

ALGEBRA 2 CP A

Curriculum Guide

Area: Mathematics

Course Level: Academic

Textbook: *Advanced Algebra, Tools for a Changing World*, Bellman, Bragg, Chapin, Gardella, Hall, Handlin, Manfre, Prentice Hall 2001

Course Length: Full Year

Credits: 5 Credits

Revised: August 2008

Midterm Exam Revised: January 2008

Final Exam Revised: June 2008

I. Prerequisite:

Students taking this course should have completed Algebra 1 Academic with at least a 75%. It is also recommended that they have completed Geometry and received at least a 75%. Students from the modified level may take Algebra 2 Academic if they had an A in the modified level and teacher recommendation.

II. Course Description:

Algebra 2 is the third year of college preparatory mathematics at an academic level. It reinforces and extends topics from Algebra 1, such as order of operations, solving equations and inequalities in one variable and related word problems, functions, operations with polynomials, laws of exponents, factoring and rational expressions and related word problems.

New topics introduced are absolute value inequalities, variation, determinants, rational exponents, radicals and irrational numbers, complex numbers, completing the square, the Quadratic Formula, conic sections, polynomial functions, rational functions, exponential and logarithmic functions and sequences and series.

Graphing calculators will be used throughout the course both for exploration and discovery, and as an aid to computation in real life problems. The graphing calculator helps students visualize concepts and utilize a graphical approach to problem solving. The use of the calculator allows students to concentrate on problem solving strategies and enables us to use the types of numbers that occur in real life situations, but may be difficult to work with if a calculator is not available. Students will be given instructions on how to use the calculators efficiently. Estimation and reasonableness of answers will be stressed so that students can recognize calculator errors.

III. Description of Instruction:

Students are expected to be active participants in the learning process. The teacher will involve them in the introduction and development of material through questioning and class discussions. Understanding of concepts is stressed rather than rote memorization of skills. When appropriate, students are guided in discovering the concepts themselves through a study of patterns and by relating the new work to their prior knowledge. Critical thinking is emphasized and students will be asked to draw, label, explain, justify, verify and interpret as they apply the concepts they learn to new situations.

Cooperative learning activities will be used throughout the course, along with both informal activities such as discussing or solving textbook problems and formal discovery and problem solving activities. Students will be encouraged to verbalize math concepts and share ideas with each other.

Homework will be given almost every day and is an important part of the course, providing students the opportunity to apply skills learned in class, strengthen their understanding of the concepts, and identify areas of uncertainty. It is imperative that students do homework regularly and conscientiously. Homework will be reviewed in class and it is the student's responsibility during that time to ask questions about problems he/she does not understand, to identify specific errors, and to take notes on any further explanations concerning these problems.

IV. District Policy: ACADEMIC INTEGRITY

Pupils are expected to be honest in all of their academic work. This means that the students in this course will not engage in any of the following acts:

- Cheating on examinations or other school assignments, including but not limited to, the non-authorized use of books or notes, the use of crib sheets, copying from other students' papers, exchanging information with other students orally, in writing, or by signals, obtaining copies of the examination illegally and other similar activities. Cheating through the use of technology to exchange information on any school assignment, examination, etc. is prohibited. Technology is defined as, but not limited to, computers, telephones, text messaging, palm pilots, calculators, cameras or any other hand held device.
- Plagiarism is not permitted in term papers, themes, essays, reports, images, take-home examinations, and other academic work. Plagiarism is defined as stealing or use without acknowledgment of the ideas, words, formulas, textual materials, on-line services, computer programs, etc. of another person, or in any way presenting the work of another person as one's own.
- Falsifications, including forging signatures, altering answers after they have been graded, inserting answers after the fact, erasing of grader's markings, and other acts that allow for falsely taking credit.

A pupil found guilty of academic dishonesty may be subjected to a full range of penalties including, but not limited to reprimand and loss of credit for all of the work that is plagiarized. Disciplinary action may also be a consequence of such behavior. Additional consequences may apply as defined in specific department policies and guidelines.

