

ALGEBRA 1 CP

8/1/06

COURSE DESCRIPTION:

This course emphasizes the basic principles of Algebra and enables students to develop their ability to solve complex problems in a logical and systematic manner. Topics addressed by this course include, numbers and sets, the language of Algebra, addition and multiplication of real numbers, solving equations and problems, solving inequalities, working with polynomials, factoring in Algebra, operations with fractions, using fractions, functions, relations and graphs, systems of open sentences in two variables, and rational and irrational numbers.

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.
- 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.
- 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.
- 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.
- 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.

CUMULATIVE PROGRESS INDICATORS:

STANDARD 4.1 - MATHEMATICS

Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:

A. Number Sense

1. Extend understanding of the number system to all real numbers.
2. Compare and order rational and irrational numbers.
3. Develop conjectures and informal proofs of properties of number systems and sets of numbers.

B. Numerical Operations

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

C. Estimation

1. Recognize the limitations of estimation, assess the amount of error resulting from estimation, and determine whether the error is within acceptable tolerance limits.

STANDARD 4.2 - MATHEMATICS

Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:

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

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

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

D. Units of Measurement

1. Understand and use the concept of significant digits.
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

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)
2. 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

STANDARD 4.3 - MATHEMATICS

Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:

A. Patterns

1. Use models and algebraic formulas to represent and analyze sequences and series.
 - Explicit formulas for n^{th} terms
 - Sums of finite arithmetic series
 - Sums of finite and infinite geometric series

2. Develop an informal notion of limit.
3. Use inductive reasoning to form generalizations.

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.
2. Analyze and explain the general properties and behavior of functions of one variable, using appropriate graphing technologies.
 - 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
3. Understand and perform transformations on commonly-used functions.
 - Translations, reflections, dilations
 - Effects on linear and quadratic graphs of parameter changes in equations
 - Using graphing calculators or computers for more complex functions
4. Understand and compare the properties of classes of functions, including exponential, polynomial, rational, and trigonometric functions.
 - Linear vs. non-linear
 - Symmetry
 - Increasing/decreasing on an interval

C. Modeling

1. Use functions to model real-world phenomena and solve problems that involve varying quantities.
 - 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 change in a dependent one.
3. Convert recursive formulas to linear or exponential functions (e.g., Tower of Hanoi and doubling).

D. Procedures

1. Evaluate and simplify expressions.
 - Add and subtract polynomials
 - Multiply a polynomial by a monomial or binomial
 - Divide a polynomial by a monomial
2. Select and use appropriate methods to solve equations and inequalities.
 - 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
3. Judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology.

STANDARD 4.4 – MATHEMATICS

Building upon knowledge and skills gained in preceding grades, by the end of Grade 12, students will:

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)
2. Evaluate the use of data in real-world contexts.
 - 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.
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.
5. Analyze data using technology, and use statistical terminology to describe conclusions.
 - 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.
2. Use concepts and formulas of area to calculate geometric probabilities.
3. Model situations involving probability with simulations (using spinners, dice, calculators and computers) and theoretical models, and solve problems using these models.
4. Determine probabilities in complex situations.
 - Conditional events
 - Complementary events
 - Dependent and independent events
5. Estimate probabilities and make predictions based on experimental and theoretical probabilities.
6. Understand and use the law of large numbers. (that experimental results tend to approach theoretical probabilities after a large number of trials).

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).
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.
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.

D. Discrete Mathematics. Vertex-Edge Graphs and Algorithms

1. Use vertex-edge graphs and algorithmic thinking to represent and solve practical problems.
 - 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)
2. Explore strategies for making fair decisions.
 - 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 – MATHEMATICS

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.
 - Counterexamples 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.
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.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:

4.1

Extending understanding of real number system to include rational and irrational numbers.

Evaluation expressions containing powers, roots, and factorials.

Applying absolute values, exponents, and approximations in real-life situations.

Translating numbers between standard notation and scientific notation.

Applying reflexive, transitive, and symmetric properties.

Simplifying expressions using the associative and commutative properties of arithmetic operations.

Applying primes, factors, and multiples in real-life situations.

Identifying equivalent and nonequivalent forms of fractions, decimals, and percents.

Demonstrating an understanding of the relationships between ratios, proportions, and percents.

4.2

Describing and giving examples of geometric and algebraic terms.

Applying properties, definitions, and relationships to identify and classify two-dimensional shapes.

Applying properties, definitions, and relationships to identify and classify three-dimensional shapes.

Identifying the relationships between geometric figures and relate them to algebraic concepts.

