

**GRADE 8 MATH**  
**2007**

**COURSE DESCRIPTION:**

Students will use rational numbers, irrational numbers, exponents, powers, roots, ratios, proportions, and percentages. They will solve simple linear equations and inequalities. They will graph functions and understand the concepts of slope and rate. They will construct shapes that meet given conditions and apply geometric concepts to solve problems. They will convert between units of measure and use rates and scale factors to solve problems. They will collect, organize, represent, and interpret relationships in data sets that have one or more variables. Students will also make decisions about how to solve problems and will communicate their ideas through a variety of methods.

**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.**

**STANDARD 8.1 (COMPUTER AND INFORMATION LITERACY ) ALL STUDENTS WILL USE COMPUTER APPLICATIONS TO GATHER AND ORGANIZE INFORMATION AND TO SOLVE PROBLEMS.**

**STANDARD 8.2 (TECHNOLOGY EDUCATION) ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF THE NATURE AND IMPACT OF TECHNOLOGY, ENGINEERING, TECHNOLOGICAL DESIGN, AND THE DESIGNED WORLD AS THEY RELATE TO THE INDIVIDUAL, SOCIETY, AND THE ENVIRONMENT**

## CUMULATIVE PROGRESS INDICATORS:

### Standard 4.1 Mathematics:

**Building upon knowledge and skills gained in preceding grades, by the end of Grade 8, students will:**

#### **A. Number Sense**

1. Extend understanding of the number system by constructing meanings for the following (unless otherwise noted, all indicators for grade 8 pertain to these sets of numbers as well):
  - Rational numbers
  - Percents
  - Exponents
  - Roots
  - Absolute values
  - Numbers represented in scientific notation
2. Demonstrate a sense of the relative magnitudes of numbers.
3. Understand and use ratios, proportions, and percents (including percents greater than 100 and less than 1) in a variety of situations.
4. Compare and order numbers of all named types.
5. Use whole numbers, fractions, decimals, and percents to represent equivalent forms of the same number.
6. Recognize that repeating decimals correspond to fractions and determine their fractional equivalents.
  - $5/7 = 0.714285714285\dots = 0.\overline{714285}$
7. Construct meanings for common irrational numbers, such as  $\pi$  (pi) and the square root of 2.

#### **B. Numerical Operations**

1. Use and explain procedures for performing calculations involving addition, subtraction, multiplication, division, and exponentiation with integers and all number types named above with:
  - Pencil-and-paper
  - Mental math
  - Calculator
2. Use exponentiation to find whole number powers of numbers.
3. Find square and cube roots of numbers and understand the inverse nature of powers and roots.

4. Solve problems involving proportions and percents.
5. Understand and apply the standard algebraic order of operations, including appropriate use of parentheses.

### **C. Estimation**

1. Estimate square and cube roots of numbers.
2. Use equivalent representations of numbers such as fractions, decimals, and percents to facilitate estimation.
3. Recognize the limitations of estimation and assess the amount of error resulting from estimation.

## **Standard 4.2 Mathematics:**

**Building upon knowledge and skills gained in preceding grades, by the end of Grade 8, students will:**

### **A. Geometric Properties**

1. Understand and apply concepts involving lines, angles, and planes.
  - Complementary and supplementary angles
  - Vertical angles
  - Bisectors and perpendicular bisectors
  - Parallel, perpendicular, and intersecting planes
  - Intersection of plane with cube, cylinder, cone, and sphere
2. Understand and apply the Pythagorean theorem.
3. Understand and apply properties of polygons.
  - Quadrilaterals, including squares, rectangles, parallelograms, trapezoids, rhombi
  - Regular polygons
  - Sum of measures of interior angles of a polygon
  - Which polygons can be used alone to generate a tessellation and why
4. Understand and apply the concept of similarity.
  - Using proportions to find missing measures
  - Scale drawings
  - Models of 3D objects
5. Use logic and reasoning to make and support conjectures about geometric objects.

## **B. Transforming Shapes**

1. Understand and apply transformations.
  - Finding the image, given the pre-image, and vice-versa
  - Sequence of transformations needed to map one figure onto another
  - Reflections, rotations, and translations result in images congruent to the pre-image
  - Dilations (stretching/shrinking) result in images similar to the pre-image
2. Use iterative procedures to generate geometric patterns.
  - Fractals (e.g., the Koch Snowflake)
  - Self-similarity
  - Construction of initial stages
  - Patterns in successive stages (e.g., number of triangles in each stage of Sierpinski's Triangle)

## **C. Coordinate Geometry**

1. Use coordinates in four quadrants to represent geometric concepts.
2. Use a coordinate grid to model and quantify transformations (e.g., translate right 4 units).

