Mini-Unit

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Subject: Algebra II

Topic/Content: The 12 basic functions

Synopsis: In this unit students will explore the 12 basic functions as well as domain, range, intercepts, continuity, slope, extreme values, vertex, axis of symmetry, turning points, and points of maximum and minimum value. Students will be able to visually recognize the graphs of these functions and their equations as well as applications of the functions and their characteristics.

State Standards

Algebraic Reasoning: Patterns and Functions
1.1 Understand and describe patterns and functional relationships
a. Describe relationships and make generalizations about patterns and functions
1.2 Represent and analyze quantitative relationships in a variety of ways
a. Represent and analyze linear and nonlinear functions and relations symbolically and with tables and graphs
Working with data
4.1 Collect, organize and display data using appropriate statistical and graphical methods
a. Create the appropriate visual or graphical representation of real data
Interdisciplinary standards
In this unit students will incorporate skills that they have learned in science, biology, reading and statistics.

Key Vocabulary

Function, domain (independent variable or x-values), range (dependant variable or y-values), x-intercepts (zeros) and y-intercepts, continuity, slope, extreme values, parabola, increasing/decreasing functions, maximum and minimum points, vertex, axis of symmetry, turning points, points of inflection, end behavior.

Enduring Understandings

- Graphs represent trends in data
- Graphic comparisons of functions as visual representations
- Algebraic comparisons of functions as number representations
- The symmetry of certain functions can give clues about the roots of the function
- Being able to manipulate functions is an effective strategy for standardized testing

Essential Questions

- What is unique about linear and constant functions?
- What do you notice about the absolute value function?
- What axis is a quadratic function symmetric to?
- What do you notice about the square root function?
- What axis is a cubed function symmetric to?
- What kind of asymptotes does a reciprocal function have?
- How can you describe the greatest integer function in plain English?
- What effect does shifting have on any function?
- What effect does translation have on any function?
- Why does exponential growth and decay look the way that it does?

Learning Objectives

Upon completion of this unit students will be able to:

- Draw the graphs of the 12 basic functions on their own.
- Identify the graphs of the 12 basic functions and their equations.
- Define the domain and range of these functions.
- Find the x- and y-intercepts, extreme values, axis of symmetry, slope, vertices and turning points of a function.
- Analyze and draw conclusions about the continuity, increasing or decreasing nature of the functions based on their graphs.
- Use a graphing calculator to graph the 12 functions and find points of maximum value, minimum value, the axis of symmetry, and vertices.
- Solve word problems using the 12 graphs.
- Graph and find equations of the translations of the functions up, down, left and right.
- Collaborate in groups and work with 3-4 students cooperatively.
- Present ideas and communicate clearly in front of the class.

Scaffolding and Linking Problems/Concepts

The first step will be introducing the 12 basic functions. This will take approximately one week during which students will study 2-3 functions per day, drawing them using tables of values, analyzing them by finding domain, range, x- and y-intercepts, asymptotes, slope, extreme points, vertices, continuity/discontinuity. The preferable order of study of the functions would be: linear, constant, absolute value, quadratic, square root, inverse squared, cube function, reciprocal function, greatest integer, inverse squared, cube root, exponential (growth and decay). The second week students will work in groups to study translations of these functions, followed by group presentations. The third week, students will explore word problems that require analyzing data using graphs and equations of the 12 basic functions.

Student Based Activities

- Students will complete the worksheets for each function.
- Students will work on the SkyHigh Skyscrapers project in class in teams of two.
- Students will work on the Population Growth project in class in teams of two.
- Students will complete a quiz on the 12 basic functions.
- Students will work in groups to pick a function and model a real-world scenario represented by that function. They will have to provide data for their chosen function, graph their function, analyze the data and write a synopsis on their conclusions.

Assessments

Once the students have been introduced to the 12 basic functions, they will complete a quiz to assess their understanding midway through the unit. Students will be asked to identify each of the functions and describe certain characteristics, like intercepts, asymptotes, domain, range, etc.

The culmination of the unit will be to have the students work in groups, where each group selects a different function. They will have to model a real world scenario and provide data. The students will have to create a poster about their function and its characteristics, how the function models their data, and any applicable information pertaining to the model. Upon completion, they will have to present their findings and explain their conclusions about their model to the class.