

# SAMPLE LESSON PLAN FORMAT

<b>Topic: Defining a Function</b>	<b>Period:</b>	<b>Course: Grade 8 (NC &amp; CA)</b>
<b>Content Standards:</b> <b>NC – 8.F.1</b> Understand that a function is a rule that assigns to each input exactly one output. <ul style="list-style-type: none"> <li>Recognize functions when graphed as the set of ordered pairs consisting of an input and exactly one corresponding output.</li> <li>Recognize functions given a table of values or a set of ordered pairs.</li> </ul> <b>CA – 8.F.1</b> Understand that a function is a rule that assigns to each output exactly one input. The graph of a function is the set of ordered pairs consisting of an input and corresponding output.		
<b>Practice Standards:</b> <i>Which 1 or 2 Practice Standards will this lesson address?</i> <ul style="list-style-type: none"> <li>Make sense of problems and persevere in solving them</li> <li>Construct viable arguments and critique the reasoning of others</li> </ul>		
<b>Mathematical Teaching Practice:</b> <i>Which 1 or 2 Teaching Practices will this lesson address?</i> <ul style="list-style-type: none"> <li>Implement tasks that promote reasoning and problem solving</li> <li>Facilitate meaningful mathematical discourse</li> <li>Pose purposeful questions</li> <li>Support productive struggle in learning mathematics</li> <li>Elicit and use evidence of student thinking</li> </ul>		
<b>Mathematical goals:</b> <i>State the specific mathematical goals for procedural fluency, conceptual understanding, and reasoning/problem solving.</i> <ol style="list-style-type: none"> <li>Students will use the vending machine activity to determine which machine represents a function, and which does not represent a function, for each pair. (reasoning/problem solving)</li> <li>Students will define function based on their reasoning with the vending machine activity. (conceptual understanding)</li> <li>Students will apply their definition of function to decide if individual vending machines represent a function or not. (reasoning/problem solving)</li> </ol>		
<b>Materials needed:</b> <i>List all tools and/or materials that will be needed to implement the task(s).</i> Laptops, Vending Machine Worksheet, writing utensil		
<b>Assessment:</b> <i>How will you know students have achieved the goals?</i> Students will be able to accurately apply the class definition of function to Machines M & N and justify/explain their conclusion in writing.		

	Activities of the Lesson	Furthering and Assessing Student Thinking	Things to Consider as You Plan
<b>Launch/ Before</b>	<p><i>What will the class be doing to get this lesson started?</i></p> <p>Students will explore Vending Machines A/B and C/D to think about why each is or is not a function.</p>	<p><i>What discussion starters will you use to help students connect this starting activity to their prior learning?</i></p> <p>I will engage students by having them think about getting a snack from the vending machine at lunch.</p> <p><i>What questions will you ask to focus student thinking?</i></p> <p>See Anticipating &amp; Monitoring Chart</p> <p><i>What questions will you ask to assess students' understanding of key mathematical ideas, problem-solving strategies, or the representations needed for today's lesson?</i></p> <p>See Anticipating &amp; Monitoring Chart</p> <p><i>How will you help students connect this starter to the upcoming lesson?</i></p> <p>This activity is designed for each portion to build students' understanding to be able to complete the next section. Our discussion of why each machine is or is not a function is what they will use to move on to the next pairs of machines.</p> <p><i>How will this activity need to be adapted to address the learning needs of individual students in your class?</i></p> <p>One issue that may arise is if a student is color blind. In this case their partner will need to assist in telling them the color relationship for each machine.</p>	<p><i>What definitions, concepts, or ideas do students need to know to engage in today's lesson? How does your starting activity help students revisit these?</i></p> <p>Students need to know how a vending machine works (press a button and get an expected drink). They will need to use "input" and "output" to write a definition of function. The vending machine activity is designed around these ideas.</p> <p><i>In what ways does this lesson build on students' previous knowledge?</i></p> <p>This activity connects their real-life experiences with vending machines to build their conceptual understanding of input/output definition of a function.</p> <p><i>What understandings and misunderstandings will you be looking for during this portion of the lesson?</i></p> <p>See Anticipating &amp; Monitoring Chart</p>