Using the rectangular coordinate system to determine the effects on figures of transformations.
Developing and applying strategies for determining area and surface area.
Using vectors to show the position of an object.
Developing and applying strategies for determining volume.
Solving problems by applying the Pythagorean Theorem.

4.3

Constructing, recognizing and extending patterns.
Evaluating algebraic expressions using independent and dependent variables.
Applying algebraic operations to solve inequalities that reflect real- life situations.
Applying algebraic operations to solve linear equations that reflect real- life situations.
Using domain and range of relations and functions to solve problems.
Finding and graphing the slope of a line.
Applying basic transformations to graphs of function.

4.4

Determining the probability of a simple and compound event.
Determining measures of central tendencies, range, rank, and frequency.
Selecting appropriate graphical representations of statistical measure.
Determine the number of possible combinations and outcomes by using tree diagrams.
Representing information using networks.
Analyzing and applying iterative processes to solve problems. (Fractals)
Analyzing and applying recursive processes to solve problems. (Compound interest)

4.5

Organizing information using illustrations, charts, or graphs, discovering patterns and arranging data.
Calculating with and using manipulative.
Estimating values.
Substituting simpler numbers.
Translating sentences into equations.
Applying formulas, definitions, and rules.
Working in reverse.
Constructing proportions or ratios.

UNIT OBJECTIVES

UNIT – NUMBERS AND SETS –

Naming Numbers, Equality and Inequality, Punctuation Marks in Algebra, Numbers and Points, The Number Line, Comparing Numbers, Sets of Numbers, Specifying Sets, Comparing Sets.

The students will be able to:

- Understand basic terminology of Algebra related to numbers and sets.
 - Numerical expressions, inequality, equation, parenthesis, symbol of inclusion or grouping symbol, simplified the expression, number line, positive direction, positive numbers, negative numbers, directed numbers, conjunctions, member, element, roster, empty set, null set, one-to one correspondence, counting numbers, infinite set, set of real numbers and finite set.
- Become familiar with the tools needed to be successful in Algebra.
- Write statements of equality called equations.
- Write mathematical expressions that are not ambiguous.
- Simplify the expression.
- Read and develop a number line.
- Understand there is exactly one point on the number line paired with any real number.
- Understand there is exactly one real number paired with any given point on the number line.
- Specify a set and be able to identify its elements.
- Identify infinite sets and finite sets by comparing sets.
- Utilize and understand the use of punctuation marks in Algebra.

INSTRUCTIONAL STRATEGIES:

NUMBERS AND SET

Traditional Strategies:

- Lecture
- Black/White Board Work
- Use of Open-ended problems, written and oral exercises, and quantitative comparison activities.
- Vocabulary

Alternative Assessment:

- Cooperative Learning
- Students relate infinite and finite sets to set in real life.
- Students draw graphs to demonstrate sets and elements.
- Students develop their own mathematical language by making up names or symbols for numerical expressions.
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software
 - Geometer's Sketchpad

EVALUATION/ASSESSMENT OF STUDENTS:

NUMBERS AND SETS

- Teacher generated quizzes and tests.
 - Multiple Choice Questions
 - Open-ended Questions
 - Writing Exercises
 - Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.

- Homework
- Seat Work
- Class Participation
- Alternative Assessment
 - Listed Above
 - Writing Assignment:
 - Example:
 - Write about a set that you are a member.
 - Identify what kind of set is it.
 -
 - What is your role in the set?

UNIT – THE LANGUAGE OF ALGEBRA –

VARIABLES AND MATHEMATICAL EXPRESSION, VARIABLES, FACTORS, COEFFICIENTS AND EXPONENTS, ORDER OF OPERATIONS, OPEN SENTENCES, VARIABLES AND OPEN SENTENCES, VARIABLES AND QUANTIFIERS, APPLYING MATHEMATICAL EXPRESSIONS AND SENTENCES

The students will be able to:

- Understand basic terminology of Algebra related to mathematical expressions.
 - Program, variables, replacement set (domain), value of a variable, constant, variable expression, mathematical expression, evaluate an expression, evaluate an expression, value of an expression, term, factor, coefficient, exponent, base, factored form of a power, exponential form, open sentence, truth (solution) set, solution, root, graph of an open sentence, and quantifier.
- Evaluate expressions in relationship to variables.
- Give sets of factors expressions.
- Determine missing coefficients.
- Simplify the expression.
- Write an algebraic expression for word problems presented.
- Write open sentences including one or more variables.
- Follow the rules for the order of operations.
 - Simplify the names of powers.
 - Simplify the names of products and quotients in order from left to right.
 - Simplify the names of sums and differences in order from left to right.
- Relate mathematical expressions and sentences to real life situation to describe numerical relationships.
- Simplify expressions following the rules for order of operations.
- Evaluate expressions in relationship to factors, coefficients and exponents.
- Translate words to mathematical symbols.

