="list-style-type: none"> 2) Identify the growing element as increasing by one block each time on three sides with one block in the middle.  <ol style="list-style-type: none"> 3) Identify the growing element as increasing by three blocks each time with one block in the middle.  <p>Connect: Describe how to find the number of blocks for position 100? What rule could you use to find the number of blocks for any position number? [Model writing this as $3 \times b + 1$]</p>
<p>Teacher Notes</p>	<ul style="list-style-type: none"> • Before you launch the task, do a pattern quick image warm-up. Show the students the pattern for three seconds and ask them to describe it. Show the pattern again for three seconds and ask them to draw it. Display the pattern and ask them to draw the next term. • Have square shapes available for students to model the pattern. • Expect students to represent using blocks and numbers and to show how they see the pattern growing.

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	<ul style="list-style-type: none"> • Notice students who use grouping or identify the recursive add 3 element for the growing pattern. Facilitate the students to connect this to multiplication (e.g., adding three multiple times is the same as $\times 3$). Facilitate the students to notice that the blue square is the constant and stays the same as the pattern grows. This can be linked to the $+ 1$ in the rule during the connect. • Introduce students to the idea that rules can be written using a variable (letters or shapes) to represent any number. Model this during the connect. • For the independent task, have multilink cubes available to model the pattern.
<p>Independent Tasks</p>	<p>Litea has a giant bag of M & Ms. She likes to eat her favourite colours of M & Ms in a specific order: blue, yellow, green, red, orange.</p> <p>What will be the colour of the 41st M & M that she eats?</p> <p>Find two different ways of solving the task and representations to prove your solutions.</p> <p>What do you notice about all of the orange M & Ms in relation to their pattern position? How could you find the location of every orange M & M? What about the red M & Ms?</p>
<p>Anticipations</p>	

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Task 3



Tevita's group is practising their sasa for the Polyfest.

The first sequence is: clap, slap, slap, clap

The second sequence is: clap, slap, slap, clap, slap, slap, clap

The third sequence is: clap, slap, slap, clap, slap, slap, clap, slap, slap, clap

What would be the next sequence?

Represent the pattern sequence using the shape blocks.

Complete the table:

Sequence number	Number of claps	Number of slaps	Total number of movements
1			
2			
3			
	5		
		10	
			19

Identify three patterns across the table and three patterns down the table.

How many claps and slaps would there be for the eighth sequence?

How many claps and slaps would there be for the 25th sequence?

Big ideas

Patterns are sequences (repeating or growing) made of numeric or spatial elements governed by a rule.

Patterns exist both in the world and in mathematics. The same pattern structure can be found in many different forms (e.g., numbers, shapes, colours, and rhythm).

A pattern can be described using a rule or you can create a pattern from a rule. To find the rule for a pattern, you need to identify the unit of the pattern (what is repeated or what grows).

In a pattern, the relationship between the ordinal position (e.g., first, second, and third) and the corresponding element is more useful for finding the pattern's rule than the relationship between successive elements. Identifying the rule of a pattern brings predictability and allows generalisations to be developed.

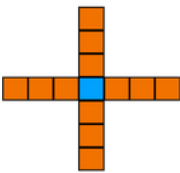
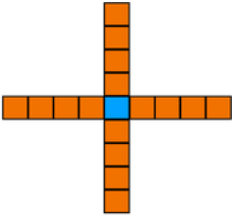
Generalisations can be expressed with both words and symbols.

Variables are symbols that take the place of numbers, or ranges of numbers. They have different meanings depending on whether they are being used as representations of quantities that vary or



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	change, representations of specific unknown variables, or placeholders in a generalised expression or formula.
Curriculum links	<p>NA-1-6: Create and continue sequential patterns.</p> <p>NA-2-7: Generalise that whole numbers can be partitioned in many ways.</p> <p>NA-2-8: Find rules for the next member in a sequential pattern.</p> <p>NA-3-8: Connect members of sequential patterns with their ordinal position and use tables, graphs, and diagrams to find relationships between successive elements of number and spatial patterns.</p>
Learning Outcomes: Students will be able to:	<ul style="list-style-type: none"> • Reproduce a pattern using objects, drawings, or symbols. • Continue a growing pattern. • Identify the growing element and constant in a linear growing pattern. • Represent the growing element and the constant using numbers and symbols. • Represent a growing pattern in a table of data. • Identify patterns in a table of data that draw on single variational thinking or co-variational thinking. • Develop generalisations expressed in words related to a growing pattern.
Mathematical language	Unit of repeat, pattern, sequence, element, rule.
Sharing back/Connect	<p>Select students to share who develop explicit generalisations using multiplication and relationships to work out the different number of movement and who identify co-variational patterns in the table (e.g., total number of movements is slaps + claps).</p> <p>Connect:</p> <p>If there is 100 slaps, how many claps will there be?</p> <p>What rules can you use to find the different types of movements?</p>
Teacher Notes	<ul style="list-style-type: none"> • During the launch, ask students to share different types of dance patterns that they know. Position them to represent the dance patterns in different ways (e.g., using letters, shapes, or colours). • Have shape blocks and counters available. • Notice students who use relational patterns for the rules (e.g., $n + 1$ for the claps). If students use recursive patterns (+ 2 for the slaps or + 3 for the total number of movement), facilitate them to connect this to multiplication (e.g., adding three multiple times is the same as $\times 3$). Facilitate the students to notice that the clap at the beginning is the constant and stays the same as the pattern grows. This can be linked to the + 1 in the rule for the total number of movements or for the claps.