<p><b>Explore/ During</b></p>	<p><i>What are the activities in which students will engage during this lesson? How will the students explore mathematical concepts during this lesson?</i></p> <p>Students will explore Vending Machine Pairs E/F, G/H, I/J, and K/L and determine which machine for each pair is or is not a function.</p> <p>The design/pairing of each set of vending machines emphasizes different scenarios to push students to compare/contrast the behavior of each machine and highlight the idea of a consistent output for a given input.</p> <p>The end result will be a definition of function for each pair of students, documented on the student worksheet. I will choose from these definitions to facilitate the summarize portion of the lesson.</p> <p><i>How will you assess the mathematical ideas brought out in the lesson?</i></p> <p>The student worksheet includes a space for them to document their reasoning for why each vending machine is or is not a function. As I monitor, I will be able to read their reasoning, listen to their thinking as they work with their partner, and assess/advance their thinking through questioning. Additionally, I will be able to use the anticipating/monitoring chart to document student thinking. This will assist me in selecting and sequencing student solution strategies for the summarize portion of the lesson.</p>	<p><i>What difficulties might students have as they engage in this activity?</i></p> <ul style="list-style-type: none"> <li>• Not pressing “Take Can” after each trial</li> <li>• Not testing each machine enough to catch inconsistencies</li> </ul> <p><i>What scaffolding moves will you use during this activity if students are struggling?</i></p> <p>See questions in Anticipating &amp; Monitoring Chart</p> <p><i>What misconceptions might students have?</i></p> <p>See solution strategies in Anticipating &amp; Monitoring Chart</p> <p><i>What questions will you ask to help students confront and correct misconceptions?</i></p> <p>See questions in Anticipating &amp; Monitoring Chart</p> <p><i>What questions will you ask to advance students’ understanding of the mathematical ideas?</i></p> <p>See questions in Anticipating &amp; Monitoring Chart</p> <p><i>How will this activity need to be adapted to address the learning needs of individual students in your class?</i></p> <p>One issue that may arise is if a student is color blind. In this case their partner will need to assist in telling them the color relationship for each machine.</p>	<p><i>What are all the ways the task can be solved?</i></p> <p>See solution strategies in Anticipating &amp; Monitoring Chart</p> <p><i>How will this activity help students develop procedural fluency?</i></p> <p>This activity is not designed to address procedural fluency. This activity is designed to have students come up with the definition of function. The next lesson will use this definition to start work on procedural fluency.</p> <p><i>How will this activity help students develop conceptual understanding?</i></p> <p>The metaphor of the vending machine and the specific design of each pair of vending machines was chosen to help students compare/contrast/reason about why each is or is not a function. The progression through each pair of machines, coupled with questioning by the teaching during monitoring will assist students conceptual understanding of input/output definition of function.</p> <p><i>How will this activity help students develop mathematical reasoning/ problem-solving skills?</i></p> <p>The metaphor of a vending machine is a novel representation of input/output for a function that students have not seen before or will likely see again. They will have to compare/contrast the behavior of each pair of machines to decide which is and is not a function.</p>
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<p><b>Summarize/After</b></p>	<p><i>What activity will you do to help summarize today's lesson?</i></p> <p>I will utilize the students' solutions and reasoning from the vending machines in the explore part of the lesson, and their resulting definitions of function to facilitate a class discussion that results in a class consensus for definition of function.</p> <p>Goal for final definition: a function is a mathematical relationship where an input has a/one consistent output.</p> <p>Students will then apply the definition of function to Vending Machines M-P to demonstrate their mastery of the mathematical goals for the lesson.</p> <p><i>How will students share their work/thinking?</i></p> <p>I will select one or two pairs of students to share their conclusion and reasoning for each pair of vending machines from the explore phase of the lesson plan. The pair of students will use the teacher/class computer to show how they came to their conclusion. I will then choose three or four definitions of function from students' work to be shared with the class. Each pair will write their definition on the board for the class to reference as we come to a class consensus definition for function.</p>	<p><i>What questions will you ask to encourage students to share their thinking with others and to assess their understanding of their peer's ideas?</i> See questions in Anticipating &amp; Monitoring Chart</p> <p><i>What talk/discourse moves will you use to facilitate a good class discussion of the mathematics?</i></p> <ul style="list-style-type: none"> <li>• Revoicing – to ensure I understood a student's thinking and to draw attention to key ideas contributed by their peers.</li> <li>• Ask students to restate another students' reasoning in reference to both pairs of vending machines and their definition of function.</li> <li>• Ask students to apply their reasoning to another students' reasoning in reference to both pairs of vending machines and their definition of function.</li> <li>• Wait time to allow students to process my questions/comments or those of their peers.</li> </ul> <p><i>What questions will you ask to advance students' understanding of the mathematical ideas?</i> See questions in Anticipating &amp; Monitoring Chart</p> <p><i>How will this activity need to be adapted to address the learning needs of individual students in your class?</i></p> <p>One issue that may arise is if a student is color blind. In this case their partner will need to assist in telling them the color relationship for each machine.</p>	<p><i>What mathematics content and processes need to be emphasized?</i></p> <p>Consistent/same output from a given input on each machine is what determines if it is a function. This will be used to construct the input/output definition of function.</p> <p><i>How can I orchestrate the discussion so students summarize their thinking?</i></p> <p>I will use my notes from the Anticipating &amp; Monitoring chart to select and sequence student solution strategies to present to the class and serve as the focus of our discussion. I will use a variety of discourse moves and advancing/assessing questions to have students participate (see Anticipating &amp; Monitoring chart).</p>
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