A teacher who believes that a pupil has been academically dishonest in his/her class should resolve the matter in the following manner:

- Reprimand the student orally and/or in writing. The teacher is also authorized to withhold credit in the work due to academic dishonesty.
- If warranted, the teacher shall file a written complaint against the student with the Administration, requesting a more stringent form of discipline. The complaint must describe in detail the academic dishonesty that is alleged to have taken place, and must request that the matter be reviewed by the Administration.
- The Administration will determine if further discipline of the pupil is appropriate, and will determine the nature of the discipline on a case-by-case basis.
- If the pupil is not in agreement with the disciplinary action of the Administration, he/she may appeal the action first to the Principal and secondly to the Superintendent. If the pupil is dissatisfied with the Superintendent's disposition of the case, he/she may grieve the action in accordance with Policy No. 5710, Pupil Grievance.

V. District Policy: Equal Opportunity

High Point Regional High School's curriculum and instruction are aligned to the State's Core Curriculum Content Standards and address the elimination of discrimination by narrowing the achievement gap, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectional or sexual orientation, gender, religion, disability or socio-economic status.

VI. Student Evaluation:

One to three quizzes, based on the course proficiencies will be given during a unit. And a chapter test will be given at the end of each unit. Cooperative group assignments and projects will also be assigned and graded. Teachers will explain their method of grading these. An exam will be given at the end of each semester, covering all work of that semester.

Homework will be checked daily. It will usually not be graded, but will be considered satisfactory if the work shown indicates the student has made a conscientious effort to complete the assignment. If a student is unable to complete an assignment because he/she didn't understand the material, the student may be asked to redo the assignment after it is reviewed in class in order to receive credit.

Sometimes an assignment given for homework may be collected and graded as a quiz. This will only be done when concepts have been thoroughly reviewed.

Grades will be calculated according to the school grading policy and the following guidelines.

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| A. Marking Period | |
| 1. Tests and Quizzes | 90 – 95% |
| 2. Homework | 05 – 10% |
| (Each teacher will explain his/her homework policy to the class) | |
| 3. Class Participation | 00 – 05% |

B.	Final Grade	
	1. Each Marking Period	20%
	2. Midterm Exam	10%
	3. Final Exam	10%

VII. The proficiencies, not the textbook, are to be used to as a guide for this course. At the end of each unit a list of resources and activities is given. The textbook is the major resource and will be listed first. The TI- 83+ graphing calculator should be used throughout the course. Appropriate lessons from supplementary materials coordinated with the textbook will be used to instruct students in the use of the calculator. Most of these are cooperative learning activities. In addition, the teacher should use the graphing calculator to help visualize graphs of functions and other concepts whenever he/she feels it is appropriate.

The teacher's textbook provides a variety of supplementary activities. Teachers should study the examples in the margins of the book for suggestions on ways to present and extend problems. The supplementary Practice Workbook also contains appropriate exercises for each concept covered.

The Prentice Hall website should be used as a resource for both students and Teachers:
<http://www.phschool.com>.

The website provides introductions to concepts, projects, student self tests and hotlinks for additional help on topics covered.

Quizzes and tests should contain problem solving situations, open ended Questions and require students to give written explanations. Although students may use graphing calculators on tests they should also be required to justify their work algebraically when possible.

Course Proficiencies

Unit 1: Build on Knowledge of Functions from Algebra

Time: 15 days

Students will be able to:

1. Organize data in tables, matrices and graphs.
2. Use scatter plots.
3. Use spreadsheets and matrices.
4. Represent data graphically, identify trend lines and correlation.
5. Identify relations and functions.
6. Find the range and domain of a function.
7. Combine functions and determine composition of functions.
8. Use functions in real life situations.
9. Analyze horizontal and vertical translations of (linear, absolute value and quadratic) functions.
10. Use basic counting methods to determine the number of possible outcomes.
11. Find permutations.
12. Classify sets of numbers.
13. Solve equations involving irrational numbers
14. Identify which set of numbers best describes various real life situations.

Resources:

1. Textbook Chapter 1
2. Math Toolbox Technology (Text pg 19) Using the graphing calculator to find the line of best fit.
3. Web Activity: www.exploremath.com Least squares fit line activity attached.
4. Web Activity: Chapter project – site: phschool.com
5. Chapter 1 internet activities, Self Test and Hot Links – www.phschool.com/atschool/mathematics/Adv_Algebra/Student_Area/ADV_S_BK_index.html
6. Practice Workbook resource book pages 6-12

Unit 2: Linear Relations and Functions

Time: 14 Days

Students will be able to:

1. Define and interpret slope.
2. Use the slope intercept form to write equations.
3. Identify the slope of a line and identify parallel and perpendicular lines from their slopes.
4. Write and interpret direct variation equations.
5. Write linear equations in slope intercept and standard forms.
6. Make predictions regarding linear functions.
7. Write the equation of a piecewise function.
8. Solve one variable equations and inequalities.
9. Solve absolute value equations and inequalities.
10. Solve and graph equations and inequalities having two variables.
11. Graph absolute value equations having two variables.
12. Find experimental probability of an event.
13. Find and use theoretical probability.