## **D. Units of Measurement**

1. Solve problems requiring calculations that involve different units of measurement within a measurement system (e.g., 4'3" plus 7'10" equals 12'1").
2. Use approximate equivalents between standard and metric systems to estimate measurements (e.g., 5 kilometers is about 3 miles).
3. Recognize that the degree of precision needed in calculations depends on how the results will be used and the instruments used to generate the measurements.
4. Select and use appropriate units and tools to measure quantities to the degree of precision needed in a particular problem-solving situation.
5. Recognize that all measurements of continuous quantities are approximations.
6. Solve problems that involve compound measurement units, such as speed (miles per hour), air pressure (pounds per square inch), and population density (persons per square mile).

## **E. Measuring Geometric Objects**

1. Develop and apply strategies for finding perimeter and area.
  - Geometric figures made by combining triangles, rectangles and circles or parts of circles
  - Estimation of area using grids of various sizes
  - Impact of a dilation on the perimeter and area of a 2-dimensional figure

3. Recognize that the volume of a pyramid or cone is one-third of the volume of the prism or cylinder with the same base and height (e.g., use rice to compare volumes of figures with same base and height).
4. Develop and apply strategies and formulas for finding the surface area and volume of a three-dimensional figure.
  - Volume - prism, cone, pyramid
  - Surface area - prism (triangular or rectangular base), pyramid (triangular or rectangular base)
  - Impact of a dilation on the surface area and volume of a three-dimensional figure
4. Use formulas to find the volume and surface area of a sphere.

### **Standard 4.3 Mathematics:**

**Building upon knowledge and skills gained in preceding grades, by the end of Grade 8, students will:**

#### **A. Patterns**

1. Recognize, describe, extend, and create patterns involving whole numbers, rational numbers, and integers.
  - Descriptions using tables, verbal and symbolic rules, graphs, simple equations or expressions
  - Finite and infinite sequences
  - Arithmetic sequences (i.e., sequences generated by repeated addition of a fixed number, positive or negative)
  - Geometric sequences (i.e., sequences generated by repeated multiplication by a fixed positive ratio, greater than 1 or less than 1)
  - Generating sequences by using calculators to repeatedly apply a formula

#### **B. Functions and Relationships**

1. Graph functions, and understand and describe their general behavior.
  - Equations involving two variables
  - Rates of change (informal notion of slope)
2. Recognize and describe the difference between linear and exponential growth, using tables, graphs, and equations.

#### **C. Modeling**

1. Analyze functional relationships to explain how a change in one quantity can result in a change in another, using pictures, graphs, charts, and equations.
2. Use patterns, relations, symbolic algebra, and linear functions to model situations.

- Using concrete materials (manipulatives), tables, graphs, verbal rules, algebraic expressions/equations/inequalities
- Growth situations, such as population growth and compound interest, using recursive (e.g., NOW-NEXT) formulas (cf. science standard 5.5 and social studies standard 6.6)

#### **D. Procedures**

1. Use graphing techniques on a number line.
  - Absolute value
  - Arithmetic operations represented by vectors (arrows) (e.g., “ $-3 + 6$ ” is “left 3, right 6”)
2. Solve simple linear equations informally, graphically, and using formal algebraic methods.
  - Multi-step, integer coefficients only (although answers may not be integers)
  - Using paper-and-pencil, calculators, graphing calculators, spreadsheets, and other technology
3. Solve simple linear inequalities.
4. Create, evaluate, and simplify algebraic expressions involving variables.
  - Order of operations, including appropriate use of parentheses
  - Distributive property
  - Substitution of a number for a variable
  - Translation of a verbal phrase or sentence into an algebraic expression, equation, or inequality, and vice versa
5. Understand and apply the properties of operations, numbers, equations, and inequalities.
  - Additive inverse
  - Multiplicative inverse
  - Addition and multiplication properties of equality
  - Addition and multiplication properties of inequalities

#### **Standard 4.4 Mathematics:**

**Building upon knowledge and skills gained in preceding grades, by the end of Grade 8, students will:**

#### **A. Data Analysis**

1. Select and use appropriate representations for sets of data, and measures of central tendency (mean, median, and mode).
  - Type of display most appropriate for given data
  - Box-and-whisker plot, upper quartile, lower quartile
  - Scatter plot
  - Calculators and computer used to record and process information
  - Finding the median and mean (weighted average) using frequency data.
  - Effect of additional data on measures of central tendency

2. Make inferences and formulate and evaluate arguments based on displays and analysis of data.
3. Estimate lines of best fit and use them to interpolate within the range of the data.
4. Use surveys and sampling techniques to generate data and draw conclusions about large groups.

