


LEVEL: Middle Primary	CONTENT: Measurement & Geometry	FOCUS: Symmetry
In the Classroom		
PURPOSE	<ul style="list-style-type: none"> Identify the qualities of a good mathematician Demonstrate the qualities of a good mathematician Explain and record thinking using a systematic approach Explain symmetry Recognise and provide examples and non-examples Recognise and explain the connection between the number of beads, the colours and the number of solutions 	
WARM UP	<p>Which one doesn't belong? (WODB) http://wodb.ca/shapes.html</p> <p>Show students some examples from WODB. Ask students what they notice about these set of four shapes. Which one do they think doesn't belong and why? Challenge students to give a reason why each shape doesn't belong. Focus is on justifying thinking. Record the language you hear the students using (positive or negative). Discuss the how students felt about the problem? What did you first think? What happened next? Did you get ideas from each other? Did you learn anything from what others said? Refer to the language used during the activity and remind students how the language we tell ourselves quickly becomes our own best friend or worst enemy. Include a discussion about having a growth mindset, persistence, learning from each other and working together.</p>	
INTRODUCTION	<p>Making Necklaces</p> <p>Rob and Jennie were making necklaces to sell at the school fair. They decided to make them very mathematical. Each necklace was to have eight beads, four of one colour and four of another. And each had to be symmetrical, like this:</p> <ul style="list-style-type: none"> How many different necklaces could they make? Can you find them all? How do you know there aren't any others? 	
EXPLICIT TEACHING & LEARNING	<p>After showing the problem to students challenge them to find all the possible solutions. Students must find a way to record these solutions. Provide students with access to materials (beads, counters or blocks). Encourage students to record their thinking in a systematic way</p> <p>Challenge – What if Rob and Jennie had 9 beads, five of one colour and four of another? How many solutions would there be? What if they had 10 beads, five of each? What other numbers could you try and how many solutions would there be? How can you record this information? Are there any patterns?</p>	
DISCUSSION/KEY QUESTIONS	<ul style="list-style-type: none"> What do you know about this problem? How many beads do you need? What does symmetry mean? How can you record your solutions? Is drawing pictures the most efficient strategy? How else could you record the solution? Is there more than one solution? How can you prove your solutions are different? What if you rotate or flip your necklace? What if you have more/less beads? What if you change the bead colours? How can you show you have all the possible solutions? 	
DELIBERATIVE PRACTICE	<p>The focus of this activity is for students not simply find solutions but to think about a way to record their discoveries in a systematic way. How can students share their thinking and compare their answers to someone else?</p>	
REFLECTION	<p>Discussion with students about the ways they demonstrated that they were a Good Mathematician</p>	
RESOURCES	<p>Which one doesn't belong? (WODB) http://wodb.ca/shapes.html</p> <p>Making Necklaces https://nrich.maths.org/9692</p> <p>Collection of coloured counters and or beads</p>	

Curriculum Connections	
CONTENT	<p>AUSTRALIAN CURRICULUM F-10</p> <p>YEAR 4 – LOCATION & TRANSFORMATION Create symmetrical patterns, pictures and shapes with and without digital technologies(ACMMG091)</p> <p>YEAR 5 – LOCATION & TRANSFORMATION Describe translations, reflections and rotations of two-dimensional shapes. Identify line and rotational symmetries (ACMMG114) Elaborations: Identifying and describing the line and rotational symmetry of a range of two-dimensional shapes, by manually cutting, folding and turning shapes and by using digital technologies; Identifying the effects of transformations by manually flipping, sliding and turning two-dimensional shapes and by using digital technologies</p>
WHAT CAME BEFORE	In year 3 students learn about symmetry in the environment. Students often have trouble with the word symmetry. As it is not used often they are unfamiliar with its meaning. Students may think there is only reflective symmetry and may not be familiar with rotational symmetry
WHAT COMES NEXT	Recognising and explaining the different types of symmetry and using this information to solve problems
VOCABULARY	Systematic, symmetry, mirror-image, reflection, rotation, flip, transform
MISCONCEPTIONS	Some students may think that symmetry is a term to describe a repeating pattern, e.g. R, B, R, B, R, B, R, B
WHAT PROFICIENCIES ARE TO BE UTILISED? Understanding Fluency Problem Solving Reasoning Communicating (NSW) Justifying (NSW)	<p>Year 4 (Australian Curriculum)</p> <p>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</p> <p>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</p> <p>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</p> <p>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.</p> <p>NSW Syllabus – Year 4 Outcomes</p> <ul style="list-style-type: none"> • 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 • manipulates, identifies and sketches two-dimensional shapes, including special quadrilaterals, and describes their features
ASSESSMENT	Exit Pass – Show students a non-example of a symmetrical pattern and ask them to explain why the pattern is not symmetrical and can they change the pattern so it is symmetrical