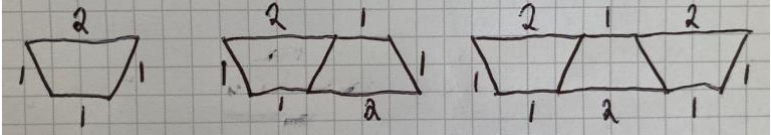
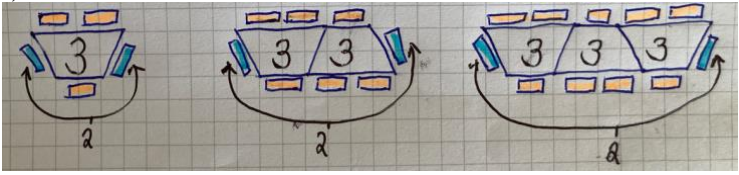
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	<ul style="list-style-type: none"> • Facilitate the students to notice patterns in the table vertically may include sequential or single variational thinking (e.g., the claps increase by one, the slaps increase by 2 each time) or horizontally co-variational or relational thinking (e.g., the slaps are $\times 2$ the sequence number or the number of slaps are number of claps $\times 2 - 2$). • Introduce students to the idea that rules can be written using a variable (letters or shapes) to represent any number. Model this during the connect. • For the independent task, have square shape pieces available.
<p>Independent Tasks</p>	<p>Jona is using the shapes to make a pattern:</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Position 3</p> </div> <div style="text-align: center;">  <p>Position 4</p> </div> </div> <p>How many blocks would I need to make:</p> <p>Position 8: Position 12:</p> <p>If I had 65 orange blocks, what position number could I make? Would I have some orange blocks left over?</p>
<p>Anticipations</p>	

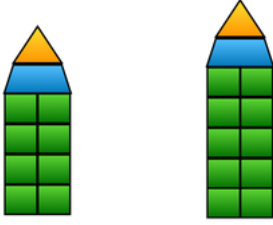
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<p>Task 4</p>	<p>You are having a family reunion at your church hall and need to help set the tables up so everyone will fit.</p> <p>One table looks like this:</p>  <p>Two tables look like this:</p>  <p>How many people could sit around three tables?</p> <p>How is the pattern growing? Use drawings and numbers to show how it is growing.</p> <p>How many people could sit around six tables? How could you find out how many people could sit around 10 tables?</p> <p>If there were 65 people seated, how many tables would there be?</p>
<p>Big ideas</p>	<p>Patterns are sequences (repeating or growing) made of numeric or spatial elements governed by a rule.</p> <p>Patterns exist both in the world and in mathematics. The same pattern structure can be found in many different forms (e.g., numbers, shapes, colours, and rhythm).</p> <p>A pattern can be described using a rule or you can create a pattern from a rule. To find the rule for a pattern, you need to identify the unit of the pattern (what is repeated or what grows).</p> <p>In a pattern, the relationship between the ordinal position (e.g., first, second, and third) and the corresponding element is more useful for finding the pattern's rule than the relationship between successive elements. Identifying the rule of a pattern brings predictability and allows generalisations to be developed.</p> <p>Generalisations can be expressed with both words and symbols. Variables are symbols that take the place of numbers, or ranges of numbers. They have different meanings depending on whether they are being used as representations of quantities that vary or change, representations of specific unknown variables, or placeholders in a generalised expression or formula.</p>
<p>Curriculum links</p>	<p>NA NA-1-6: Create and continue sequential patterns.</p> <p>NA-2-7: Generalise that whole numbers can be partitioned in many ways.</p> <p>NA-2-8: Find rules for the next member in a sequential pattern.</p> <p>NA-3-8: Connect members of sequential patterns with their ordinal position and use tables, graphs, and diagrams to find relationships between successive elements of number and spatial patterns.</p>