Resources:

1. Textbook Chapter 2.
2. Chapter 2 Self Test- on line www.phschool.com/atschool/mathematics (Advanced Algebra student)
3. Chapter 2 Support File Alternative Assessment pages 34-35 (task scoring guides page 53-54)
4. Cooperative Activity – Work together problem text page 91.
5. Practice workbook – Practice 2-2 Direct variation, 2-3 Application of slope intercept form of a line to write the equation of a trend line.

Unit 3: Matrices

Time: 15 days

Students will be able to:

1. Organize data into matrices and identify matrix elements.
2. Perform the matrix operations of addition and subtraction manually and using the graphing calculator.
3. Solve matrix equations.
4. Perform scalar and matrix multiplication.
5. Use matrix multiplication to solve real world problems.
6. Represent translations and dilations with matrices.
7. Draw and interpret finite and directed graphs.
8. Write a matrix to represent a finite or directed graph and vice versa.
9. Find the determinant of a 2 X 2 matrix manually.
10. Find the determinant of a 3 X 3 matrix with the graphing calculator.
11. Find and use the inverse of a matrix to solve a matrix equation.

Resources:

1. Textbook Chapter 3
2. Demonstration for matrix multiplication - McDougal Little Algebra 2 – Electronic Lesson Presentations (CD-ROM) Presentation 4.2
3. Practice Workbook – Pages 19-24
4. Cooperative learning activity – Students work in groups using graphing calculator Mini Lab
5. Graphing Calculator Handbook – Pages 42-43

Unit 4: Linear Systems

Time: 14 Days

Students will be able to:

1. Solve a system of equations in two variables by graphing, substitution and elimination.
2. Graph systems of inequalities.
3. Solve Linear programming problems.
4. Use systems of equations to make production decisions.
5. Use substitution and elimination to solve systems of equations in three variables.
6. Use systems of equation to solve real world problems.
7. Solve systems of equations using inverse matrices.
8. Use Cramer's rule to solve systems of equations in two and three variables.
9. Compare different methods of solving systems and determine the best choice for a given situation.

Resources:

1. Textbook Chapter 4
2. Cooperative activity – students work in groups of 3 on Chapter 4 project – Chapter 4 Support File – Chapter project manager. Students use - http://www.phschool.com/atschool/Mathematics/Adv_Algebra/Student_Area/ADV_SC4_ACT1_index.html for project information.
3. Function Grapher - http://www.phschool.com/atschool/Mathematics/Adv_Algebra/Student_Area/ADV_SC4_HL_index.html
4. Demonstration for substitution and elimination (linear combinations) - McDougal Little Algebra 2 – Electronic Lesson Presentations (CD-ROM) Presentation 3.2
5. Web activity – Students use Explore Math interactive tool at web site to solve linear programming problems exploremath.com/activities/Activity_page.cfm?ActivityID=31
6. Practice Workbook – Pages 25-30

Unit 5: Quadratic Functions

Time: 15 Days

Students will be able to:

1. Recognize and use quadratic functions.
2. Decide whether to use a linear or quadratic model to describe a set of data.
3. Graph a parabola in vertex form $Y = a(x-h)^2 + k$. and find the minimum or maximum value of a quadratic function.
4. Write an equation in standard form and find the vertex.
5. Find the x intercepts of quadratic functions.
6. Find the inverse of a function.
7. Graph and use square root functions.
8. Solve quadratic equations by factoring, finding square roots, graphing, completing the square and using the quadratic formula.
9. Apply methods of solving quadratic equations to real world problems.
10. Identify and graph complex numbers.
11. Add, subtract and multiply complex numbers.
12. Use the discriminant to find the type and number of solutions of a quadratic equation.
13. Use matrix techniques to find an algebraic model.