INSTRUCTIONAL STRATEGIES:

LANGUAGE OF ALGEBRA

Traditional Strategies:

- Lecture
- Black/White Board Work
- Use of Open-ended problems, written and oral exercises, and quantitative comparison activities.
- Vocabulary

Alternative Assessment:

- Cooperative Learning

- Students relate mathematical expression to real life situations.
- Do-Now Problems
- Writing of algebraic expression for solutions of word problem.
- Problem Solving
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software
 - Geometer's Sketchpad

**EVALUATION/ASSESSMENT OF STUDENTS:
LANGUAGE OF ALGEBRA**

- Teacher generated quizzes and tests.
 - Multiple Choice Questions
 - Open-ended Questions
 - Writing Exercises
 - Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation
- Alternative Assessment
 - Listed Above
 - Using Alternative Assessment from Numbers and set, utilizing your mathematical language you developed write an open sentence.
 - Each student writes a word problem and then a pair-share, partner reflects word problem into a mathematical expression.

**UNIT – ADDITION AND MULTIPLICATION OF REAL NUMBERS –
IDENTIFYING AXIOMS, AXIOMS OF CLOSURE AND EQUALITY,
COMMUTATIVE AND ASSOCIATIVE AXIOMS, ADDING REAL NUMBERS,
ADDITION ON THE NUMBER LINE, THE OPPOSITE OF A REAL NUMBER,
ABSOLUTE VALUE, RULES FOR ADDITION, MULTIPLYING REAL NUMBERS
THE DISTRIBUTIVE AXIOM, RULES FOR MULTIPLICATION, AND THE
RECIPROCAL OF A REAL NUMBER.**

The students will be able to:

- Understand basic terminology of Algebra related to addition and multiplication of real numbers.
 - Assumption, axiom, postulate, unique, closure, commutative operations, binary operations, associative operation, displacement, identify element, opposite, additive inverse, absolute inverse, distributive, equivalent, simplified, similar, reciprocal, and multiplicative inverse.
- State an absolute value of numbers.
- Understand axioms of equality.
- Understand axioms of closure.
- Understand commutative axioms.
- Identify and name axioms of statements.
- Simplify expressions in relationship to addition and multiplication.
- Follow the rules for addition and multiplication.
- Find the reciprocal of a real number.
- Understand and relate the structure and methods of statements for:

- Associate axioms
- Additive Axiom of 0
- Axiom of Opposite
- Property of the Opposite of a Sum
- Distributive Axiom
- Multiplicative Axiom of 1
- Multiplicative Property of 0
- Multiplicative Property of -1
- Property of Opposite in Products

INSTRUCTIONAL STRATEGIES:

ADDITION AND MULTIPLICATION OF REAL NUMBERS

Traditional Strategies:

- Lecture
- Black/White Board Work
- Use of Open-ended problems, written and oral exercises, and quantitative comparison activities.
- Vocabulary

Alternative Assessment:

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Develop a flow chart of a program.
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software
 - Geometer's Sketchpad

EVALUATION/ASSESSMENT OF STUDENTS:

ADDITION AND MULTIPLICATION OF REAL NUMBERS

- Teacher generated quizzes and tests.
 - Multiple Choice Questions
 - Open-ended Questions
 - Writing Exercises
 - Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation
- Alternative Assessment
 - Listed Above
 - Utilizing a flow chart, display the output of a program for a given value.
 - Design a flow chart depicting a real life situation.

UNIT – SOLVING EQUATIONS AND PROBLEMS –

TRANSFORMING EQUATIONS, TRANSFORMING EQUATIONS BY ADDITION, SUBTRACTING REAL NUMBERS, TRANSFORMING EQUATIONS BY MULTIPLICATION, DIVIDING REAL NUMBERS, USING SEVERAL TRANSFORMATIONS, USING EQUATIONS, USING EQUATIONS TO SOLVE PROBLEMS, EQUATIONS HAVING THE VARIABLE IN BOTH MEMBERS, EQUATIONS AND FUNCTIONS.

The students will be able to:

- Understand basic terminology of Algebra related to solving equations and problems.
 - Hypothesis, conclusion, direct proof, theorem, members of an equation (inequality), equivalent equations, transformation, difference, quotient, inverse operation, identify, formula, function, domain, range, and values of a function.
- Develop a theorem using logical reasoning from facts and given assumptions.
- Understand theorem of addition property of equality.
- Understand theorem of multiplication property of equality.
- Solve an equation.
- Understand the rules of Subtraction and division.
- Transform equation by addition.
- Subtract real numbers.
- Transform equations by multiplication.
- Divide real numbers.
- Utilize equations to solve problems.
- Understand equations that have variables in both members.
- Understand and relate the structure and methods solving word problems:
 - Choose a variable with an appropriate replacement set and use the variable in representing each described number.
 - Form an open sentence by using facts given in the problem.
 - Find the solution set of the open sentence.
 - Check your answer with the words of the problem.

