

Analyzing Elementary Functions

In this project you will analyze various functions. Thoroughly analyze the following aspects of each function, explaining your methods and conclusions. Remember the "rule of four": use verbal, algebraic, graphic, and numeric approaches. For each function, create a table of values and a carefully drawn graph, and include them with your analysis.

- (a) What are the domain and range of the function?
- (b) What are its x- and y-intercepts?
- (c) Identify any removable, jump, or infinite discontinuities.
- (d) Report the intervals on which the function is increasing and the intervals on which it is decreasing.
- (e) Is the function bounded above, below, both, or neither?
- (f) Does it have any local or absolute maximum and minimum values? At which x values do these occur?
- (g) Is the function even, odd, or neither? Is its graph symmetrical? If so, describe the type of symmetry.
- (h) Does the graph of the function have any horizontal and vertical asymptotes? If so, write the equations of the asymptotes.
- (i) Is the function one-to-one? If so, determine the equation of the associated inverse function.

Function 1. $first(x) = |x^2 - 2|$

Function 2. $rat(x) = \frac{1}{x^2 - 1}$

Function 3. $rad(x) = \sqrt{x^2 - 4}$

Function 4. $int(x) = \llbracket x \rrbracket$ (the greatest integer less than or equal to x.)

Function 5. $knoll(x) = x \cdot e^{-x}$

Function 6. $last(x) = |x^3 - 3x|$