Resources:

1. Textbook Chapter 5
2. For proficiency 13 – Mini-Lab 16 Modeling with Matrices I (attached)
3. Web Activity Proficiency 4 and 9 - Quadratics: Polynomial (standard) Form – Lab on exploremath.com (attached)
4. Practice Workbook Pages 31-38
5. www.phschool.com
6. Student Self Test.

Unit 6: Polynomials and Polynomial Functions

Time: 15 days

Students will be able to:

1. Explore graphs of power functions.

2. Use rational exponents to represent radical expressions.
3. Use powers and roots to solve polynomial equations.
4. Describe graphs of polynomial functions and identify relative minimum and maximum.
5. Model data with polynomial functions using the graphing calculator (cubicReg)
6. Analyze multiple zeros and factors of the factored form of a polynomial.
7. Write a polynomial function from its zeros.
8. Solve polynomial equations by factoring and graphing.
9. Divide polynomials using long division and synthetic division.
10. Find all the zeros of polynomial functions.
11. Find the number of possible combinations of items and use methods to solve real world problems.

Resources:

1. Textbook Chapter 6
2. Math Toolbox exploration – Pascal’s Triangle- page 290
3. Internet Activity – Polynomials and Polynomial functions
http://www.phschool.com/atschool/Mathematics/Adv_Algebra/Student_Area/ADV_SC6_ACT2_index.html
4. Proficiency 9, Synthetic Division -Electronic Lesson Presentations (CD-ROM) Algebra 2 – 6.2.
5. Practice Workbook Pages 39-45
6. Internet Activity - exploremath.com Introduction to Polynomials (attached)

Unit 7: Exponential and Logarithmic Functions

Time: 15 days

Students will be able to:

1. Use exponential functions as models of growth and decay for real life problems.
2. Fit exponential curves to data.
3. Graph exponential functions and identify the role of the constants in $y = ab^{kx}$
4. Use the natural base “e” in real world problems such as computing continuously compounded interest.
5. Evaluate logarithmic expressions; graph logarithmic functions and apply them to real world situations.
6. Apply properties of logarithms to expand and condense logarithmic expressions.
7. Solve exponential and logarithmic equations with and without the graphing calculator.
8. Use a calculator to find common logs and natural logs.
9. Solve equations using natural logarithms.

Resources:

1. Textbook Chapter 7
2. Graphing Calculator activity – Mini-Lab 36 Exponential Functions (attached)
3. Internet Activities – exploremath.com Exponential Functions and Logarithmic Functions (attached).
4. Practice Workbook – pages 46-51
5. Proficiency 2 Math Toolbox – Technology students work in cooperative groups and using the graphing calculator.

Unit 8: Rational Functions

Time: 14 days

Students will be able to:

1. Identify and solve inverse variations.
2. Graph rational functions using the graphing calculator.
3. Identify vertical and horizontal asymptotes and graph inverse variations
4. Analyze the graphs of rational functions, identifying behavior at asymptotes, identifying and classifying discontinuities.
5. Simplify, add, subtract, multiply and divide rational expressions.
6. Solve rational equations.
7. Identify independent and mutually exclusive events.
8. Find the probability of multiple events.

Resources:

1. Textbook chapter 8
2. Math Toolbox Technology – Graphing Rational Functions with the graphing calculator – page 356

Unit 9: Quadratic Relations

Time: 15 days

Students will be able to:

1. Identify and graph conic sections.
2. Write and graph the equation of a parabola.
3. Use properties of a parabola to solve problems.
4. Write and graph the equation of a circle and find the center and radius.
5. Write and graph the equation of an ellipse and find the foci and eccentricity.
6. Graph hyperbolas and find the foci.
7. Translate conic sections on the plane.
8. Write and identify the equation of a translated conic section.
9. Apply the equations and graphs of conic sections to real world problems.

Resources:

1. Textbook Chapter 9
2. Cooperative Activity Chapter Project – Under Pressure – pages 349
3. Practice Workbook pages 59-65
4. Internet Activities – www.exploremath.com parabolas, ellipses, hyperbolas (attached)

Unit 10: More Probability and Statistics

Time: 15 Days

Students will be able to:

1. Make a probability distribution and use it to conduct a simulation.
2. Find conditional probabilities.
3. Use formulas and tree diagrams
4. Calculate measures of central tendency and use them to analyze data
5. Draw and interpret box and whisker plots.