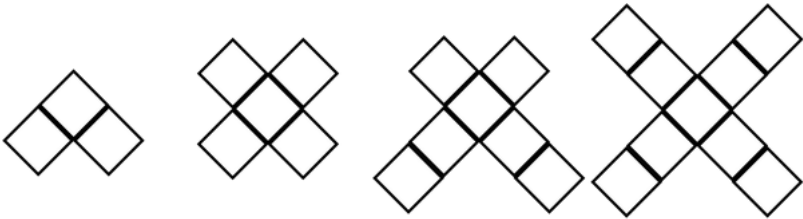
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<p>Mathematical language</p>	<p>Position, element, rule, unit of repeat, variable.</p>
<p>Sharing back/Connect</p>	<p>Select students to share who can show how the pattern increases using representations, colours, and numbers:</p> <p>1)</p>  <p>2)</p>  <p>Connect:</p> <p>How could you find out how many people can be seated for 100 tables?</p> <p>What rule could you use to find out how many people can be seated for h tables?</p>
<p>Teacher Notes</p>	<ul style="list-style-type: none"> • Before you launch the task, do a pattern quick image warm-up. Show the students the pattern for three seconds and ask them to describe it. Show the pattern again for three seconds and ask them to draw it. Display the pattern and ask them to draw the next term. • Expect students to represent using drawings, colours, and numbers to show how they see the pattern growing. • Notice students who use grouping or identify the recursive add 3 element for the growing pattern. Facilitate the students to connect this to multiplication (e.g., adding three multiple times is the same as $\times 3$). Facilitate the students to notice that the chair at the end would need to be moved out to avoid getting squashed, physically model this if necessary.

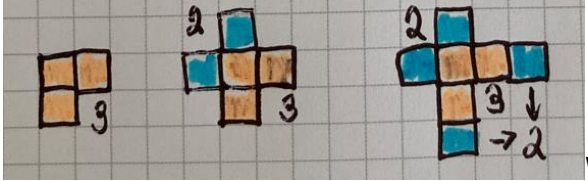
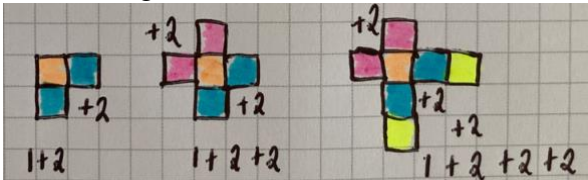
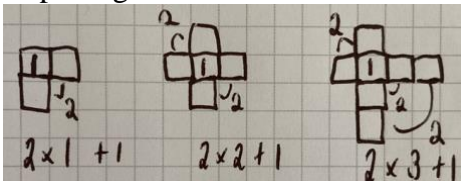
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	<ul style="list-style-type: none"> Support students to develop an explicit generalisation in words and number ($3h + 2$) to find the number of people who can be seated. For the independent task, use the task below. 																																													
<p>Independent Tasks</p>	<div style="text-align: center;">  </div> <p>Position 4 Position 5 This is my pencil pattern.</p> <p>Draw the following position numbers: 1, 2, 3, and 6.</p> <p>How would you draw position 10?</p> <p>Complete the table</p> <table border="1" data-bbox="528 943 1386 1359"> <thead> <tr> <th>Position number</th> <th>Number of squares</th> <th>Number of rhombuses</th> <th>Number of triangles</th> <th>Total number of shapes</th> </tr> </thead> <tbody> <tr><td>1</td><td></td><td></td><td></td><td></td></tr> <tr><td>2</td><td></td><td></td><td></td><td></td></tr> <tr><td>3</td><td></td><td></td><td></td><td></td></tr> <tr><td>4</td><td></td><td></td><td></td><td></td></tr> <tr><td>5</td><td></td><td></td><td></td><td></td></tr> <tr><td>6</td><td></td><td></td><td></td><td></td></tr> <tr><td>7</td><td></td><td></td><td></td><td></td></tr> <tr><td>8</td><td></td><td></td><td></td><td></td></tr> </tbody> </table> <p>Identify three patterns going horizontally and three patterns going vertically.</p> <p>What rules could you use to find the number of different shapes?</p>	Position number	Number of squares	Number of rhombuses	Number of triangles	Total number of shapes	1					2					3					4					5					6					7					8				
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<p>Task 5</p>	<p>Tui is weaving and develops a pattern that looks like this:</p>  <p>Position 1 Position 2 Position 3 Position 4</p> <p>How many squares does each position have?</p> <p>Use colours, numbers, and drawings to show how the pattern is growing.</p> <p>Complete the table:</p> <table border="1" data-bbox="528 869 954 1249"> <thead> <tr> <th>Position</th> <th>Number of squares</th> </tr> </thead> <tbody> <tr><td>1</td><td></td></tr> <tr><td>2</td><td></td></tr> <tr><td>3</td><td></td></tr> <tr><td>4</td><td></td></tr> <tr><td>5</td><td></td></tr> <tr><td>8</td><td></td></tr> <tr><td>10</td><td></td></tr> <tr><td>12</td><td></td></tr> <tr><td>25</td><td></td></tr> </tbody> </table>	Position	Number of squares	1		2		3		4		5		8		10		12		25	
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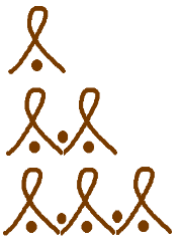
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<p>Learning Outcomes: Students will be able to:</p>	<ul style="list-style-type: none"> • Reproduce a pattern using objects, drawings, or symbols. • Continue a growing pattern. • Identify the growing element and constant in a linear growing pattern. • Represent the growing element and the constant using numbers and symbols. • Represent a growing pattern in a table of data. • Develop generalisations expressed in words related to a growing pattern.
<p>Mathematical language</p>	<p>Position, element, rule, unit of repeat, variable, generalisation.</p>
<p>Sharing back/Connect</p>	<p>Select students to share who use generalisation strategies such as:</p> <ol style="list-style-type: none"> 1) Chunking generalisation <div style="text-align: center;">  </div> 2) Recursive generalisation <div style="text-align: center;">  </div> 3) Explicit generalisation <div style="text-align: center;">  </div> <p>Model any of the generalisation strategies if students have not used them.</p> <p>Connect:</p> <p>What is different about the generalisation solutions? What is the same about the generalisation solutions? What connections can you make between the different types of generalisation?</p>

