Dover-Sherborn High School
Mathematics Curriculum
Algebra II Level 1/CP

A. DESCRIPTION

This course reviews and extends the major topics of Algebra I, and provides a thorough foundation in the concepts of Algebra II as preparation for the topics studied in Precalculus.

B. OBJECTIVES

The student should be able to:
1. extend his/her knowledge of the real number system;
2. demonstrate a knowledge of the complex number system;
3. develop and graph the equations of the conic sections;
4. analyze functions and their inverses;
5. examine and solve problems using higher degree polynomials;
6. learn the principles of counting and basic probability, and
7. expand his/her knowledge of finite sequences and series by solving related problems that demonstrate this knowledge.

C. OUTLINE
1. The real number system [AII.N.2]; [AII.P.8]; [AII.P.9]; [AII.P.10]; [AII.P.11]; [AII.P.13]
   a. structure, properties and operations of real numbers
   b. radicals and rational expressions
   c. first degree equations and inequalities, including systems
   d. operations involving matrices
   e. linear programming
   f. second degree equations
   g. absolute value
   h. radical equations
2. The complex number system [AII.N.1]; [AII.P.7]; [AII.P.11]
   a. operations with complex numbers
   b. quadratic equations with complex solutions
3. Conic sections [AII.G.3]; [AII.P.7]; [AII.P.8]; [AII.P.11]; [AII.P.12]
   a. development of the properties and equations of the circle, ellipse, parabola
   b. and hyperbola, with translations
   c. systems of quadratic equations

4. Functions [AII.P.4]; [AII.P.5]; [AII.P.6]; [AII.P.7]; [AII.P.8]; [AII.P.10]; [AII.P.11]; [AII.P.12]; [AII.P.13]
   a. definition of a function and a relation
   b. graphing functions such as:
   c. $y = x$, $y = -x$, $y = \frac{1}{x}$, $y = |x|$, $y = \sqrt{x}$ and translations
   d. introduction to symmetry, asymptotes and excluded regions
   e. determining and graphing the inverse of a function
   f. graphing exponential and logarithmic functions
   g. solving exponential and logarithmic equations
   h. applications to growth, decay and interest problems
5. Higher degree polynomials and equations [AII.N.2]; [AII.P.6]; [AII.P.8]; [AII.P.11]; [AII.P.12]; [AII.G.3]
   a. remainder and factor theorems
   b. synthetic division
   c. graphing polynomials
   d. approximating irrational roots
6. Sequences and series [AII.P.1]; [AII.P.2]
   a. arithmetic sequences and series
   b. geometric sequences and series
7. Probability and Statistics [AII.D.1]; [AII.D.2]; [AII.P.1]; [AII.P.3]
   a. sequential counting
   b. permutations and combinations
   c. binomial theorem
   d. simple probability

D. TEXT

Algebra 2, Schultz, Ellis, et al.; Holt, Rinehart and Winston, 2001
ISBN 0-03-052223-4

E. RESOURCE MATERIALS
1. Computer programs written by students
2. Worksheets prepared by individual teachers
3. Graphical calculators
4. Mathematics Teacher
5. Web sites

Course Title: Algebra II Level 1 Grade: 10

Unit: The Real Number System

Month Presented: September Unit Length: 2

Essential Question(s):

- How can an equivalent expression be found?
- How can classes of numbers be defined and recognized?
- What are the properties of real numbers?
- What is the usefulness of the identity and the inverse for an operation?
- How do "shortcuts" work? (e.g., what are the conditions for using the Distributive Property?)

Learning Objectives:

- Manipulate and simplify expressions appropriately using order of operations.
- Simplify and evaluate expressions involving grouping symbols and absolute value.
- Translate word phrases and sentences into algebraic expressions and equations.
- Translate word problems into algebraic equations.
- Interpret and use the number line, and the concepts of opposites and absolute value.

Instructional Strategies & Activities:

- Note-taking
- Group work/cooperative learning
- Reflection and self-assessment
- Solution sharing
- Independent practice

Materials Utilized:

- Textbook
- Teacher-generated notes, worksheets and explorations
- Ceiling-mounted computer-projector and SmartPad
- Graphing calculator projector

Assessment Strategies:

- Class discussion responses
- Warm-Up activities and problems
- Daily homework error analysis
- Quizzes and tests: multiple choice, fix-the-false-statements, show-work, open-response questions
- Quiz corrections explained by student
- Reflection and self-assessment
- Four-corner activities

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Unit: Functions

Month Presented: October Unit Length: 2

Essential Question(s):

- What is the meaning of "*x*"?
- What is the meaning of "*f(x)*"?
- How can I distinguish a function from a relation?
- How do I use transformations to graph functions?
- How can I describe the domain and range of a function graphically and analytically?
- How do I construct the inverse of a function graphically, analytically and numerically?

