

I. Technology Component. Using a hand-held graphing calculator, the learner will be able to **graphically** and **numerically** demonstrate:

- A. How to graph functions of the following types:
  1. circular functions
  2. algebraic combinations of circular functions
  3. algebraic combinations of circular functions and polynomials, exponentials, and logarithms
- B. How to choose a proper calculator window to display any of the above functions in order to identify
  1. roots
  2. vertical asymptotes
  3. functional end behavior, including
    - a) horizontal asymptotes
    - b) oblique asymptotes
    - c) growth without bounds
  4. holes in functions (points of non-definition)
  5. extrema (maxima and minima)
  6. inflection points
  7. regions of functional increase and decrease
  8. intersections of functions
- C. How to solve right triangle trigonometry problems, including
  1. missing angle and missing leg
  2. using law of sines and law of cosines
  - 3.
- D. How to solve a system of two equation or inequalities
- E. How to solve a system of equations and inequalities involving absolute value
- F. How to program simple algorithm to solve the quadratic equation to approximate complex roots
- G. How to graph functional transformations including
  1. horizontal and vertical translations
  2. reflections about the x and y axes
  3. dilations and contractions
  4. combinations of the above transformations
- H. How to graphically demonstrate symmetry about
  1. the x-axis
  2. the y-axis
  3. the origin
  4. the line  $y=x$ , with meaning for inverse functions

II. Algebraic Component. Using **algebraic** methods the learner will be able to demonstrate:

- A. How to algebraically solve equations of the following types
  1. linear
  2. quadratic by completing the square and by solving the quadratic equation
  3. solvable polynomials
  4. solvable radicals
  5. solvable rationals
  6. solvable exponentials
  7. solvable logarithmics

- B. How to represent symbolically operations with functions, including
  1. addition, subtraction, multiplication, and division
  2. composition
  3. the role of composition in inverse functions
  4. piecewise define functions
- C. How to describe functions as in part A. by
  1. describing their domains and ranges
  2. restricting domains of relations, including inverse relations, to generate functions
  3. using the vertical and horizontal line tests
  4. using the concept of one-to-one in conjunction with invertibility of a function.
- D. How to symbolically represent functional transformations, including
  1. horizontal and vertical translations
  2. reflections about the x and y axes
  3. dilations and contractions
- E. How to recognize and symbolically represent functional symmetry, including
  1. horizontal symmetry
  2. vertical symmetry
  3. symmetry about the origin
- E. How to use calculus ready concepts such as
  1. average rate of change including the
    - a) secant line model
    - b) difference quotient
  2. end behavior or asymptotic behavior
- F. How to apply various important theorems for solving equations, including
  1. The Fundamental Theorem of Algebra
  2. factor theorems
  3. polynomial division algorithms for integral quotients
- G. Given factorization of a function, how to identify the following
  1. roots
  2. vertical asymptotes
  3. functional end behavior, including
    - a) horizontal asymptotes
    - b) oblique asymptotes
    - c) growth without bounds
  4. holes in functions (points of non-definition)
  5. extrema (maxima and minima)
  6. inflection points
  7. regions of functional increase and decrease
  8. intersections of functions
- H. How to solve exponential equations using laws of exponents and laws of logarithms, including change of bases.
- I. How to construct and compute the Newton quotient.

III. Problem-Solving Component. Using the **Rule of Three**, that is algebraically, graphically, or numerically, the learner will demonstrate solutions to the following types of problems:

- A. traditional right triangle problems (missing side, missing angle)
- B. traditional right triangle problems (missing side, missing angle) using law of sines or law of cosines
- C. simple harmonic motion problems, incorporating period, amplitude, and phase, including
  1. pendulum
  2. weight suspended by a spring