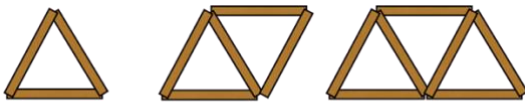
Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

<p>Teacher Notes</p>	<p>Can you connect this to a rule?</p> <ul style="list-style-type: none"> • Have square shapes to construct the pattern if needed. • Facilitate the students to notice that the pattern is growing in two directions and ask them to use colours and numbers to illustrate how the pattern is growing. • Support students to develop an explicit generalisation in words and number ($2j + 1$) to find the number of people squares. • For the independent task, have rectangle shapes and counters.
<p>Independent Tasks</p>	<p>You are having a birthday party at a hall and need to help set the tables up so everyone will fit.</p> <p>The first three tables look like this:</p> <pre> X X X X X X X [] X X [] [] X X [] [] [] X X X X X X X </pre> <p>How many people could sit around four tables?</p> <p>How is the pattern growing? Use drawings and numbers to show how it is growing.</p> <p>How many people could sit around 6 tables? How many people could sit around 9 tables? How many people could sit around 12 tables?</p> <p>How could you find out how many people could sit around 100 tables?</p> <p>What is a rule that could be used to find out how many people could sit around p tables?</p>
<p>Anticipations</p>	

Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

<p>Task 6</p>	<p>Parveen and her family are preparing for her cousin's wedding. The women and girls are all having their hands decorated with mehndi. Parveen notices that there is a pattern in one of the designs her aunty is creating.</p>  <p>Parveen is interested in working out how many circles there will be for different amounts of loops.</p> <p>How many loops and circles would there be for positions 4, 5 and 6? How is the pattern growing between each position?</p> <p>Use what you notice to work out the number of circles and loops for position 12 and 24.</p> <p>Can you come up with a rule to find out how many loops and circles there would be for any position?</p>
<p>Big ideas</p>	<p>Patterns are sequences (repeating or growing) made of numeric or spatial elements governed by a rule.</p> <p>Patterns exist both in the world and in mathematics. The same pattern structure can be found in many different forms (e.g., numbers, shapes, colours, and rhythm).</p> <p>A pattern can be described using a rule or you can create a pattern from a rule. To find the rule for a pattern, you need to identify the unit of the pattern (what is repeated or what grows).</p> <p>In a pattern, the relationship between the ordinal position (e.g., first, second, and third) and the corresponding element is more useful for finding the pattern's rule than the relationship between successive elements. Identifying the rule of a pattern brings predictability and allows generalisations to be developed.</p> <p>Generalisations can be expressed with both words and symbols. Variables are symbols that take the place of numbers, or ranges of numbers. They have different meanings depending on whether they are being used as representations of quantities that vary or change, representations of specific unknown variables, or placeholders in a generalised expression or formula.</p>
<p>Curriculum links</p>	<p>NA-1-6: Create and continue sequential patterns.</p> <p>NA-2-7: Generalise that whole numbers can be partitioned in many ways.</p> <p>NA-2-8: Find rules for the next member in a sequential pattern.</p> <p>NA-3-8: Connect members of sequential patterns with their ordinal position and use tables, graphs, and diagrams to find</p>