Learning Objectives:

- Use function notation appropriately to reflect input and output values.
- Distinguish between a function and a relation.
- Graph functions, including piecewise-defined functions, and analyze domain and range.
- Use algebra to predict graphical behavior, and vice-versa.
- Add and subtract functions.
- Compose functions in both orders.

Instructional Strategies & Activities:

- Note-taking
- Group work/cooperative learning
- Reflection and self-assessment
- Solution sharing
- Independent practice

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Assessment Strategies:

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Unit: Linear Functions and Systems

Month Presented: November Unit Length: 3

Essential Question(s):

- How can I recognize linearity: analytically, geometrically, numerically?
- How can I recognize direct variation: verbally, analytically, geometrically?
- How do I use transformations to graph linear functions?
- How can I describe the domain and range of a linear function: analytically and graphically?
- How do I construct the inverse of a linear function: analytically, graphically, numerically?
- What is similar/different about equation and inequality solutions?
- What is similar/different about linear-model and real-world solutions?
- What does it mean to solve a system of linear equations: verbally, analytically, graphically?
- What does it mean to solve a system of linear inequalities: verbally, analytically, graphically?

Learning Objectives:

- Use multiple forms of a linear equation interchangeably.
- Use algebra to predict graphical behavior, and vice-versa.
- Use piecewise-defined functions, like absolute value and greatest integer functions.
- Solve and graph two-variable-equations.
- Solve and graph two-variable-inequalities.

Instructional Strategies & Activities:

- Note-taking
- Group work/cooperative learning
- Reflection and self-assessment
- Solution sharing
- Independent practice

Materials Utilized:

- Textbook
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Assessment Strategies:

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Course Title: Algebra II Level 1 Grade: 10

Unit: Polynomial Functions

Month Presented: Jan-Feb Unit Length: 3

Essential Question(s):

- How can I recognize a polynomial function: analytically, graphically, and numerically?
- How do I use transformations to graph a polynomial function?
- How can I describe the domain and range of a polynomial function: analytically and graphically?
- How do I construct the inverse of a polynomial function: analytically, graphically, and numerically?
- What are the different methods to solve a polynomial equation, and how do I choose among them?
- How many solutions should I expect to account for with a polynomial equation?
- What is a zero?
- What are conjugate pairs?
- What are the similarities/differences between real-number and polynomial long division?
- What are the similarities/differences between polynomial long division and synthetic division?

Learning Objectives:

- Use algebra to predict graphical behavior, and vice-versa, including critical points with extreme values.
- Solve and graph polynomial functions, with and without a graphing calculator.
- Use the remainder and factor theorems.
- Write a polynomial function given its real or imaginary zeros.

Instructional Strategies & Activities:

- Note-taking
- Group work/cooperative learning
- Reflection and self-assessment
- Solution sharing
- Independent practice

Materials Utilized:

- Textbook
- Teacher-generated notes, worksheets and explorations
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- Graphing calculator projector

Assessment Strategies:

- Class discussion responses
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Unit: Rational and Radical Functions

Month Presented: Feb-Mar Unit Length: 3

Essential Question(s):

- How can I recognize a rational function: analytically, graphically, and numerically?
- What happens if I divide two polynomials: analytically and graphically?
- What's the graphical interpretation of division by zero?
- How do I use transformations to graph a rational function?
- How can I describe the domain and range of a rational function: analytically and graphically?
- How do I construct the inverse of a rational function: analytically, graphically, and numerically?
- What is similar/different about an asymptote and a hole: analytically and graphically?
- What is a limit as x approaches +- infinity?
- How can I solve a rational equation?
- How can I recognize a radical function: analytically, graphically?
- How do I use transformations to graph a radical function?
- How can I describe the domain and range of a radical function: analytically and graphically?
- How do I construct the inverse of a radical function: analytically, graphically, numerically?
- How can I solve a radical equation?
- What is an extraneous solution, and how can I check for one?

Learning Objectives:

- Use algebra to predict graphical behavior, and vice-versa, including critical locations on rational equations with vertical asymptotes or gaps as well as limiting behavior at the infinities.
- Use algebra to predict graphical behavior, and vice-versa, including domain restrictions on radical equations.
- Solve and graph rational and radical equations, with and without a graphing calculator.