6. Determine the standard deviation of a set of data and use it to describe the data manually and with the graphing calculator.
7. Find sample proportions and margin of error.
8. Use a normal curve to describe data distribution and find probabilities.
9. Apply probabilities to real world situations.
10. Use data collection and analysis to make business decisions.

Resources:

1. Textbook chapter 11 (Omit section 11-6)
2. Cooperative Activity – Students work in groups on Math toolbox Technology Page 545
3. Practice Workbook pages 72-78
4. Problem of the day 11-5,

Unit 11: Sequences and Series

Time: 13 days

Students will be able to:

1. Write the rule for a given sequence using recursive and explicit formulas.
2. Find the n th term in a sequence.
3. Identify and generate an arithmetic sequence and find the n th term and mean.
4. Identify and generate a geometric sequence and find the n th term and mean.
5. Use summation notation to write a series and represent the sum.
6. Find the sum of finite and infinite geometric series.
7. Find the area under a curve, by approximation, as a series, and using technology.

Resources:

1. Textbook chapter 12
2. Cooperative activity – Math Toolbox Exploration – Fibonacci Sequence Page 571
3. Practice Workbook – pages 79-84
4. Chapter 12 Support File – Alternative assessment

For each chapter students will use the on line self test at **phschool.com**

THE NEW JERSEY CORE CURRICULUM CONTENT STANDARDS

STANDARD 4.1 (NUMBER AND NUMERICAL OPERATIONS) ALL STUDENTS WILL DEVELOP NUMBER SENSE AND WILL PERFORM STANDARD NUMERICAL OPERATIONS AND ESTIMATIONS ON ALL TYPES OF NUMBERS IN A VARIETY OF WAYS.

A. Number Sense

1. Extend understanding of the number system to all real numbers.
Unit 1-proficiency 12
2. Compare and order rational and irrational numbers.
Unit 1- proficiency 12
3. Develop conjectures and informal proofs of properties of number systems and sets of numbers.
Covered in a previous course.

B. Numerical Operations

1. Extend understanding and use of operations to real numbers and algebraic procedures.
Unit 2- proficiency 9, Unit 1- proficiency 13
2. Develop, apply, and explain methods for solving problems involving rational and negative exponents.
Unit 7-proficiency 7, Unit 6-proficiency 2
3. Perform operations on matrices.
 - Addition and subtraction
 - Scalar multiplicationUnit 3- proficiencies 2,3,4,5
4. Understand and apply the laws of exponents to simplify expressions involving numbers raised to powers
Unit 6- proficiencies 2, 3

C. Estimation

4. Recognize the limitations of estimation, assess the amount of error resulting from estimation, and determine whether the error is within acceptable tolerance limits.
Unit 10 proficiency 7

STANDARD 4.2 (GEOMETRY AND MEASUREMENT) ALL STUDENTS WILL DEVELOP SPATIAL SENSE AND THE ABILITY TO USE GEOMETRIC PROPERTIES, RELATIONSHIPS, AND MEASUREMENT TO MODEL, DESCRIBE AND ANALYZE PHENOMENA.

Most of the indicators in this standard are addressed in other courses; however, some geometric concepts are integrated into applications in Algebra 2 as noted below.

A. Geometric Properties

1. Use geometric models to represent real-world situations and objects and to solve problems using those models (e.g., use Pythagorean Theorem to decide whether an object can fit through a doorway).

Covered in previous courses

2. Draw perspective views of 3D objects on isometric dot paper, given 2D representations (e.g., nets or projective views).

Covered in previous courses

3. Apply the properties of geometric shapes.

Parallel lines – transversal, alternate interior angles, corresponding angles

Triangles

a. Conditions for congruence

b. Segment joining midpoints of two sides is parallel to and half the length of the third side

c. Triangle Inequality

Minimal conditions for a shape to be a special quadrilateral

Circles – arcs, central and inscribed angles, chords, tangents

Self-similarity

Covered in previous courses

4. Use reasoning and some form of proof to verify or refute conjectures and theorems.

Verification or refutation of proposed proofs

Simple proofs involving congruent triangles

Counterexamples to incorrect conjectures

Covered in previous courses

B. Transforming Shapes

1. Determine, describe, and draw the effect of a transformation, or a sequence of transformations, on a geometric or algebraic object, and, conversely, determine whether and how one object can be transformed to another by a transformation or a sequence of transformations.

