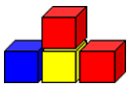
LEVEL: Year 4	CONTENT: Number & Algebra	FOCUS: Pattern
In the Classroom		
PURPOSE	• Use materials to copy and continue a pattern • Record a pattern using numbers and symbols • Investigate number sequences • Create a table to look for patterns • Identify rules or functions for number patterns • Use what is known about a pattern to predict missing or future terms	
WARM UP	**Play Multo** Students draw up 4 x 4 grids and place 16 numbers (the solutions to the multiplication facts) from zero up to 100 in the boxes. The teacher shuffles the multiplication flashcards then calls out the fact one at a time, while students cross out the solution. If they get four numbers in a line (column, row, diagonally) or four corners they call "MULTO"	
INTRODUCTION	Brief introduction to Good Mathematicians – make a list and place on the board, include teamwork, asking questions, sharing ideas, recording ideas, explaining thinking, persistence, checking solutions, working systematically and learning from mistakes.	
EXPLICIT TEACHING & LEARNING	**Up and Down Staircases** One block is needed to make an up-and-down staircase, with one step up and one step down.  4 blocks make an up-and-down staircase with 2 steps up and 2 steps down.  How many blocks would be needed to build an up-and-down staircase with 5 steps up and 5 steps down? **Challenge** Explain how you would work out the number of blocks needed to build a staircase with any number of steps.	
DISCUSSION/KEY QUESTIONS	• Can you describe the pattern? • What comes next in the pattern? • How could we record these patterns in our books? • Instead of using symbols, how else could we record the patterns in our books? • If we create a table, could this help us see what is happening with the pattern? • What is the rule or function for this pattern? • Can we use this information to predict future terms?	
DELIBERATIVE PRACTICE	The focus of this activity is to discover if students can use numbers to describe a pattern created with objects. We want to encourage students to record what they know about the pattern in a table and then use this information to help predict future terms and identify the rule or function for the pattern. By recording the pattern, hopefully students will see the connection between the solution and multiplication.	
REFLECTION	Reflect on how using a table can help us analyse what is happening with the numbers. From here we can look for patterns, develop a rule and predict future terms. Also reflect as a class on students who were a Good Mathematician and why – have students nominate one another. Remind students of list created at the beginning of the lesson.	
RESOURCES	Cubes or multilink blocks 1cm x 1cm grid paper Multiplication fact chart 0 x 0 up to 9 x 9 multiplication fact flashcards NRICH Up and Down staircases https://nrich.maths.org/2283	

Curriculum Connections	
CONTENT	**NSW Syllabus Mathematics K-10 – Stage 2.2** **Patterns & Algebra 2** Investigate number sequences involving multiples of 3, 4, 6, 7, 8 and 9 (ACMNA074) • generate number patterns using multiples of 3, 4, 6, 7, 8 and 9, e.g. 3, 6, 9, 12, ... • investigate visual number patterns on a number chart (Problem Solving) Explore and describe number patterns resulting from performing multiplication (ACMNA081) • use the word 'term' when referring to numbers in a number pattern • describe the position of each term in a given number pattern, e.g. 'The first term is 6' (Communicating) • find a higher term in a number pattern resulting from performing multiplication, given the first few terms, e.g. determine the next term in the pattern 4, 8, 16, 32, 64, … • describe how the next term in a number pattern is calculated, e.g. 'Each term in the pattern is double the previous term' (Communicating)
WHAT CAME BEFORE	Students will be familiar with creating and identifying repeating patterns with objects and in number sequences but may need assistance with using numbers to describe what is happening with an object pattern.
WHAT COMES NEXT	By creating a table to analyse what is happening in a pattern will help students begin to make generalisations about patterns. This will further support students' ability to identify the 'function' or 'rule' of the pattern. The process encourages not just prediction, but justification with proof about what is happening. If students change their perspective on the problem they may be able to make links with square numbers, which they will learn about in Stage 3.
VOCABULARY	Repeating pattern, growing pattern, next, before, after, ordinal numbers, first, second, last, copy, continue, create, explain, unit of repeat, objects, rule or function of the pattern (e.g. 2, 4, 6, 8 the function is add 2 or + 2), skip counting, table, analyse, systematic, odd and even numbers.
MISCONCEPTIONS	Some students think that a 4 block staircase requires only 3 steps as they miss stepping off the staircase. This is important as it will interfere with the totals and may hinder students from making a connection to square numbers and multiplication.
WHAT PROFICIENCIES ARE TO BE UTILISED? **Understanding** **Fluency** **Problem Solving** **Reasoning** **Communicating (NSW)** **Justifying (NSW)**	**Year 4 (Australian Curriculum)** **Understanding** includes making connections between representations of numbers, partitioning and combining numbers flexibly, extending place value to decimals, using appropriate language to communicate times and describing properties of symmetrical shapes **Fluency** includes recalling multiplication tables, communicating sequences of simple fractions, using instruments to measure accurately, creating patterns with shapes and their transformations and collecting and recording data **Problem-solving** includes formulating, modelling and recording authentic situations involving operations, comparing large numbers with each other, comparing time durations and using properties of numbers to continue patterns **Reasoning** includes using generalising from number properties and results of calculations, deriving strategies for unfamiliar multiplication and division tasks, comparing angles, communicating information using graphical displays and evaluating the appropriateness of different displays. objects and using number properties to continue number patterns **NSW Syllabus Mathematics K-10 – Stage 2.2 Outcomes** • uses appropriate terminology to describe, and symbols to represent, mathematical ideas • selects and uses appropriate mental or written strategies, or technology, to solve problems • checks the accuracy of a statement and explains the reasoning used • generalises properties of odd and even numbers, generates number patterns, and completes simple number sentences by calculating missing values
ASSESSMENT	Ask students to use numbers and symbols to record and continue the pattern in their books. Students are encouraged to create a table to show what is happening with the pattern and then use this information to find out the rule or function for the pattern.