SATEC

San Antonio Technology In Education Coalition

Foundations of Functions

So That's How It Looks!

A Lesson In Sketching Reasonable Graphs of Real World Situations

The Prompt for this lesson is from Algebra and Trigonometry, by Paul Foerster. The SATEC materials are written by Edward Durant, Dennifer Lane and Paul Tisdel

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INTRODUCTION-About the Mathematics

A. Student Performance Objectives TEK/EOC Correlation

Objective 1 – The student will demonstrate an understanding of the characteristics of graphing in problems involving real-world and mathematical situations.

b(2)**Foundations of functions.** The student uses the properties and attributes of functions.

(B) For a variety of situations, the student identifies the mathematical domains and ranges and determines reasonable domain and range value for given situations.

Objective 2 – The student will graph problems involving real-world and mathematical situations.

(b)(1) **Foundations of functions.** The student understands that a function represents a dependence of one quantity on another and can be described in a variety of ways.

(D) The student represents relationships among quantities using [concrete models,] tables, graphs, diagrams, verbal descriptions, equations, and inequalities.

Objective 8 – The student will use problem-solving strategies to analyze, solve, and/or justify solutions to real-world and mathematical problems involving one-variable or two variable situations.

(b)(1) **Foundations of functions.**

(E)The student interprets and makes inferences from functional relationships.

B. CRITCAL MATHEMATICS EXPLORED

The main focus of the lesson is having students learn to sketch a graph of a real-world situation and recognize that the graph actually describes what is happening. The concepts of **independent and dependent variables** will be revisited as well as **domain and range**. You will have the opportunity to introduce the notion of the **x and y-intercepts** and their meaning in real-world situations. Other concepts that can be explored informally are the ideal of **rate of change**, **continuous or discrete graphs, linear or non-linear graphs, and piece-wise graphs.** It is especially critical that the teacher emphasize the **reasonableness of the graph.**

C. HOW STUDENTS WILL ENCOUNTER THE CONCEPTS

The students will be given verbal descriptions of a real-world situations. Students will then sketch graphs that they feel appropriately describe the situation. Finally, studentS will have their solutions checked to see if they are **reasonable** through presentation of their solution to the entire class for peer and teacher evaluation.

D. SETTING UP

LIST OF MATERIALS

Student Activity

- Write-on transparency sheets (3 or 4 per group)
- Transparency markers (2 different colored markers per group)
- Overhead projector
- Rulers

Teacher Preparation for the lesson

It is especially critical that the teacher have read through the situations and suggest graphs. Equally important is the development of the questions you wish to ask respecting the graphs of the situations. Try to anticipate various student interpretations and be prepared to discuss reasonableness of their solution. Especially develop questions that will cause the student to reflect on the meaning of the graph at different points and over various intervals.

E. ANSWER KEY

The situations presented are represented by a variety of models. In the collection you will find linear, quadratic, periodic, and exponential. There will most certainly be "piece wise" functions depending upon how the situation is interpreted.

What is critical in this exercise is that the graph **reasonably** represents the situation. You should not permit an unreasonable graph to be accepted. Try to find out by questioning if the student actually understands the situation. Determine also if the students has gaps in knowledge relating to how graphs are formed.

You should certainly begin to assemble a collection of reasonable graphs for each situation. Assumptions that students make will often result in different graphs.

F. ASSESSMENT IDEAS

1. Create a similar set of situations. Have the students sketch reasonable graphs of each situation. Be sure that they determine the independent and dependent variables and label the axes.

2. Give students matching exercise consisting of graphs and descriptions.

3. A multiple choice activity in which students must select either an appropriate situation to match a graph or select a graph to match the situation can be used for a short quiz or sponge activity.

F. EXTENSION IDEAS

A. Collect graphs from newspapers or other periodicals. Use these with exploratory questions that determine if the students understand the content of the graphs.

B. Give students sketches of graphs without detail. Have the students create a story or situation which reasonably matches the graph.

C. Have students make a collection of different kinds of graphs. They should learn the names of each type of graph and be able to explain the content of each particular graph they have chosen.

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Student Activity

Instructions

You are being given word descriptions of various real-world situations. For each of these you should determine the variables and decide which is independent and which is dependent. Next, draw independent and dependent axes and sketch a graph you believe **reasonably** represents the situation. You must be prepared to defend your solution. Be sure to title your graph using the form ***name of dependent variable versus name of independent variable.***

Each student will have to present at least one of the situations to the entire class and be prepared to explain what each part of the graph represents.

The Real-World Situations

1. The distance you travel depends on the number of hours you drive for a set speed.

2. The amount of water in a load of wet clothes depends on the number of minutes they have been in clothes dryer running at the ***normal*** setting.

3. The size of a balloon depends upon the number of breaths that have been blown into it.

4. The amount of money you receive for recycling aluminum cans depends upon the number of pounds of cans turned in.

5. The height of a person depends upon their age.

6. The speed at which a skydiver falls to the ground is related to the number of seconds since she jumped out of the airplane.

7. A quarterback throws a football. The height that the football is above the ground is related to the number of seconds that have elapsed since the ball was released.

8. The height of a pecan tree depends on the number of years that have passed since the pecan was planted.

9. The number of pages left to read in a book depends on the number of minutes you have been reading.

10. You are attending a concert. How loud the music sounds depends on how far you are from the speakers on the stage.

11. After taking a bath, you open the drain on the bathtub. The amount of water left is the tub is related to the number of minutes the drain remains open.

12. You are connected to a device that measures the amount of air in your lungs. The amount of air in your lungs depends on time.

13. Your father puts some water in the kettle to make hot chocolate. After he turns on the stove, the temperature of the water is related to how long the stove is left on.

14. The temperature in a home depends upon how long the air conditioner is turned on.

15. The price you pay for a fountain drink depends upon the number of ounces the cup will hold.

16. You dive into a deep lake. How far down you can go depends on how long you can hold your breath.

17. A cement manufacturing company digs its raw materials from a quarry. The depth of the quarry depends on the number of years the company has been digging.

18. An oil exploration company is drilling an oil well. The depth of the well depends on the number of days the company has been drilling.

19. The number of minutes in a day depends upon the day of the year.

20. The number of people on the earth is related to the year since 1 A.D.