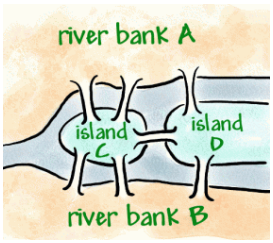
AMSI SCHOOLS LESSON OUTLINE

LEVEL: Middle Primary	CONTENT: Location & Transformation	FOCUS: Maps
In the Classroom		
PURPOSE	• Identify the qualities of a good mathematician • Demonstrate the qualities of a good mathematician • Use trial and error to investigate the problem • Share ideas and approaches with other students • Use a grid to create a map of Konigsberg • Identify key features of a map, including labels • Include key features on grid maps of familiar locations • Apply knowledge of the Konigsberg Bridge problem to solve similar problems • Explain and record thinking using a systematic approach	
WARM-UP	**Good Mathematician** Brief discussion about the qualities of good mathematicians -. Make a list of the key terms and during the lesson list any other words or phrases (positive or negative) you hear students use. Reflect on this language at the end of the lesson 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.	
INTRODUCTION	**The 7 Bridges of Konigsberg** Prior the lesson, draw a map with chalk outside on the asphalt. Use cones to make the bridges (so they can be moved later). The map needs to be large enough that students can walk the paths. Begin lesson by explaining the backstory: Konigsberg is a town on the Preger River, which in the 18th century was a German town, but now is in Russian. Within the town are two river islands that are connected to the banks with seven bridges. Here we have a smaller representation of how the bridges and islands were set out. It became a tradition by the townsfolk to try to walk around the town in a way so that they only crossed each bridge once, but it proved to be a difficult problem. Your challenge is to try and find a way to cross all seven bridges, only once, without retracing your steps.  	
EXPLICIT TEACHING & LEARNING	**Map of Konigsberg** Use the grid to create a map of Konigsberg. Include all the important features. **Challenge** In 1736, famous mathematician Leonhard Euler (pronounced Oiler), investigated this problem and discovered that it was not possible. Your challenge is to redraw your map of Konigsberg so it is possible to travel on all 7 bridges. You cannot change the layout of the town, but you may alter, add or move the location of the bridges.	
DISCUSSION/KEY QUESTIONS	• What do you notice about this problem? • How many locations are there? How many bridges? • Do you think a route that travels on all 7 bridges is possible? • What method will you use to track your progress? • Did you take a systematic approach? • Can you represent the problem as a map? • What features of the map should be included? • Can you redraw the map so a route is possible? • How can this information be used to solve similar pathway problems?	
DELIBERATIVE PRACTICE	The focus of this activity is to encourage students to use trial and error and persistence to solve the problem. Often problems have solutions – this problem has no solution. Students need to understand that sometimes “no solution” is a solution. Learning from this – how can students modify the layout of the bridges to make a route over 7 bridges possible?	
REFLECTION	Discussion with students about WWW and EBI regarding the task. This should lead into a discussion about the power of having a positive mindset, learning from each other and working together to achieve a task.	
RESOURCES	Sidewalk chalk and grid paper, large map of Konigsberg drawn outside which students can walk on to investigate the task **The 7 Bridges of Konigsberg** https://www.mathsisfun.com/activity/seven-bridges-konigsberg.html **The Konigsberg Bridge Problem** https://nrich.maths.org/2484	

Curriculum Connections	
CONTENT	**VICTORIAN CURRICULUM F-10** **LEVEL 3 – LOCATION & TRANSFORMATION** Create and interpret simple grid maps to show position and pathways (VCMMG143) **Elaborations:** Create a map of the classroom or playground **LEVEL 4 – LOCATION & TRANSFORMATION** Use simple scales, legends and directions to interpret information contained in basic maps (VCMMG172) **Elaborations:** Identify the scale used on maps of cities and rural areas in Australia and a city in Indonesia and describing the difference; Use directions to find features on a map
WHAT CAME BEFORE	Students use location words to give directions and interpret simple maps of familiar locations. It is not specified whether these maps are drawn on a grid and may be more like a picture.
WHAT COMES NEXT	Maps require additional information, often remembered by the acronym, BOLTSS (Border, Orientation, Legend, Title, Scale & Source). Interpreting maps becomes of greater importance and locating key information, which may not be found on some maps, also increases in importance. Converting between scales also becomes important, but this can only be in line with number requirements for that level. For example, in Year 4 students are introduced to decimal numbers, but multiplying decimals by whole numbers in not introduced until Year 6.
VOCABULARY	Map, location, bridge, direction, travel, route, grid, grid references, labels, birds-eye view, pathway, legend, key, scale, features, BOLTSS (Border, Orientation, Legend, Title, Scale & Source), compass points, orientation
MISCONCEPTIONS	Students may not realise that to complete this task you will need to walk on one of the bridges more than once. The solution is there is no solution, unless a bride is added, altered or removed. When drawing a map, students will often place the compass point north vertically on the page. North may not be up – this will depend on how the map is drawn.
WHAT PROFICIENCIES ARE TO BE UTILISED? **Understanding** **Fluency** **Problem Solving** **Reasoning** **Communicating (NSW)** **Justifying (NSW)**	**Level 3 (Australian Curriculum)** **Understanding** includes connecting number representations with number sequences, partitioning and combining numbers flexibly, representing unit fractions, using appropriate language to communicate times, and identifying environmental symmetry **Fluency** includes recalling multiplication facts, using familiar metric units to order and compare objects, identifying and describing outcomes of chance experiments, interpreting maps and communicating positions **Problem-solving** includes formulating and modelling authentic situations involving planning methods of data collection and representation, making models of three-dimensional objects and using number properties to continue number patterns **Reasoning** includes using generalising from number properties and results of calculations, comparing angles and creating and interpreting variations in the results of data collections and data displays.
ASSESSMENT	**Exit Pass** – Present students with another map. Can you take a walk around the islands **crossing each bridge only once?**