Unit 1-proficiency 9

2. Recognize three-dimensional figures obtained through transformations of two-dimensional figures (e.g., cone as rotating an isosceles triangle about an altitude), using software as an aid to visualization.

Covered in previous courses

3. Determine whether two or more given shapes can be used to generate a tessellation.

Unit 1 proficiency 9

4. Generate and analyze iterative geometric patterns.
 - Fractals (e.g., Sierpinski's Triangle)
 - Patterns in areas and perimeters of self-similar figures
 - Outcome of extending iterative process indefinitely
 - Covered in previous courses

C. Coordinate Geometry

1. Use coordinate geometry to represent and verify properties of lines.
 - Distance between two points
 - Midpoint and slope of a line segment
 - Finding the intersection of two lines
 - Lines with the same slope are parallel
 - Lines that are perpendicular have slopes whose product is -1

Unit 2 proficiency 3

2. Show position and represent motion in the coordinate plane using vectors.
 - Addition and subtraction of vectors
 - Covered in previous courses

D. Units of Measurement

1. Understand and use the concept of significant digits.
 - Covered in previous courses
2. Choose appropriate tools and techniques to achieve the specified degree of precision and error needed in a situation.
 - Degree of accuracy of a given measurement tool
 - Finding the interval in which a computed measure (e.g., area or volume) lies, given the degree of precision of linear measurements

Covered in previous courses

E. Measuring Geometric Objects

1. Use techniques of indirect measurement to represent and solve problems.
 - Similar triangles
 - Pythagorean theorem
 - Right triangle trigonometry (sine, cosine, tangent)

Covered in previous courses

3. Use a variety of strategies to determine perimeter and area of plane figures and surface area and volume of 3D figures
 - Approximation of area using grids of different sizes

Finding which shape has minimal (or maximal) area, perimeter, volume, or surface area under given conditions using graphing calculators, dynamic geometric software, and/or spreadsheets
Estimation of area, perimeter, volume, and surface area

Covered in previous courses

STANDARD 4.3 (PATTERNS AND ALGEBRA) ALL STUDENTS WILL REPRESENT AND ANALYZE RELATIONSHIPS AMONG VARIABLE QUANTITIES AND SOLVE PROBLEMS INVOLVING PATTERNS, FUNCTIONS, AND ALGEBRAIC CONCEPTS AND PROCESSES.

A. Patterns

1. Use models and algebraic formulas to represent and analyze sequences and series.

Explicit formulas for n th terms – Unit 11 proficiencies 1, 2

Sums of finite arithmetic series – Unit 11 proficiency 6

Sums of finite and infinite geometric series – Unit 11 proficiency 6

2. Develop an informal notion of limit.

This concept is developed throughout the course as various functions are studied.

Unit 2, proficiency 7; unit 5, proficiency 3,

Unit 6, proficiency 4; unit 7, proficiencies 1, 4

4. Use inductive reasoning to form generalizations.

This is done throughout the course. Some examples would be the Internet and graphing calculator activities in units 7, 8, 9, 11

B. Functions and Relationships

1. Understand relations and functions and select, convert flexibly among, and use various representations for them, including equations or inequalities, tables, and graphs. This concept is developed throughout the course through the study of lines, parabolas, polynomials and other functions. (Unit 1 proficiency 5, Unit 5 proficiency 1, Unit 6 proficiencies 1, 6, Unit 7 proficiency 2, Unit 8 prof. 4)

2. Analyze and explain the general properties and behavior of functions of one variable, using appropriate graphing technologies. Unit 2 prof. 2,3,4, 6, Unit 1 prof. 6, Unit 4 prof. 1, Unit 5 prof. 3, 5, Unit 7 prof. 3.

Slope of a line or curve

Domain and range

Intercepts

Continuity

Maximum/minimum

Estimating roots of equations

Intersecting points as solutions of systems of equations

Rates of change

5. Understand and perform transformations on commonly used functions. Unit 1 prof. 9, Unit 5 prof. 3, 7, Unit 7 prof. 3, Unit 8 prof. 2, Unit 9 prof. 7, 8.

Translations, reflections, dilation

Effects on linear and quadratic graphs of parameter changes in equations

Using graphing calculators or computers for more complex functions

6. Understand and compare the properties of classes of functions, including exponential, polynomial, rational, and trigonometric functions. (All except trigonometric functions are covered in this course.