Instructional Strategies & Activities:

- Note-taking
- Group work/cooperative learning
- Reflection and self-assessment
- Solution sharing
- Independent practice

Materials Utilized:

- Textbook
- Teacher-generated notes, worksheets and explorations
- Ceiling-mounted computer-projector and SmartPad
- Graphing calculator projector

Assessment Strategies:

- Class discussion responses
- Warm-Up activities and problems
- Daily homework error analysis
- Quizzes and tests: multiple choice, fix-the-false-statements, show-work, open-response questions
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Unit: Exponential and Logarithmic Functions

Month Presented: May-June Unit Length: 3

Essential Question(s):

- How can I recognize an exponential function: analytically, graphically?
- How do I use transformations to graph an exponential function?
- How can I describe the domain and range of an exponential function: analytically and graphically?
- How do I construct the inverse of an exponential function: analytically, graphically?
- How can I solve an exponential equation?
- What is e?
- How can I solve a logarithmic equation?

Learning Objectives:

- Use algebra to predict graphical behavior, and vice-versa, with and without a graphing calculator.extreme values.
- Solve and graph exponential and logarithmic equations, with and without a graphing calculator.
- Interpret real-life applications of exponential and logarithmic models.

Instructional Strategies & Activities:

- Note-taking
- Group work/cooperative learning
- Reflection and self-assessment
- Solution sharing
- Independent practice

Materials Utilized:

- Textbook
- Teacher-generated notes, worksheets and explorations
- Ceiling-mounted computer-projector and SmartPad
- Graphing calculator projector

Assessment Strategies:

- Class discussion responses
- Warm-Up activities and problems
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Unit: Sequences and Series

Month Presented: Apr-May Unit Length: 3

Essential Question(s):

- How can I describe the pattern in a sequence: recursively and/or explicitly?
- How can I reconstruct a sequence, given a rule that defines it?
- What are the components of sigma notation?
- How can I find a shortcut to sum the terms of a series?
- How can I know whether the sum of an infinite number of terms exists?
- What is Pascal's Triangle, and what is its pattern useful for?
- How can I expand a binomial which is raised to any power?

Learning Objectives:

- Recognize sequences/series which are arithmetic or geometric in nature.
- Use explicit and recursive statements of sequences interchangeably.
- Interpret and write rules for sequences.
- Interpret and write rules for series sums.
- Interpret and write sigma notation expressions for partial and infinite series.
- Use the Binomial Theorem to expand a binomial, or to identify a particular term in the expansion.

Instructional Strategies & Activities:

- Note-taking
- Group work/cooperative learning
- Reflection and self-assessment
- Solution sharing
- Independent practice

Materials Utilized:

- Textbook
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Assessment Strategies:

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Unit: Probability

Month Presented: March Unit Length: 2

Essential Question(s):
- How can I figure out all the ways in which an event might happen?
- Why is a probability a ratio?

Learning Objectives:
- Distinguish permutations from combinations: verbally and algebraically.
- Use the fundamental counting principle to count total possible outcomes.

Instructional Strategies & Activities:
- Note-taking
- Group work/cooperative learning
- Reflection and self-assessment
- Solution sharing
- Independent practice

Materials Utilized:
- Textbook
- Teacher-generated notes, worksheets and explorations
- Ceiling-mounted computer-projector and SmartPad
- Graphing calculator projector

Assessment Strategies:
- Class discussion responses
- Warm-Up activities and problems
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Unit: Statistics

Month Presented: May Unit Length: 1

Essential Question(s):

- How can I analyze a set of one-variable data?
- How can I construct one value which is typical for an entire data set?
- How can I describe how the rest of the data drifts away from the one typical value?
- How can I display data values graphically?

Learning Objectives:

- Identify the similarities/differences between mean, median and mode as the typical value for a set of data values.
- Identify and use the appropriate measure of dispersion for mean and for median.
- Display one-variable data in an appropriate graphical form.

Instructional Strategies & Activities:

- Note-taking
- Group work/cooperative learning
- Reflection and self-assessment
- Solution sharing
- Independent practice

Materials Utilized:

- Textbook
- Teacher-generated notes, worksheets and explorations
- Ceiling-mounted computer-projector and SmartPad
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Assessment Strategies:

- Class discussion responses
- Warm-Up activities and problems
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