INSTRUCTIONAL STRATEGIES:**SOLVING EQUATIONS AND PROBLEMS****Traditional Strategies:**

- Lecture
- Black/White Board Work
- Use of Open-ended problems, written and oral exercises, and quantitative comparison activities.
- Vocabulary

Alternative Assessment:

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Develop a flow chart of a program.
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software
 - Geometer's Sketchpad

EVALUATION/ASSESSMENT OF STUDENTS:**SOLVING EQUATIONS AND PROBLEMS**

- Teacher generated quizzes and tests.
 - Multiple Choice Questions
 - Open-ended Questions
 - Writing Exercises
 - Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work

- Class Participation
- Alternative Assessment
 - Listed Above
 - Using the web, find the average enrollment trends of three New Jersey State Colleges and Universities and make predictions about future enrollment.
 - Research the average weight of Hopatcong wrestlers.
 - Research Benjamin Banneker and what he contributed to the mathematical field.

UNIT – SOLVING INEQUALITIES –

AXIOMS OF ORDER, INTERSECTION AND UNION OF SETS, COMBINING INEQUALITIES, ABSOLUTE VALUE IN OPEN SENTENCES, PROBLEMS ABOUT INTEGERS, PROBLEMS ABOUT ANGLES, UNIFORMS-MOTION PROBLEMS, AND MIXTURE.

The students will be able to:

- Understand basic terminology of Algebra related to solving inequalities.
 - Comparison, transitive, equivalent inequality, universe, universal set, region, subset, intersection, union, disjunction, consecutive integers, multiple, rotation, counterclockwise, directed angle, initial side, terminal side, degree, complementary angles, complement, supplementary angles, supplement, and uniform motion.
 - Demonstrate an understanding of solving problems about angles.
 - Solve then graph the solution set.
 - Recognize consecutive integers.
 - Find absolute value in open sentences.
 - Combine inequalities.
 - Gain an understanding how both equations and inequalities can be useful in solving a variety of problems.
 - Make a drawing and a chart for word problems.
 - Form an open sentence, and be able to solve it concerning a word problem.

INSTRUCTIONAL STRATEGIES:

SOLVING INEQUALITIES

Traditional Strategies:

- Lecture
- Black/White Board Work
- Use of Open-ended problems, written and oral exercises, and quantitative comparison activities.
- Vocabulary

Alternative Assessment:

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Develop a drawing of word programs.
- Develop a chart of word problems.
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software
 - Geometer's Sketchpad

EVALUATION/ASSESSMENT OF STUDENTS:

SOLVING INEQUALITIES

- Teacher generated quizzes and tests.

- Multiple Choice Questions
- Open-ended Questions
- Writing Exercises
- Word Problems
- Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation
- Alternative Assessment
 - Listed Above
 - Students develop word problems and trades with partner to make a drawing and chart to solve the problem.
 - Students identify where the measuring of angles would benefit a project.
 - Research A.M. Turing and what machine he invented.

**UNIT –WORKING WITH POLYNOMIALS –
 ADDING POLYNOMIALS, SUBTRACTING POLYNOMIALS, THE PRODUCT OF
 POWERS, THE POWER OF A PRODUCT, MULTIPLYING A POLYNOMIAL BY A
 MONOMIAL, MULTIPLYING TWO POLYNOMIALS, THE QUOTIENT OF POWER,
 ZERO AND NEGATIVE EXPONENTS, DIVIDING A POLYNOMIAL BY A
 MONOMIAL, DIVIDING A POLYNOMIAL BY A POLYNOMIAL.**

The students will be able to:

- Understand basic terminology of Algebra related to working with polynomials.
 - Monomial, polynomial, binomial, trinomial, degree (monomial), polynomial in simple form, degree (polynomial), expand (an expression).
- Simplify an expression for a product.
- Simplify an expression for a quotient.
- Find the area using polynomials.
- Add polynomials.
- Subtract polynomials.
- Gain an understanding of the product of powers.
- Gain an understanding of the power of product.
- Multiply a polynomial by a monomial.
- Multiply two polynomials.
- Divide a polynomial by a monomial.
- Divide a polynomial by a polynomial.
- Gain an understanding of zero and negative exponents.
- Understand the property of quotient
 - For all real numbers x and y are nonzero real numbers c and d : $\frac{xy}{Cd} = \frac{x \cdot y}{c \cdot d}$
 -
- Understand the rules for dividing two powers with the same base.

