Activity: Exploring AROC Given by Tables

Course: Functions & Modeling

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Activity Abstract:

In Exploring AROC Given by Tables, Functions & Modeling instructors are provided with problems involving analyzing rates of change given in tables. A large group activity is provided where the entire classroom discusses, calculates, interprets, and applies rates of change with population values. Students then use rates of change to estimate and predict future population values. An alternative small group activity includes a shorter full-class activity with four small group tasks. With this option, students will consider increasing, decreasing, and constant rates of change with similar explorations. Each option allows students to determine if a limiting value exists for the population data provided in the table.

Instructional Plan:

Rationale for selecting/designing this problem/task sequence:

This problem/task focuses on analyzing rates of change given tables. Students will see various rates of change in tables including varied rates of change, constant rate of change, and rates of change that lead to limiting values.

In either activity, students will begin with prior knowledge of being able to read a table, use function notation, and describing table changes in words. The students transition to interpreting, calculating, and using average rates of change. By the end of the activity, the students can use average rates of change to estimate values, interpret a provided calculation, and predict future population values. They can also determine whether a particular table will approach a limiting value or not by considering the average rates of change.

Prerequisite Knowledge:

- Students should have a general understanding of considering values in a table to determine if the values are increasing, decreasing, constant or a mixture.
- Students should have general knowledge of averages and rates of change (without necessarily formal instruction) based on completing previous mathematics courses.

Learning objective(s) and alignment with Student Learning Outcomes (SLOs From CEP Matrix):

- Interpret functions using real-world contexts by translating across multiple representations, including symbols, tables, graphs, and words.
- Determine key characteristics of functions, including global properties and local patterns of change, and interpret their meanings in context, including asymptotes, concavity, end behavior, extrema, increasing/decreasing intervals, and turning points.

MIP Components of Inquiry:

This section outlines how our activity will meet the Mathematical Inquiry Project (MIP) criteria for active learning, meaningful applications, and academic success skills.

Active Learning: Students engage in active learning when they work to resolve a problematic situation whose resolution requires them to select, perform, and evaluate actions whose structures are equivalent to the structures of the concepts to be learned.

- We will promote active learning by giving students more open-ended questions for discussing how the population changes over time and estimating values. Students will select, perform, and evaluate actions that result in computations to describe changes in population.
- Students will have to select how to calculate values such as P(9), which are not given on the table.
- Additional actions include evaluating with function notation, calculating average rates of change, and estimating function values with averages or average rates of change.
- Students will use their calculated average rates of change to make predictions about future population values.

- Students will perform calculations in a manner they feel is the best approach to determining the expected outcomes for each table and question. Then the students will evaluate how accurate their estimated value is based on the trends of the table.

Meaningful Applications: Applications are meaningfully incorporated in a mathematics class to the extent that they support students in identifying mathematical relationships, making and justifying claims, and generalizing across contexts to extract common mathematical structure.

- Multiple table options will be provided where students can look at different examples of AROC and how the AROC supports the described trends.
- Students will need to make claims about trends in population and justify their claims with math.
- Students will need to determine if the same approach will apply for each of the different tables and determine the mathematical relationships represented by each table.
- In asking students to predict a population value for both a midpoint and non midpoint value taps into Harel's idea of intellectual need. Including the non midpoint value makes it clear that finding an arithmetic average is not sufficient for all predictions or estimated values.
- In asking students to analyze a given calculation (part g), students must generalize the structure of estimating function values with rates of change. They will make note of a starting value with the addition of the rate of change for a certain change in x (or domain or time). This allows students to understand the calculation with both an increasing rate of change or decreasing rate of change.

Academic Success Skills: Academic success skills foster students' construction of their identity as learners in ways that enable productive engagement in their education and the associated academic community.

- In the group work option, students will be working together with other students to develop and work through mathematical ideas associated with AROC. Some groups will see tables increasing or decreasing toward a limiting value while others will see a constant rate of change. Participation in the group and then sharing their knowledge to the class will enable students to support the classroom community.
- Students will be able to discover their mathematical understanding of the provided tables and show that they can examine, identify, and evaluate population trends represented in the tables. This helps support students' identities of capable doers/participants of mathematics (rather than passive observers).