## **B. Probability**

1. Interpret probabilities as ratios, percents, and decimals.
2. Determine probabilities of compound events.
3. Explore the probabilities of conditional events (e.g., if there are seven marbles in a bag, three red and four green, what is the probability that two marbles picked from the bag, without replacement, are both red).
4. Model situations involving probability with simulations (using spinners, dice, calculators and computers) and theoretical models.
  - Frequency, relative frequency
5. Estimate probabilities and make predictions based on experimental and theoretical probabilities.
6. Play and analyze probability-based games, and discuss the concepts of fairness and expected value.

## **C. Discrete Mathematics—Systematic Listing and Counting**

1. Apply the multiplication principle of counting.
  - Permutations: ordered situations with replacement (e.g., number of possible license plates) vs. ordered situations without replacement (e.g., number of possible slates of 3 class officers from a 23 student class)
  - Factorial notation
  - Concept of combinations (e.g., number of possible delegations of 3 out of 23 students)
2. Explore counting problems involving Venn diagrams with three attributes (e.g., there are 15, 20, and 25 students respectively in the chess club, the debating team, and the engineering society; how many different students belong to the three clubs if there are 6 students in chess and debating, 7 students in chess and engineering, 8 students in debating and engineering, and 2 students in all three?).
3. Apply techniques of systematic listing, counting, and reasoning in a variety of different contexts.

## **D. Discrete Mathematics—Vertex-Edge Graphs and Algorithms**

1. Use vertex-edge graphs and algorithmic thinking to represent and find solutions to practical problems.
  - Finding the shortest network connecting specified sites

- Finding a minimal route that includes every street (e.g., for trash pick-up)
- Finding the shortest route on a map from one site to another
- Finding the shortest circuit on a map that makes a tour of specified sites
- Limitations of computers (e.g., the number of routes for a delivery truck visiting  $n$  sites is  $n!$ , so finding the shortest circuit by examining all circuits would overwhelm the capacity of any computer, now or in the future, even if  $n$  is less than 100)

### **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.
3. Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).
4. Use computer software to make and verify conjectures about geometric objects.
6. Use computer-based laboratory technology for mathematical applications in the sciences.

### **Standard 8.1: Technological Literacy**

Building upon knowledge and skills gained in preceding grades, by the end of Grade 8, students will:

#### **A. Basic Computer Skills and Tools**

1. Use appropriate technology vocabulary.
2. Use common features of an operating system (e.g., creating and organizing files and folders).
3. Demonstrate effective input of text and data, using touch keyboarding with proper technique.
4. Input and access data and text efficiently and accurately through proficient use of other input devices, such as the mouse.
5. Create documents with advanced text-formatting and graphics using word processing.
6. Create a file containing customized information by merging documents.
7. Construct a simple spreadsheet, enter data, and interpret the information.
8. Design and produce a basic multimedia project.
9. Plan and create a simple database, define fields, input data, and produce a report using sort and query.
10. Use network resources for storing and retrieving data.
11. Choose appropriate electronic graphic organizers to create, construct, or design a document.
12. Create, organize and manipulate shortcuts.

#### **B. Application of Productivity Tools**

#### **Social Aspects**

1. Demonstrate an understanding of how changes in technology impact the workplace and society.
2. Exhibit legal and ethical behaviors when using information and technology, and discuss consequences of misuse.
3. Explain the purpose of an Acceptable Use Policy and the consequences of inappropriate use of technology.

4. Describe and practice safe Internet usage.
5. Describe and practice “etiquette” when using the Internet and electronic mail.

### **Information Access and Research**

5. Choose appropriate tools and information resources to support research and solve real world problems, including but not limited to:
  - On-line resources and databases
  - Search engines and subject directories
7. Evaluate the accuracy, relevance, and appropriateness of print and non-print electronic information sources.