**INSTRUCTIONAL STRATEGIES:
 WORKING WITH POLYNOMIALS**

Traditional Strategies:

- Lecture
- Black/White Board Work
- Use of open-ended problems, written and oral exercises, and quantitative comparison activities.

- Vocabulary

Alternative Assessment:

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Develop a drawing of word programs.
- Develop a chart of word problems.
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software
 - Geometer's Sketchpad

EVALUATION/ASSESSMENT OF STUDENTS:

WORKING WITH POLYNOMIALS

- Teacher generated quizzes and tests.
 - Multiple Choice Questions
 - Open-ended Questions
 - Writing Exercises
 - Word Problems
 - Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation
- Alternative Assessment
 - Listed Above
 - Research Lise Meitner and what effect her mathematical mind had on society.
 - Students develop theory of how you can multiply some numbers by 9 just by using your fingers and thumbs.
 - Students develop drawing to interpret word problems.
 - Students develop charts for others to interpret word problems.

UNIT –FACTORING IN ALGEBRA –

DISTRIBUTIVE AXIOM IN FACTORING, IDENTIFYING MONOMIAL FACTORS, BINOMIALS, MULTIPLYING THE SUM AND DIFFERENCE OF TWO NUMBERS, TRINOMIALS, SQUARING A BINOMIAL.

The students will be able to:

- Understand basic terminology of Algebra related to working factoring.
 - Factoring a number (over a set of numbers), prime number, prime factor, positive integral factors, greatest common factor (of two integrals), polynomial factoring, monomial factor, greatest monomial factor (of a polynomial), factoring by grouping terms, and trinomial square.
- Find the greatest common factor of a number of integers.
- Factor a polynomial by using a distributive axiom.
- Factor trinomial products.
- Factor completely and check it by multiplication.
- Solve a polynomial equation by factoring.
- Factoring a trinomial square.
- Squaring a binomial

INSTRUCTIONAL STRATEGIES:

FACTORING IN ALGEBRA –

Traditional Strategies:

- Lecture
- Black/White Board Work
- Use of open-ended problems, written and oral exercises, and quantitative comparison activities.
- Vocabulary

Alternative Assessment:

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Develop a drawing of word programs.
- Develop a chart of word problems.
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software
 - Geometer's Sketchpad

EVALUATION/ASSESSMENT OF STUDENTS:

FACTORING IN ALGEBRA –

- Teacher generated quizzes and tests.
 - Multiple Choice Questions
 - Open-ended Questions
 - Writing Exercises
 - Word Problems
 - Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation
- Alternative Assessment
 - Listed Above
 - Research how Ancient Egyptian problems compare to solving problems of today.
 - Use factoring in problem solving.
 - Research why in ancient times man called “6” the perfect number.
 - Research scientific notation and illustrate how to use it.

UNIT –OPERATIONS WITH FRACTIONS –

DEFINING FRACTIONS, REDUCING FRACTIONS TO LOWEST TERMS, RATIO, PERCENT AND PERCENTAGE PROBLEMS, MULTIPLYING FRACTIONS, DIVIDING FRACTIONS, EXPRESSIONS INVOLVING MULTIPLICATION AND DIVISION. SUMS AND DIFFERENCES OF FRACTIONS WITH EQUAL DENOMINATORS, SUMS AND DIFFERENCES OF FRACTIONS WITH UNEQUAL DENOMINATORS, MIXED EXPRESSIONS, AND COMPLEX FRACTIONS.

The students will be able to:

- Understand basic terminology of Algebra related to operations with fractions.
 - Fraction, reducing a fraction, fraction in lowest terms, ratio, rational number, rational expression, percent, percentage, base, rate, least common denominator, mixed expression, and complex fraction.
- Multiply property of fractions.
- Reduce a fraction to lowest terms.

- Gain an understanding of the property of quotients and the rule for multiplying fractions.
- Divide fractions.
- Find the least common denominator of several fractions.
- Add and subtract fractions.
- Change a mixed expression to a fraction.
- Change a rational expression to a mixed expression.