Trigonometric functions are covered in another course.) Unit 1 prof. 6, Unit 2 prof. 7, Unit 5 prof. 2,

Linear vs. non-linear

Symmetry

Increasing/decreasing on an interval

C. Modeling

7. Use functions to model real-world phenomena and solve problems that involve varying quantities.) Real world problems are used throughout the course to apply knowledge of concepts and processes. Unit 1 prof. 8 Unit 2 prof, 4, 9, Unit 4 prof. 3,6, Unit 5 prof. 9, Unit 7 prof. 1, 4, Unit 8 prof. 1

Linear, quadratic, exponential, periodic (sine and cosine), and step functions (e.g., price of mailing a first-class letter over the past 200 years

Direct and inverse variation

Absolute value

Expressions, equations and inequalities

Same function can model variety of phenomena

Growth/decay and change in the natural world

Applications in mathematics, biology, and economics (including compound interest)

2. Analyze and describe how a change in an independent variable leads to a change in a dependent variable.

Unit 1, proficiency 8

3. Convert recursive formulas to linear or exponential functions (e.g., Tower of Hanoi and doubling).

D. Procedures

8. Evaluate and simplify expressions.

Unit 7 prof. 2, 3, 8, 9

Add and subtract polynomials

Multiply a polynomial by a monomial or binomial

Divide a polynomial by a monomial

9. Select and use appropriate methods to solve equations and inequalities. Unit 2 prof. 8, 9, 10, Unit 5 prof. 8,
 Linear equations – algebraically
 Quadratic equations – factoring (when the coefficient of x^2 is 1) and using the quadratic formula
 All types of equations using graphing, computer, and graphing calculator techniques – Judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology.

Graphing calculators are used throughout the course for analyzing graphs of various functions and using graphing as an alternative method for solving equations and inequalities.

STANDARD 4.4: (DATA ANALYSIS, PROBABILITY, AND DISCRETE MATHEMATICS) ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF THE CONCEPTS AND TECHNIQUES OF DATA ANALYSIS, PROBABILITY, AND DISCRETE MATHEMATICS, AND WILL USE THEM TO MODEL SITUATIONS, SOLVE PROBLEMS, AND ANALYZE AND DRAW APPROPRIATE INFERENCES FROM DATA.

A. Data Analysis

1. Use surveys and sampling techniques to generate data and draw conclusions about large groups.
 Advantages/disadvantages of sample selection methods (e.g., convenience sampling, responses to survey, random sampling) .
 Covered in other courses
2. Evaluate the use of data in real-world contexts. Unit 1 prof. 4 Unit 10, prof. 10
 Accuracy and reasonableness of conclusions drawn
 Bias in conclusions drawn (e.g., influence of how data is displayed)
 Statistical claims based on sampling
3. Design a statistical experiment, conduct the experiment, and interpret and communicate the outcome. Unit 1 prof 1 (Project 1)
4. Estimate or determine lines of best fit (or curves of best fit if appropriate) with technology, and use them to interpolate within the range of the data.
 Unit 1 prof. 4
5. Analyze data using technology, and use statistical terminology to describe conclusions. Unit 10 prof. 6, 8, 9
 Measures of dispersion: variance, standard deviation, outliers
 Correlation coefficient
 Normal distribution (e.g., approximately 95% of the sample lies between two standard deviations on either side of the mean)

B. Probability

1. Calculate the expected value of a probability-based game, given the probabilities and payoffs of the various outcomes, and determine whether the game is fair.

Covered in other courses

2. Use concepts and formulas of area to calculate geometric probabilities.

Covered in other courses

3. Model situations involving probability with simulations (using spinners, dice, calculators and computers) and theoretical models, and solve problems using these models.

Unit 10, prof. 1,

4. Determine probabilities in complex situations.

Unit 8 prof. 7,8, Unit 10, prof. 2,

Conditional events

Complementary events

Dependent and independent events

5. Estimate probabilities and make predictions based on experimental and theoretical probabilities.

Unit 2 proficiency 12

6. Understand and use the "law of large numbers" (that experimental results tend to approach theoretical probabilities after a large number of trials).

Unit 2 proficiency 13

C. Discrete Mathematics—Systematic Listing and Counting

1. Calculate combinations with replacement (e.g., the number of possible ways of tossing a coin 5 times and getting 3 heads) and without replacement (e.g., number of possible delegations of 3 out of 23 students). Unit 6 prof.