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	relationships between successive elements of number and spatial patterns.
Learning Outcomes: Students will be able to:	<ul style="list-style-type: none"> • Reproduce a pattern using objects, drawings, or symbols. • Continue a growing pattern. • Identify the growing element and constant in a linear growing pattern. • Represent the growing element and the constant using numbers and symbols. • Represent a growing pattern in a table of data. • Develop generalisations expressed in words related to a growing pattern. • Test whether a generalisation works for a growing pattern.
Mathematical language	Position, element, rule, unit of repeat, variable, generalisation.
Sharing back/Connect	<p>Select students to share who develop recursive or explicit generalisations in words for the pattern. If no students develop an explicit generalisation then support them to turn the recursive generalisation into an explicit generalisation.</p> <p>Connect:</p> <p>Parveen develops three different possible rules for the pattern. Can you help her by checking which are true?</p> <ol style="list-style-type: none"> 1) Position number add position number subtract one ($b + b - 1$) 2) Position number multiplied by one add one ($p \times 1 + 1$) 3) Position number multiply by two subtract one ($h \times 2 - 1$)
Teacher Notes	<ul style="list-style-type: none"> • During the launch, ask students to share different types of patterns that they know from their culture or every-day life. • Facilitate the students to notice the connection and relationship between the loops and the circles. • Notice students who use a table of data or a structured way of tracking the number of circles as the pattern grows. Position students to use a table of data if needed. • Expect students to move from recursive generalisation (it increases by + 2 after the first pattern) to an explicit generalisation. Note that this pattern has a different structure. • For the independent task, have ice-block sticks.
Independent Tasks	<p>Ice-block sticks</p>  <p>Position 1 Position 2 Position 3</p>

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	<p>How many different patterns can you see in the picture? Use colours and or number to show the different patterns.</p> <p>How would you draw the next stage? How would you draw the 10th stage?</p> <p>How many triangles would there be if there were 31 ice-block sticks? Would there be any sticks left over?</p> <p>How many triangles would there be if there were 50 ice-block sticks? Would there be any sticks left over?</p>
Anticipations	

Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

<p>Task 7</p>	<p>Viliani has saved some money (he only has dollars and no cents). His Kui feine wants to reward him for helping her with some jobs. She offers him two deals:</p> <p>Deal 1: She will double his money</p> <p>Deal 2: She will add \$10 to his savings.</p> <p>Use a number sentence to represent the two deals.</p> <p>Show the results for Deal 1 and Deal 2 in a table.</p> <table border="1" data-bbox="528 633 991 938"> <thead> <tr> <th>Viliani's savings</th> <th>Deal 1</th> <th>Deal 2</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table> <p>Which deal is better?</p> <p>What advice would you give Viliani depending on the amount of money he has saved?</p>	Viliani's savings	Deal 1	Deal 2																		
Viliani's savings	Deal 1	Deal 2																				
<p>Big ideas</p>	<p>Patterns are sequences (repeating or growing) made of numeric or spatial elements governed by a rule.</p> <p>Patterns exist both in the world and in mathematics. The same pattern structure can be found in many different forms (e.g., numbers, shapes, colours, and rhythm).</p> <p>A pattern can be described using a rule or you can create a pattern from a rule. To find the rule for a pattern, you need to identify the unit of the pattern (what is repeated or what grows).</p> <p>In a pattern, the relationship between the ordinal position (e.g., first, second, and third) and the corresponding element is more useful for finding the pattern's rule than the relationship between successive elements. Identifying the rule of a pattern brings predictability and allows generalisations to be developed.</p> <p>Generalisations can be expressed with both words and symbols.</p> <p>Variables are symbols that take the place of numbers, or ranges of numbers. They have different meanings depending on whether they are being used as representations of quantities that vary or change, representations of specific unknown variables, or placeholders in a generalised expression or formula.</p>																					
<p>Curriculum links</p>	<p>NA-1-6: Create and continue sequential patterns.</p> <p>NA-2-1: Use simple additive strategies with whole numbers and fractions.</p> <p>NA-2-6: Communicate and interpret simple additive strategies using words, diagrams (pictures), and symbols.</p> <p>NA-2-8: Find rules for the next member in a sequential pattern.</p>																					

Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

Learning Outcomes: Students will be able to:	<ul style="list-style-type: none"> • Represent a situation with unknowns using a number sentence. • Solve number sentences with different quantities. • Represent a function in a table of data. • Compare functional situations for different quantities.
Mathematical language	Unknown, variable, table of data.
Sharing back/Connect	<p>Select students to share who can represent the unknown using a letter or informal variable (shape) and use the table of data to compare the results.</p> <p>Connect:</p> <p>Ask students to show the results for both deals on a line graph using two different colours. Ask them to discuss how the graph could help them make predictions.</p>
Teacher Notes	<ul style="list-style-type: none"> • Before you launch the task, do a pattern quick image warm-up. Show the students the pattern for three seconds and ask them to describe it. Show the pattern again for three seconds and ask them to draw it. Display the pattern and ask them to draw the next term. • Facilitate the students to notice that the different deals will vary depending on the amount of savings that Viliami starts with. • Expect students to represent using number sentences and a variable and a table of data.
Independent Tasks	<p>Principal has decided to have a ‘best reader’ contest for all the students at school. The student who reads the most books in their year level will get a lollipop. The principal has a box with 200 lollipops. Each day 7 lollipops are taken and given to the ‘best reader’ for each year level (Year 0 – 6).</p> <p>How many lollipops will be left in the box after the contest has lasted 4 days? 6 days? 10 days? 20 days?</p> <p>Write a number sentence or rule that calculates the number of lollipops after any number of days.</p> <p>How many days will there be until the lollipops run out?</p>
Anticipations	

Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

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Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

<p>Task 8</p>	<div data-bbox="772 194 1142 448" data-label="Image"> </div> <p>Niu was looking at a design to make a mat. She would like your help to work out how many white squares she will need.</p> <div data-bbox="772 622 1142 846" data-label="Image"> </div> <p>How does the pattern grow?</p> <p>Show how the pattern grows using colours and or numbers. What part stays the same and what part grows?</p> <p>How many white squares would there be for position 6? How many white squares would there be for position 9? How many white squares would there be for position 11?</p> <p>How would you find the number of white squares for position 99? Can you work out a rule for the number of white squares?</p>
<p>Big ideas</p>	<p>Patterns exist both in the world and in mathematics. The same pattern structure can be found in many different forms (e.g., numbers, shapes, colours, and rhythm).</p> <p>A pattern can be described using a rule or you can create a pattern from a rule. To find the rule for a pattern, you need to identify the unit of the pattern (what is repeated or what grows).</p> <p>In a pattern, the relationship between the ordinal position (e.g., first, second, and third) and the corresponding element is more useful for finding the pattern's rule than the relationship between successive elements. Identifying the rule of a pattern brings predictability and allows generalisations to be developed.</p> <p>Generalisations can be expressed with both words and symbols. Variables are symbols that take the place of numbers, or ranges of numbers. They have different meanings depending on whether they are being used as representations of quantities that vary or change, representations of specific unknown variables, or placeholders in a generalised expression or formula.</p>
<p>Curriculum links</p>	<p>NA-1-6: Create and continue sequential patterns. NA-2-8: Find rules for the next member in a sequential pattern.</p>

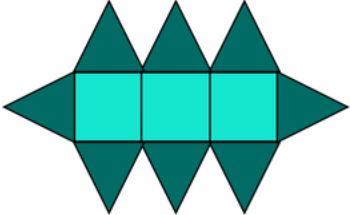
Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