**INSTRUCTIONAL STRATEGIES:
OPERATIONS WITH FRACTIONS –**

Traditional Strategies:

- Lecture
- Black/White Board Work
- Use of open-ended problems, written and oral exercises, and quantitative comparison activities.
- Vocabulary

Alternative Assessment:

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Develop a drawing of word programs.
- Develop a chart of word problems.
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software
 - Geometer's Sketchpad

**EVALUATION/ASSESSMENT OF STUDENTS:
OPERATIONS WITH FRACTIONS**

- Teacher generated quizzes and tests.
 - Multiple Choice Questions
 - Open-ended Questions
 - Writing Exercises
 - Word Problems
 - Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation
- Alternative Assessment
 - Listed Above
 - Research D.N. Lehmer, Explain through the research how his achievements related to mathematics, literature and music.

**UNIT –USING FRACTIONS –
SOLVING EQUATIONS AND INEQUALITIES, PERCENT MIXTURE PROBLEMS,
INVESTMENT PROBLEMS, SOLVING FRACTIONAL EQUATIONS, RATE-OF-
WORK PROBLEMS AND THE MOTION PROBLEM.**

The students will be able to:

- Understand basic terminology of Algebra related to using fractions.
 - Simple interest and fractional equations.

- Understand equations whose numerical coefficients are fractions and fractional equations having variable in the denominator of a fraction may be solved by multiplying both members by the least common denominator of the terms of the equation.
- Understand how to solve problems involving percent, mixtures, investments, work, or motion.
- Solve and graph the solution set.
- Find the solution set if the sentence is an inequality.
- Find the solution to percent mixture problems.
- Find the solution to problems involving investments.
- Solve rate-of-work problems.
- Solve motion problems.

INSTRUCTIONAL STRATEGIES:

USING FRACTIONS –

Traditional Strategies:

- Lecture
- Black/White Board Work
- Use of open-ended problems, written and oral exercises, and quantitative comparison activities.
- Vocabulary

Alternative Assessment:

- Cooperative Learning
- Do-Now Problems
- Problem Solving.
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software
 - Geometer's Sketchpad

EVALUATION/ASSESSMENT OF STUDENTS:

USING FRACTIONS

- Teacher generated quizzes and tests.
 - Multiple Choice Questions
 - Open-ended Questions
 - Writing Exercises
 - Word Problems
 - Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation
- Alternative Assessment
 - Listed Above
 - Research as many jobs as you can think in a hospital that utilize mathematics in their preparation. Describe how math is used and what mathematical background is needed to succeed.
 - Students develop word problems that involve, rate-of-work, investments, and/or motion problems. Problems are traded with other classmates.

UNIT –FUNCTIONS, RELATIONS AND GRAPHS –

FUNCTIONS DESCRIBED BY TABLES, COORDINATES IN A PLANE, RELATIONS, OPEN SENTENCES IN TWO VARIABLES, THE GRAPH OF A LINEAR EQUATION IN TWO VARIABLES, SLOPE OF A LINE, THE SLOPE-INTERCEPT FORM OF A LINEAR EQUATION, DETERMINING AN EQUATION OF A LINE, DIRECT VARIATION AND PROPORTION, QUADRATIC FUNCTIONS, INVERSE VARIATION, JOINT VARIATION AND COMBINED VARIATION.

The students will be able to:

- Understand basic terminology of Algebra related functions, relations and graphs.
 - Ordered pair, bar graph, pictograph, broken-line graph, components, horizontal axis, origin, vertical axis, graph of an ordered pair, plotting a point, quadrant, abscissa, ordinate, coordinates of a point, coordinate axes, coordinate plane, plane rectangular coordinate system, relation, domain of a relation, range of relation, open sentence in two variables, solution set of an open sentence in two variables, the graph of an equation, an equation of a line, linear equation in two variables, linear function, slope of a line, y-intercept, slope-intercept form, direct variation, constant of proportionality, proportion, means, extremes, quadratic direct variation, quadratic function, parabola, inverse variation, hyperbola, joint variation, and combined variation.
- Understand that bar and broken-line graphs are visual presentation of statistics
- Graph a linear equation in two variables.
- Utilize slope-intercept form of a linear equation to find an equation for a line.
- Measure the slope of a nonvertical straight line, choosing two different points on the line, and computing the ratio of the difference between the ordinates of the points to the corresponding difference between the abscissas of the points.
- Understand direct variation and inverse variation.
- Demonstrate the relation of ordering pairings of the members of two sets by developing a table, graph, roster, or rule.
- Set up a rectangular coordinate system in a plane.
- Find a missing value in an inverse variation.
- Determine the slope of lines.
- Plot points on tables representing ordered pairs.
- Solve quadratic equations using quadratic functions.
- Understand the graph of each quadratic function and determine the direction of the curve.

INSTRUCTIONAL STRATEGIES:

FUNCTIONS, RELATIONS AND GRAPHS –

Traditional Strategies:

- Lecture
- Black/White Board Work
- Use of open-ended problems, written and oral exercises, and quantitative comparison activities.
- Vocabulary

Alternative Assessment:

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Develop broken-line graph from a table.
- Develop bar graphs.