### **Problem Solving and Decision Making**

8. Use computer applications to modify information independently and/or collaboratively to solve problems.
9. Identify basic hardware problems and demonstrate the ability to solve common problems.
10. Determine when technology tools are appropriate to solve a problem and make a decision.

### **Standard 8.2: Technological Literacy**

**Building upon knowledge and skills gained in preceding grades, by the end of Grade 8, students will:**

#### **Nature and Impact of Technology**

1. Describe the nature of technology and the consequences of technological activity.
2. Describe how components of a technological product, system, or environment interact.
3. Describe how one technological innovation can be applied to solve another human problem that enhances human life or extends human capability.
4. Describe how technological activity has an affect on economic development, political actions, and cultural change.
5. Explain the cultural and societal effects resulting from the dramatic increases of knowledge and information available today.

#### **B. Design Process and Impact Assessment**

1. Demonstrate and explain how the design process is not linear.
2. Use hands on activities to analyze products and systems to determine how the design process was applied to create the solution.
3. Identify a technological problem and use the design process to create an appropriate solution.

4. Describe how variations in resources can affect solutions to a technological problem.
5. Select and safely use appropriate tools and materials in analyzing, designing, modeling or making a technological product, system or environment.

### C. Systems in the Designed World

1. Explain technological advances in medical, agricultural, energy and power, information and communication, transportation, manufacturing, and construction technologies.
2. Explain reasons why human-designed systems, products, and environments need to be monitored, maintained, and improved to ensure safety, quality, cost efficiency, and sustainability.
3. Explain the functions and interdependence of subsystems such as waste disposal, water purification, electrical, structural, safety, climatic control, and communication.

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

#### Standard 4.1 Mathematics:

- Students develop an estimate of  $\pi$  by carefully measuring the diameter and circumference of a variety of circular objects (cans, bicycle tires, clocks, wooden blocks). They will list the measures in a table and discuss observations and possible relationships. After the estimate is made,  $\pi$  is used to solve a variety of real-world circle problems. Next they will make a scatterplot (with diameter on the horizontal axis) and draw the line of best fit. They can discuss why  $\pi$  is represented in the drawing as the slope of the line.
- Students will construct their own graph for the square roots of the numbers from 1 to 25, using trial-and-error to approximate each root to the nearest tenth. They plot the numbers on the horizontal scale, and their square roots on the vertical scale.
- Students work on traditional "systems of equations" problems, involving two unknowns, by devising non-algebraic solution strategies for them. Some samples are: *Two numbers have a sum of 32; they have a product of 240. What are the numbers?* or *Sally is 22 years younger than her Dad. In 3 years, her Dad will be 3 times as old as she. How old is Sally?*
- Students use holiday circulars advertising big sales on games and toys to comparison shop for specific items between different stores. *Is the new Nintendo game, Action Galore, cheaper at Sears where it is 20% off their regular price of \$49.95 or at Macy's where it's specially priced at \$41.97?*
- One morning, as the students arrive at school, they see a giant handprint left on the blackboard overnight. They measure it and find it to be almost exactly one meter long. *How big was the person who left the print? Could she have fit in the room to make the print, or did she have to reach in through the window? How could you decide how much she weighs?*
- Students discuss different ways of finding "easy" percents, such as 50% of 30 or 15% of 25. They then generate percent exercises that can be solved mentally and share them with their classmates.