	<p>NA-3-8: Connect members of sequential patterns with their ordinal position and use tables, graphs, and diagrams to find relationships between successive elements of number and spatial patterns.</p>
<p>Learning Outcomes: Students will be able to:</p>	<ul style="list-style-type: none"> • Reproduce a pattern using objects, drawings, or symbols. • Continue a growing pattern. • Identify the growing element and constant in a linear growing pattern. • Represent the growing element and the constant using numbers and symbols. • Represent a growing pattern in a table of data. • Develop generalisations expressed in words related to a growing pattern. • Test whether a generalisation works for a growing pattern.
<p>Mathematical language</p>	<p>Position, element, rule, table of data</p>
<p>Sharing back/Connect</p>	<p>Select students to share who have developed different generalisations and number sentences or a coloured representation to justify this.</p> <div data-bbox="528 965 1015 1245" style="text-align: center;"> <p> $3 + 5$ $3 + 5 \times 1$ </p> <p> $3 + 5 + 5$ $3 + (5 \times 2)$ </p> <p> $3 + 5 + 5 + 5$ $3 + (5 \times 3)$ </p> </div> <p>Connect:</p> <p>What is the same about the generalisations that have been developed? What is different about the generalisations that have been developed?</p>
<p>Teacher Notes</p>	<ul style="list-style-type: none"> • Have coloured squares available for students to construct the pattern. • Facilitate the students to notice that the pattern has a constant (the part that stays the same) and a part that grows. Support them to colour the part that stays the same in one colour and the part that grows in a different colour and link their number sentences to this. • Notice students who use a table of data or a structured way of tracking the number of white squares as the pattern grows. Position students to use a table of data if needed. • Expect students to move from recursive generalisation (it increases by + 5 after the first pattern) to an explicit generalisation.

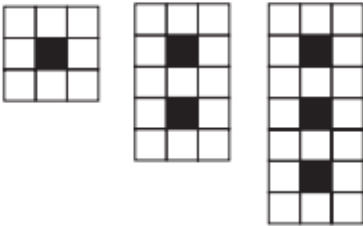
Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

	<ul style="list-style-type: none">• For the independent task, have shapes available and grid paper for the students to work with.
Independent Tasks	<p>Develop a growing pattern to match these rules:</p> <p>Tiles = Position number multiplied by two ($g = 2 \times k$)</p> <p>Tiles = Position number add four ($a = b + 4$)</p> <p>Tiles = Position number multiplied by two add two ($f = d \times 2 + 2$)</p> <p>Develop your own growing patterns and write a rule to match them.</p>
Anticipations	

Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

<p>Task 9 (optional task)</p>	<p>Flower pattern</p>  <p>Position 3</p> <p>Use the counters to make Position 2, and Position 1</p> <p>How many different patterns can you see? Explain these and justify them with colours, numbers, and the counters.</p> <p>How many triangles would Position 4 have? How many shapes would Position 4 have altogether?</p> <p>How many triangles would Position 4 have? How many shapes would Position 4 have altogether?</p> <p>Describe how you would find the triangles for Position 51.</p>
<p>Big ideas</p>	<p>Patterns exist both in the world and in mathematics. The same pattern structure can be found in many different forms (e.g., numbers, shapes, colours, and rhythm).</p> <p>A pattern can be described using a rule or you can create a pattern from a rule. To find the rule for a pattern, you need to identify the unit of the pattern (what is repeated or what grows).</p> <p>In a pattern, the relationship between the ordinal position (e.g., first, second, and third) and the corresponding element is more useful for finding the pattern's rule than the relationship between successive elements. Identifying the rule of a pattern brings predictability and allows generalisations to be developed.</p> <p>Generalisations can be expressed with both words and symbols. Variables are symbols that take the place of numbers, or ranges of numbers. They have different meanings depending on whether they are being used as representations of quantities that vary or change, representations of specific unknown variables, or placeholders in a generalised expression or formula.</p>
<p>Curriculum links</p>	<p>NA-1-6: Create and continue sequential patterns.</p> <p>NA-2-8: Find rules for the next member in a sequential pattern.</p> <p>NA-3-8: Connect members of sequential patterns with their ordinal position and use tables, graphs, and diagrams to find relationships between successive elements of number and spatial patterns.</p>
<p>Learning Outcomes: Students will be able to:</p>	<ul style="list-style-type: none"> • Reproduce a pattern using objects, drawings, or symbols. • Continue a growing pattern.

Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

	<ul style="list-style-type: none"> • Identify the growing element and constant in a linear growing pattern. • Represent the growing element and the constant using numbers and symbols. • Represent a growing pattern in a table of data. • Develop generalisations expressed in words related to a growing pattern. • Test whether a generalisation works for a growing pattern.
Mathematical language	Position, element, rule, table of data
Sharing back/Connect	<p>Select students to share who have developed different generalisations and number sentences or a coloured representation to justify this.</p> <p>Connect:</p> <p>What position number would have exactly 42 triangles?</p>
Teacher Notes	<ul style="list-style-type: none"> • Have shapes available for students to construct the pattern. • Facilitate the students to notice that the pattern has a constant (the part that stays the same) and a part that grows. Support them to colour the part that stays the same in one colour and the part that grows in a different colour and link their number sentences to this. • Notice students who use a table of data or a structured way of tracking the number of triangles and total number of shapes as the pattern grows. Position students to use a table of data if needed. • Expect students to move from recursive generalisation (it increases by + 2) to an explicit generalisation.
Independent Tasks	<p>Niu was looking at a design to make a mat.</p>  <p>What position number would have 18 white squares?</p> <p>What position number would have 53 white squares?</p> <p>What position number would have 123 white squares?</p>
Anticipations	

Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

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Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

<p>Task 10 (optional task)</p>	<p>Position 1 Position 2 Position 3</p> <p>Show Position four with the counters.</p> <p>Show Position five with the counters.</p> <p>Show Position ten with the counters.</p> <p>What patterns do you notice?</p> <p>What would be a quick way to count the counters for Position ten?</p>
<p>Big ideas</p>	<p>Patterns exist both in the world and in mathematics. The same pattern structure can be found in many different forms (e.g., numbers, shapes, colours, and rhythm).</p> <p>A pattern can be described using a rule or you can create a pattern from a rule. To find the rule for a pattern, you need to identify the unit of the pattern (what is repeated or what grows).</p> <p>In a pattern, the relationship between the ordinal position (e.g., first, second, and third) and the corresponding element is more useful for finding the pattern's rule than the relationship between successive elements. Identifying the rule of a pattern brings predictability and allows generalisations to be developed.</p> <p>Generalisations can be expressed with both words and symbols. Variables are symbols that take the place of numbers, or ranges of numbers. They have different meanings depending on whether they are being used as representations of quantities that vary or change, representations of specific unknown variables, or placeholders in a generalised expression or formula.</p>
<p>Curriculum links</p>	<p>NA-1-6: Create and continue sequential patterns.</p> <p>NA-2-8: Find rules for the next member in a sequential pattern.</p> <p>NA-3-8: Connect members of sequential patterns with their ordinal position and use tables, graphs, and diagrams to find relationships between successive elements of number and spatial patterns.</p>
<p>Learning Outcomes: Students will be able to:</p>	<ul style="list-style-type: none"> • Reproduce a pattern using objects, drawings, or symbols. • Continue a growing pattern. • Identify the growing element in a growing pattern. • Represent the growing element using numbers and symbols. • Develop generalisations expressed in words related to a growing pattern.
<p>Mathematical language</p>	<p>Position, element, rule, table of data</p>

Level 2 Year 3/4: Number and Algebra: Patterns and Relationships

Sharing back/Connect	<p>Select students to share who have noticed that the pattern has consecutive numbers of circles in each row related to the position number.</p> <p>Connect:</p> <p>Describe what Position 100 would look like? What would be a quick way to work out how many circles in total you would need for Position 100?</p>
Teacher Notes	<ul style="list-style-type: none"> • Have coloured counters available for students to construct the pattern. • If students have difficulty creating or continuing the pattern ask them to re-create the earlier positions and compare them to see what is the same and different. • Facilitate students to represent the pattern firstly with the counters and then with numbers for each row of counters.
Independent Tasks	<p>Complete the following assessment tasks (attached at the end of the document) as the independent activity:</p> <p>A3: Cross pattern</p> <p>A3A: Squares pattern</p>
Anticipations	

DMIC

DEVELOPING MATHEMATICAL INQUIRY COMMUNITIES ASSESSMENT TASK

ALGEBRA: LEVEL 2

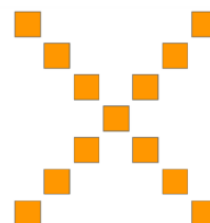
Task A3



First position



Second position



Third position

Look at this growing pattern. Can you:

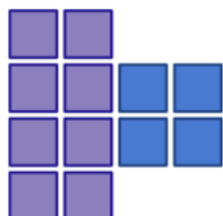
- Show how the number of squares grows using a diagram, numbers, or a table of data. graph.
- Describe the pattern in words and/or numbers
- Show how you work out the number of squares for the following pattern numbers: Pattern 5; Pattern 10; Pattern 50
- Write the rule for the number of squares in words or symbols.

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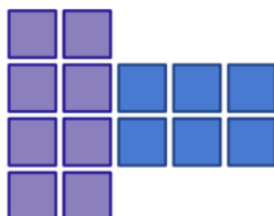
DEVELOPING MATHEMATICAL INQUIRY COMMUNITIES ASSESSMENT TASK

ALGEBRA: LEVEL 2

Task A3A



Position Two



Position Three

Look at this growing pattern. Can you:

- Draw Position One and Position Four.
- Describe the pattern in words and/or numbers.
- Show how you work out the total number of squares for the following pattern numbers: Pattern 5; Pattern 10; Pattern 50.
- Write the rule for the number of squares in words or symbols.