11

2. Apply the multiplication rule of counting in complex situations, recognize the difference between situations with replacement and without replacement, and recognize the difference between ordered and unordered counting situations. Unit 6 prof 11.

3. Justify solutions to counting problems.

4. Recognize and explain relationships involving combinations and Pascal's Triangle, and apply those methods to situations involving probability. Unit 6 prof. 11 (math toolbox exploration)

D. Discrete Mathematics—Vertex-Edge Graphs and Algorithms

7. Use vertex-edge graphs and algorithmic thinking to represent and solve practical problems.

Unit 3 proficiency 7

Circuits that include every edge in a graph
Circuits that include every vertex in a graph
Scheduling problems (e.g., when project meetings should be scheduled to avoid conflicts) using graph coloring
Applications to science (e.g., who-eats-whom graphs, genetic trees, molecular structures)

8. Explore strategies for making fair decisions.

(Not covered in this course)

Combining individual preferences into a group decision (e.g., determining winner of an election or selection process)

Determining how many Student Council representatives each class (9th, 10th, 11th, and 12th grade) gets when the classes have unequal sizes (apportionment)

STANDARD 4.5 (MATHEMATICAL PROCESSES) ALL STUDENTS WILL USE MATHEMATICAL PROCESSES OF PROBLEM SOLVING, COMMUNICATION, CONNECTIONS, REASONING, REPRESENTATIONS, AND TECHNOLOGY TO SOLVE PROBLEMS AND COMMUNICATE MATHEMATICAL IDEAS.

Standard 4.5 is addressed throughout the course. Teachers use a variety of strategies including discovery, technology, writing, and modeling to assist students in their development as problem solvers.

Cumulative Progress Indicators

At each grade level, with respect to content appropriate for that grade level, students will:

A. Problem Solving

1. Learn mathematics through problem solving, inquiry, and discovery.

2. Solve problems that arise in mathematics and in other contexts (cf. workplace readiness standard 8.3).

Open-ended problems

Non-routine problems

Problems with multiple solutions

Problems that can be solved in several ways

3. Select and apply a variety of appropriate problem-solving strategies (e.g., "try a simpler problem" or "make a diagram") to solve problems.

4. Pose problems of various types and levels of difficulty.

5. Monitor their progress and reflect on the process of their problem solving activity.

B. Communication

1. Use communication to organize and clarify their mathematical thinking.

Reading and writing

Discussion, listening, and questioning

2. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.

3. Analyze and evaluate the mathematical thinking and strategies of others.

4. Use the language of mathematics to express mathematical ideas precisely.

C. Connections

1. Recognize recurring themes across mathematical domains (e.g., patterns in number, algebra, and geometry).
2. Use connections among mathematical ideas to explain concepts (e.g., two linear equations have a unique solution because the lines they represent intersect at a single point).
3. Recognize that mathematics is used in a variety of contexts outside of mathematics.
4. Apply mathematics in practical situations and in other disciplines.
5. Trace the development of mathematical concepts over time and across cultures (cf. world languages and social studies standards).
6. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

D. Reasoning

1. Recognize that mathematical facts, procedures, and claims must be justified.
2. Use reasoning to support their mathematical conclusions and problem solutions.
3. Select and use various types of reasoning and methods of proof.
4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.
5. Make and investigate mathematical conjectures.
 - Counter examples as a means of disproving conjectures
 - Verifying conjectures using informal reasoning or proofs.
6. Evaluate examples of mathematical reasoning and determine whether they are valid.

E. Representations

1. Create and use representations to organize, record, and communicate mathematical ideas.
 - Concrete representations (e.g., base-ten blocks or algebra tiles)
 - Pictorial representations (e.g., diagrams, charts, or tables)
 - Symbolic representations (e.g., a formula)
 - Graphical representations (e.g., a line graph)
2. Select, apply, and translate among mathematical representations to solve problems.
3. Use representations to model and interpret physical, social, and mathematical phenomena.

F. Technology

1. Use technology to gather, analyze, and communicate mathematical information.
2. Use computer spreadsheets, software, and graphing utilities to organize and display quantitative information (cf. workplace readiness standard 8.4-D).

3. Use graphing calculators and computer software to investigate properties of functions and their graphs.
4. Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).
5. Use computer software to make and verify conjectures about geometric objects.
6. Use computer-based laboratory technology for mathematical applications in the sciences (cf. science standards).