- Develop a graph from information on a table. And vice a verse.
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software
 - Geometer's Sketchpad

**EVALUATION/ASSESSMENT OF STUDENTS:
FUNCTIONS, RELATIONS AND GRAPHS**

- Teacher generated quizzes and tests.
 - Multiple Choice Questions
 - Open-ended Questions
 - Writing Exercises
 - Word Problems
 - Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation
- Alternative Assessment
 - Listed Above
 - Graph equations that are linear.
 - On graph paper have students trace a silhouette and then list coordinates. Give another student the coordinates and have them copy the silhouette. Compare the two pictures.

**UNIT –SYSTEMS OF OPEN SENTENCES IN TWO VARIABLES –
THE GRAPHIC METHOD, THE ADDITION OR SUBTRACTION METHOD,
PROBLEMS WITH TWO VARIABLES, MULTIPLICATION IN THE ADDITION OR
SUBTRACTION METHOD, THE SUBSTITUTION METHOD, DIGIT PROBLEMS,
MOTION PROBLEMS, AGE PROBLEMS, PROBLEMS ABOUT FRACTIONS,
GRAPH OF AN INEQUALITY IN TWO VARIABLES, GRAPHS OF SYSTEM OF
LINEAR INEQUALITIES.**

The students will be able to:

- Understand basic terminology of Algebra related to systems of open sentences in two variables.
 - Graphic method, parallel lines, intersection, systems of simultaneous equations, inconsistent equations, consistent equations, equivalent systems, addition or subtraction method, substitution method, half-plane (open-closed), boundary line, graph of an inequality in two variables, systems of inequalities.
- Understand that solution set of a system of open sentences in two variables consists of ordered pairs of numbers.
- Solve a system of linear inequalities.
- Solve digit problems, motion problems, age problems and problems about fractions by using two variables to form two equations.
- Solve simultaneous linear equations by applying the substitution principle.
- Understand when to use addition or subtraction property of equality to eliminate variables
- Understand when to use the multiplication property of equality before adding or subtracting.
- Understand the difference between consistent equation systems and inconsistent.

- Read graphs to determine the solution set in relationship to infinite sets, two parallel lines, one ordered pair of numbers and empty set.

INSTRUCTIONAL STRATEGIES:

SYSTEMS OF OPEN SENTENCES IN TWO VARIABLES –

Traditional Strategies:

- Lecture
- Black/White Board Work
- Use of open-ended problems, written and oral exercises, and quantitative comparison activities.
- Vocabulary

Alternative Assessment:

- Cooperative Learning
- Do-Now Problems
- Problem Solving/Word Problems
- Develop graphs of inequality in two variables.
- Develop problems using fractions with the need to use two variables to solve.
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software
 - Geometer's Sketchpad

EVALUATION/ASSESSMENT OF STUDENTS:

SYSTEMS OF OPEN SENTENCES IN TWO VARIABLES

- Teacher generated quizzes and tests.
 - Multiple Choice Questions
 - Open-ended Questions
 - Writing Exercises
 - Word Problems
 - Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation
- Alternative Assessment
 - Listed Above
 - Students develop problems involving motion, age, digit and substitution.
 - Students research linear programming.
 - Research Ramanujan and explain why he thought numbers were his friends.
 - Students develop a magic square – a square array of integers such that the sum of each row of each column and of each diagonal is the same. Using the following rules:
 - Write the numerals in order, putting each in a separate cell. Begin by writing 1 in the middle cell of the top row.
 - Move from cell to cell by going up and to the right one step at a time. If you find yourself going out of the square or getting into a cell that is already filled, make the move and then proceed as follows:
 - When a move takes you out at the top of the square, drop down to the lowest cell in that column. When a move takes you out at the right of the square, shift to the cell farthest left in that row.

- When a move takes you to a cell already filled, drop down one row, instead. When a move takes you out the upper right hand corner, drop down one row, instead.

