Lesson Plan: How to determine whether a Relation is a Function

Lulu Yamashita
Department of Mathematics
California State University, Los Angeles

Lesson: How to determine whether a Relation is a Function

Timeframe: 50 minutes

Materials needed: white/black board, PowerPoint, notebook, textbook

Objectives:

> *Basic (understanding what and how)*
>
> *1.* State the definition of a function.
>
> *2.* Determine whether a relation in three different forms is a function: a set of ordered pairs, an equation in x and y, and a map.
> *3.* Use the vertical line test to determine whether the graph is the graph of a function.
>
> *Advanced: (*understanding why by making connections*)*
> *1.* Explain why a graph doesn't represent a function by then horizontal line test, then explain why the horizontal line test reflects the definition of the function.
>
> *2.* Explain why an equation doesn't represent a function, using the definition of the function.
>
> *3.* Explain how the vertical line test works using the definition of the function.

Background:

   This is a lesson in College Algebra, and is the very first lesson. Students are very often confused with the concept of functions perhaps because it sounds abstract. While 80% of the students are able to identify functions correctly, less than half of them are able to explain why.
   Ideally students will go on to learn how to create a function, so they can use it to solve application problems. They need to keep in mind that a function should only yield one output for each input, otherwise it won't be useful.

Introduction to Lesson:

   After learning what a relation is, the student will learn how to determine whether a relation is a function.
   The "what and the how" part is pretty straightforward, so students will learn it in pre-lesson time.
   In class, I will provide more examples under basic objectives, and they will focus on learning the advanced objectives during group work.
   After class, students do homework individually to strengthen their understanding of the topic.

Pre-Class Individual Space Activities and Resources:

Steps	Purpose	Estimated Time	Learning Objective

Step 1: **Watch online videos** **MyMathLab, YouTube, or Khan Academy**	**Preview lessons**	**10 min**	**Basic** **Definitions**
Step 2: **Do pre-lesson assignments on MyMathLab.** **Due before each class meeting.**	**Practice with online help**	**20-30 min**	**Basic** **Determine whether a relation is a function or not**
Step 3: **Do pre-lesson assignments from textbook**	**Practice with textbook examples**	**20-30 mins**	**Basic** **Determine whether a relation is a function or not**

In-Class Group Space Activities and Resources:

Steps	Purpose	Estimated Time	Learning Objective

Step 1: **Pop quiz**	**Encourage student to do their pre-lessons**	**10 min**	*1.* Basic State the definition of a function.
Step 2: **Go over the quiz.**	**Make sure they know the basics.**	**5 min**	*2.* Basic Objectives **(knowing what and how)**
Step 3: **Group assignments**	**Discuss with classmates in order to gain deeper understanding.** **Provide them chance to ask me questions.**	**20-30 min**	*Advanced Objectives* (understanding why by making connections)
Step 4: **(optional)** **Board work** **Show group solutions on the board and explain to the class**	**Make sure everyone in the group understands the solution**	**10 min**	**Advanced**
Step 5: Closure activity **Go over group solutions**	**Provide feedback** **Correct their mistakes** **Reiterate new concepts**	**5 min**	**Advanced**

Post-Class Individual Space Activities:

1. Online homework due every week.
2. Online quizzes due in completion of each chapter

Connections to Future Lesson Plan(s):

        Determining whether a relation is a function or not is the first lesson in college algebra, and yet the most difficult to many students. The reason is that the topic is more conceptual than arithmetic. It doesn't involve much math, neither does it require analytical skills, but it does require a thorough understanding of the *definition*. The value of the lesson, besides being an important basic concept, is really training students to make decisions based on the definition. In fact, the ability of solving a problem by using the definition, is probably more valuable than knowing what a function is. I remember being reminded by my graduate professors to do just that when I got stuck proving a theorem.

        Thus, I want to make sure students know how to make connections between each of the three cases and the definition of the function. It is very common to see students who are able to provide a solution to a problem without knowing why. Making connections forces students to understand the definition and therefore their own answers. And since the "why" part is the most difficult, it is better to have them learn it in class, with the help of their peers and the instructor.

Topic: Finding x and y-intercepts of a function.
Ask students: Is it possible for the graph of a function to have two y-intercepts?
The answer is no, because two y-intercepts would mean the failure of the vertical line test, or violation of the definition of a function since these two intercepts are two order pairs that share the same x-value but different y-values.