Java Applet for the Box Example

This applet was developed to address, in part, the high school algebra standard in West Virginia. In addition, the applet may be used in a course for pre-service teachers or as in introductory laboratory in College Algebra to familiarize the students with the grapher. The accompanying worksheets may be used to guide the applet, or the applet may used in isolation.

Content Standards are meant to be broad descriptions of what students should know and be able to do in a content area. They describe what students' knowledge and skills should be at the end of a sequence of study. The Lemonade applet was written taking into account standard 2 from the *West Virginia Content Standards and Objectives for Mathematics* (WVDE, 2004).

Standard 2: Students will:

- **demonstrate understanding of patterns, relations, and functions;**
- **represent and analyze mathematical situations and structures using algebraic symbols;**
- **use mathematical models to represent and understand quantitative relationships; and**
- **analyze change in various contexts through communication, representation reasoning and proof, problem solving, and making connections within and beyond the field of mathematics.**

A content objective is an incremental step toward the accomplishment of content standards (WVDE, 2004). The java activity may be used to explore the following objectives from Algebra I, Algebra II, and PreCalculus. These are found in the *West Virginia Content Standards and Objectives* document. The format of each standard identification is **course_abbreviation.standard_number.objective_number**. So **A2.2.8** is coded for Algebra II and addresses standard 2, algebra, and is objective number 8.

A2.2.8 solve equations containing radicals and exponents.

A2.2.9 define a function: find the domain, range, zeros; find the inverse of a function; **find the value of a function for a given element in its domain; and perform basic operations on functions** including composition of functions.

A2.2.10 explore basic families of functions: recognize linear, quadratic, absolute value, step, and **exponential functions; and convert among graphs, tables and equations.**

PC.2.1 investigate and sketch the graphs of polynomials and rational functions **using the characteristics of zeros**, upper and lower bounds, **y-intercepts**, symmetry, asymptotes and **end behavior, maximum and minimum points and domain and range.**

PC.2.5 solve equations and practical problems involving exponential and logarithmic expressions: include natural and common logarithms; use laws of exponents; and **confirm solutions graphically and numerically.**

Performance Descriptors describe in narrative form how students demonstrate achievement of the content standards. In West Virginia, five performance levels have been adopted. The descriptors are meant to give teachers more information about the level of their students and are also used to explain student performance on statewide assessment instruments (WVDE, 2004). The following performance descriptors are suggested for the Maximizing Area applet.

 # Distinguished

The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in **Algebra II.** The student solves practical application problems giving solutions in a clear, concise manner. The student solves equations containing rational exponents and justifies solutions. The student finds domain, range, and zeros of functions converting forms among graphs, tables and equations.

 # Above Mastery

The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in **Algebra II**. The student solves practical application problems and performs basic operations with complex numbers and gives answers in simplest form. The student solves equations containing rational exponents. The student finds domain, range, and zeros of basic functions (such as exponential) using graphs, tables and equations and performs basic operations on functions.

 # Mastery

The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in **Algebra II**. The student performs simple operations with complex numbers. The student solves equations containing rational exponents and finds domain, range, and zeros of basic functions using graphs, tables and equations.

 # Partial Mastery

The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in **Algebra II**. Performance needs further development. The student inconsistently finds the domain, range and zeros of simple functions. The student attempts to solve equations and given a graph.

 # Novice

The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in **Algebra II.** Performance needs considerable development. The student attempts to solve simple equations.