- Students' abilities to order rational numbers (both positive and negative) are assessed by asking them to identify points on a number line between, say, -3 and -5.
- Students are each given a rational number on a large card (-1.2, 4, 3/4, -2 1/4, -1, 3.14, 22/7, and so on). They then order themselves from least to greatest along the front or side of the classroom. They also respond to instructions like: *Hold up your card if it is between -2.5 and +0.7.*
- Given a circle graph of some interesting data, students estimate the size of each section of the graph as a fraction, a percent, and as a decimal. Students also create their own circle graphs.
- Students explore patterns in particular families of decimal expansions, such as those for the fractions,  $1/7$ ,  $2/7$ ,  $3/7$ , ... or  $1/9$ ,  $2/9$ ,  $3/9$ , ... .
- Students explore the question of which fractions have terminating decimal equivalents and which have repeating decimal equivalents. They discover that the only fractions in lowest terms which correspond to terminating decimals are those whose denominators have only 2 and 5 as prime factors.
- Students explore the question of which fractions have decimal equivalents where one digit repeats and learn that these are the fractions  $1/9$ ,  $2/9$ ,  $3/9$ , ... . They generalize this to find the fractions whose decimal equivalents have two digits repeating like .171717 ... .
- Students choose a stock from the New York Stock Exchange and estimate and then compute the net gain or loss each week for a \$1,000 investment in the company.
- Students use spreadsheets to "program" a set of regular, repeated, calculations. They might, for example, create a prototype on-line order blank for a school supply company that lists each of the ten items available, the individual price, a cell for each item in which to place the quantity ordered, the total computed price for each item, and the total price for the order.
- Students regularly have *human vs. calculator races*. Given a list of specially selected computation exercises (e.g.,  $53 \times 20$ ,  $40 \times 10$ ,  $95 + 17 + 5$ ), one student uses mental math strategies and another uses a calculator. They quickly come to realize that the human has the advantage in many situations.
- Students develop their own "rules" for operations on numbers raised to powers by rewriting the expressions without exponents. For example,  $7^2 \times 7^4 = (7 \times 7) \times (7 \times 7 \times 7 \times 7) = 7 \times 7 \times 7 \times 7 \times 7 \times 7 = 7^6$ . *You just add the exponents!*
- Students use the relationship between the area of a square and the length of one of its sides to begin their study of roots. Starting with squares on a geoboard with areas of 1, 4, 9, and 16, they then are asked to find squares whose areas are 2, 5, and 13.
- Students investigate how the surface area and volume of an object changes as it is enlarged by various scale factors.
- Students use *The Geometer's Sketchpad* software to draw a geometric figure on a computer screen, scale it larger or smaller, and then compare the lengths of the sides of the original with those of the scaled image. They also compare the areas of the two.
- Students are comfortable using a variety of approaches to the solution of proportion problems. Example: *If 8 pencils cost 40 cents, how much do 10 pencils cost?*
- Students spend \$100 by selecting items from a catalog. They must compute sales tax and consider it in deciding what they will buy.
- Students bring in calculators from home to examine their differences. Among other activities, they each key in " $6 + 2 \times 4 =$ " and then compare their calculator displays. Some of the displays show 32 and others show 14. *Why? Which is right? Are the other calculators broken?*
- Students use the digits 1, 2, 3, and 4 to find expressions for each of the numbers between 0 and 50. For example,  $7 = (3 \times 4) / 2 + 1$ .
- Students use fractions, decimals, or mixed numbers interchangeably when one form of the number makes estimation easier than another. For example, rather than estimating 33 1/3% of \$120, students consider  $1/3 \times 120$  which yields a much quicker estimate.
- Similarly, in their work with percents, students master the common fraction equivalents for familiar percentages and use fractions for estimation in appropriate situations. For example, an estimate of 117% of 50 can most easily be obtained by considering 6/5 of 50.

- Students collect and bring to class sales circulars from local papers which express the discounts on sale items in a variety of ways including percent off, fraction off, and dollar amount off. For items chosen from the circular, the students discuss which form is the easiest form of expression of the discount, which is most understandable to the consumer, and which makes the sale seem the biggest bargain.
- Students judge the reasonableness of the results of fraction addition and subtraction by "rounding off" the fractions involved to  $0$ ,  $1/2$ , or  $1$ .