UNIT –RATIONAL AND IRRATIONAL NUMBERS

THE NATURE OF RATIONAL NUMBERS, DECIMAL FORMS FOR RATIONAL NUMBERS, ROOTS OF NUMBERS, PROPERTIES OF IRRATIONAL NUMBERS, GEOMETRIC INTERPRETATION OF SQUARE ROOTS, MULTIPLICATION, DIVISION AND SIMPLIFICATION OF SQUARE-ROOT RADICALS, MULTIPLICATION OF BINOMIALS CONTAINING SQUARE-ROOT RADICALS, AND RADICAL EQUATIONS

The students will be able to:

- Understand basic terminology of Algebra related to rational and irrational numbers.
 - Real number system, number system, system of rational numbers, rational operations, terminating, non-terminating, repeating periodic, raising to a power, extracting a root, nth root, radical, root index, radicand, principal square root, perfect square, irrational numbers. Property of completeness, hypotenuse, converse, radical in simplest form, rationalizing in simplest form, rationalizing the denominator, conjugate, and radical equation.
- Understand that a rational number can be expressed as a fraction in an unlimited number of ways and as either a terminating decimal or a repeating decimal.
- Understand the property of density.
- Round a decimal.
- Understand the Pythagorean theorem.
- Understand that the roots of rational numbers are not all rational numbers.
- Understand that irrational numbers are represented by unending, non-repeating decimals.
- Understand that the set of real numbers is the union of the set of rational numbers and the set of irrational numbers.
- Understand and demonstrate the Property of Pairs of Divisors.
- Demonstrate sums and difference of square roots having the same radicand can be simplified by applying the distributive axiom.
- Demonstrate how squaring both members of an equation produce a new equation.

INSTRUCTIONAL STRATEGIES:

RATIONAL AND IRRATIONAL NUMBERS–

Traditional Strategies:

- Lecture
- Black/White Board Work
- Use of open-ended problems, written and oral exercises, and quantitative comparison activities.
- Vocabulary

Alternative Assessment:

- Cooperative Learning
- Do-Now Problems
- Problem Solving/Word Problems
- Student develops a flow chart of a program.
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software

- Geometer's Sketchpad

EVALUATION/ASSESSMENT OF STUDENTS: RATIONAL AND IRRATIONAL NUMBERS

- Teacher generated quizzes and tests.
 - Multiple Choice Questions
 - Open-ended Questions
 - Writing Exercises
 - Word Problems
 - Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation
- Alternative Assessment
 - Listed Above
 - Research Sir Arthur Stanley

UNIT –TRIGONOMETRIC FUNCTIONS

The students will be able to:

- Understand basic terminology of TRIGONOMETRY
 - geometric assumptions, rays and angles, the measurement of angles, triangles, tangent of angle, sine and cosine of an angle, function values, numerical trigonometry, similar triangles, coplanar points, collinear points, classification of angles, angles in standard position, values of the three functions of an angle, right triangles, and numerical trigonometry.
- Understand that any three points are coplanar.
- Understand that any two points are collinear.
- Understand the range of acute, obtuse and reflex angles.
- Identify an angle in standard position.
- Determine the height of an object when its shadow length is known and the angle of the sun's rays are known.
- Evaluate the tangent of an angle in standard position if the slope of the terminal side is known.
- Evaluate the tangent of an angle in standard position if the terminal side passes through a given point.
- Evaluate the tangent of an angle when the sine and cosine of the angle are known.
- Use a scientific calculator to determine the sine, cosine and tangent of an angle with a given number of degrees.
- Determine the diagonal of a rectangle if the width or length of the rectangle is known and the angle formed by the diagonal and a side is known.

INSTRUCTIONAL STRATEGIES:

TRIGONOMETRY

Traditional Strategies:

- Lecture
- Black/White Board Work
- Use of open-ended problems, written and oral exercises, and quantitative comparison activities.
- Vocabulary

Alternative Assessment:

- Cooperative Learning
- Do-Now Problems
- Problem Solving/Word Problems
- Student develops a flow chart of a program.
- Use of technology based resources
 - TI-83/84 and TI84 emulation software
 - smart board software
 - Geometer's Sketchpad

EVALUATION/ASSESSMENT OF STUDENTS:**RATIONAL AND IRRATIONAL NUMBERS**

- Teacher generated quizzes and tests.
 - Multiple Choice Questions
 - Open-ended Questions
 - Writing Exercises
 - Word Problems
 - Quantitative Comparison Questions
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation
- Alternative Assessment
 - Research Egyptian pyramids
 - Survey of the school's property

EVALUATION/ASSESSMENT OF CURRICULUM:

This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five Year Curriculum Review schedule. (See attached)

RESOURCES/BIBLIOGRAPHY:

“New Jersey Core Curriculum Content Standards for Technological Literacy” New Jersey State Department of Education, 2004

“New Jersey Mathematics Curriculum Framework”, Joseph G. Rosentein, Janet H. Caldwell, Warren D. Crown, 2004

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Algebra- Tools for a Changing World, Allan Bellman, Sadie Chavis Bragg Ed.D, Suzanne H. Chapin, ED.D. Theodore Gardella, Bettye Hall, William Handlin Sr., and Edward Manfre, Prentice Hall, 1998