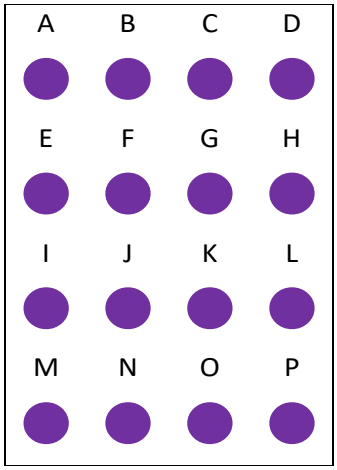
LEVEL: Upper Primary	CONTENT: Location	FOCUS: Problem Solving
In the Classroom		
PURPOSE	• Identify the qualities of a good mathematician • Demonstrate the qualities of a good mathematician • Explain and record thinking using a systematic approach • Identify and explain horizontal, vertical and diagonal lines • Use location words to describe directions • Recognise and explain shape transformations	
INTRODUCTION	**Good Mathematician** Brief discussion about the qualities of good mathematicians - remind students that everyone is a good mathematician and encourage students to use the strategies that they have suggested	
WARM UP	**Brian's Pegboard (3x3)** Brian has a pegboard with 9 pegs in a 3 by 3 square array. He also has a piece of string that he wants to put from the top left hand peg A, to the bottom right hand peg I, so that it touches all of the other pegs on the way only once. If the string is never put diagonally between the pegs, how many different ways can Brian string up his pegboard? **Challenge** – Can Brian string up his pegboard so that it starts at A and ends at B?	
EXPLICIT TEACHING & LEARNING	**Brian's Pegboard (4x4)** Imagine that Brian also has a pegboard with 16 pegs in a 4 by 4 square array and he wants to put a piece of string from the top left hand peg A, to the neighbouring peg B, so that it touches all of the other pegs on the way. • If the string is never put diagonally between the pegs, how many different ways can Brian string up his pegboard?	
DISCUSSION/KEY QUESTIONS	• What is vertical/horizontal/diagonal? • Do you think there is more than one method? • How can you record your thinking? • Is your strategy systematic? • Can you prove that you have found all the methods? • Can you describe the path you created? • Can you explain how different pathways are related, i.e. using knowledge of shape transformations?	
DELIBERATIVE PRACTICE	The focus of this activity is for students demonstrate a systematic approach to trailing and recording possible solutions. Students are encouraged to explain the method they used, compare solutions and prove they have found all the possible solutions.	
REFLECTION	Discussion with students about the ways they demonstrated that they were a Good Mathematician	

RESOURCES	**Brian's Pegboard I** https://nzmaths.co.nz/resource/brians-pegboard-i **Brian's Pegboard II** https://nzmaths.co.nz/resource/brian-s-pegboard-ii Empty pegboard grids
Curriculum Connections	
CONTENT	**NSW SYLLABUS – STAGE 3** Investigate combinations of translations, reflections and rotations, with and without the use of digital technologies (ACMMG142)
WHAT CAME BEFORE	The focus of this problem shifts from merely finding possible solutions but being able to demonstrate and explain a systematic strategy. Students may be able to find possible solution, but are they able to explain their reasoning, and support this with evidence.
WHAT COMES NEXT	As students become more familiar with problem solving they should begin to pose and solve their own problems. In this example, for the 4 x 4 grid what pathways between peg A and other pegs are possible, which pathways are not. Is there a pattern to these pathways? What if you had a 5 x 5 grid?
VOCABULARY	Systematic, path, pathway, location words, vertical, horizontal, left, right, shape transformation, flip, slide, turn, reflect, rotate, translate, prove, justify, efficient
MISCONCEPTIONS	Students may have trouble using location words to distinguish between different solutions.
WHAT PROFICIENCIES ARE TO BE UTILISED? **Understanding** **Fluency** **Problem Solving** **Reasoning** **Communicating (NSW)** **Justifying (NSW)**	**Year 6 (Australian Curriculum)** **Understanding** includes describing properties of different sets of numbers, using fractions and decimals to describe probabilities, representing fractions and decimals in various ways and describing connections between them, and making reasonable estimations **Fluency** includes representing integers on a number line, calculating simple percentages, using brackets appropriately, converting between fractions and decimals, using operations with fractions, decimals and percentages, measuring using metric units and interpreting timetables **Problem-solving** includes formulating and solving authentic problems using fractions, decimals, percentages and measurements, interpreting secondary data displays and finding the size of unknown angles **Reasoning** includes explaining mental strategies for performing calculations, describing results for continuing number sequences, explaining the transformation of one shape into another and explaining why the actual results of chance experiments may differ from expected results. **NSW Syllabus – Year 6 Outcomes** • describes and represents mathematical situations in a variety of ways using mathematical terminology and some conventions • selects and applies appropriate problem-solving strategies, including the use of digital technologies, in undertaking investigations
ASSESSMENT	Rather than assessing students this task is more about a discussion about strategies, what is working, what wasn't working, what did you do when you got stuck, etc.