### **Standard 4.2 Mathematics:**

- Students identify congruent angles on a parallelogram grid, using their results to develop conjectures about alternate interior angles and corresponding angles of parallel lines and about opposite angles of a parallelogram.
- Students will complete the Stained Glass Window Project from NCTM Resources.
- Students construct squares on each side of a right triangle on a geoboard and find the area of each square. They repeat this process using several different triangles, recording their results in a table. Then they look for patterns in the table.
- Students measure the distance diagonally from first to third base on a baseball field and compare it to the distance run by a player who goes from first to second to third. They note that it is a shorter distance diagonally across the field than it is along the two sides. They repeat this type of measuring activity for other squares and rectangles, noting their results in a table and discussing any patterns they see. They calculate the square of each of the three sides of each triangle, record their results in a table, and look for patterns.
- Students use the "nibble" technique to create a shape which will tessellate the plane, that is, copies of this shape will fit together to cover a planar surface like a sheet of white oak-tag. Start with a square, cut off a "nibble" along the top or bottom edge of the square and translate the nibble vertically to the opposite edge of the square; the "nibble" will then be outside the boundary of the original square. Take a "nibble" from the right or left edge of the square and translate it horizontally to the opposite edge of the square. Trace this shape repeatedly onto a sheet of white oak-tag, by interlocking the pattern, and decorate the copies of the shape. Attempt this process several times until a pleasing shape is created.
- Students analyze the patterns found in Arabic designs such as tiled floors and walls in Spain, identifying figures that represent translations, reflections, and rotations. Then they generate their own tile designs using basic geometric shapes. They can create their own tile patterns using *Tesselmania!* software. Students apply transformations to figures drawn on coordinate grids, record the coordinates of the original figure and its image, and look for patterns. They express these patterns verbally and symbolically. For example, flipping a point across the x-axis changes the sign of the y-coordinate so that the point  $(x,y)$  moves to  $(x,-y)$ .
- Students investigate the natural shapes that are produced by growth. They look at how nature produces complex structures in which basic shapes occur over and over. For example, spider webs, honeycombs, pineapples, pinecones, nautilus shells, and snowflakes grow larger in a systematic way (iteration).
- Students use the reducing and/or enlarging feature on a copier or a computer to explore repeated reductions/enlargements by the same factor (iteration).
- Students are asked to find how many pumpkin seeds there are in a kilogram. They decide to measure how much 50 seeds weigh and use this result to help them find the answer.
- Students use approximate "rules of thumb" to help them convert units. For example:

1 km is about  $6/10$  of a mile

1 liter is a little bigger than a quart

1 meter is a little bigger than a yard

1 kg is about 2 pounds

20 degrees Centigrade is about 70 degrees Fahrenheit (room temperature)

1000 ml of water normally weighs about 1 kg

- Students plan a school garden, determining the unit of measure appropriate for the garden, estimating its size, and then computing the perimeter (for fencing) and area (for fertilizer).
- Groups of students make and use a scale drawing ( $1/4$  inch = 1 foot) of an apartment and use scale models of the furniture to furnish the living room and dining room.
- Students use a map to plan an auto trip across the United States, finding the distance traveled each day and the amount of time required to drive each day's route.
- Students use objects shown in a movie poster for *King Kong* to determine how tall the ape is.
- Students measure a given hallway in school and compare their results, noting that their results are different because any measurement is approximate. They discuss how accurate their individual measurements are (degree of precision) and, after reviewing all of their measurements, determine the likely errors in their individual measurements. They also discuss how more precise measures may be obtained and what degree of precision is needed in this situation.
- Students develop a formula for finding the surface area of a rectangular prism by constructing boxes of various sizes using graph paper, finding the area of each side and adding them, and looking for patterns in their results. They describe their findings in their journals.
- Students construct different parallelograms whose base and height have the same length on their geoboards. They sketch each parallelogram and record its area (found by counting squares). They discuss their results.
- Students use plastic models of a pyramid and a prism, each having the same height and polygonal base, to investigate the relationship between their volumes.
- Students use a paper fastener to connect two models of rays to form angles of different sizes. They estimate the correct position, then measure their guess with a protractor to see how close they were.
- Students bring cans from home, arrange them by estimated volume from smallest to largest, determine the actual volumes by measuring and computing, and compare these results to their estimates.
- Students are given a parallelogram-shaped piece of oak-tag and asked to cut it apart and arrange the parts so that it is easy to find its area. Their solutions are expressed verbally and symbolically. This same process is repeated for a trapezoid.
- Students use pattern blocks to see how the area of a square changes when the length of its side is doubled. They repeat the experiment using equilateral triangles.
- Students use cubes to explore how the volume of a cube changes when the length of one side is doubled, then when the lengths of two sides are doubled, and, finally, when the lengths of all three sides are doubled.
- Students use graph paper to draw as many rectangles as they can that have a perimeter of 16 units. They find the area of each rectangle, look for patterns, and summarize their results.
- Students trace around their hand on graph paper and count squares to find an approximate value of the area of their hand. They use graph paper with smaller squares to find a better approximation.

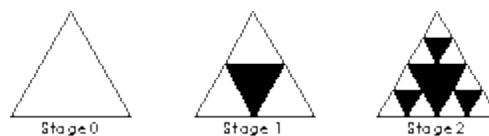
### **Standard 4.3 Mathematics:**

- Students use the following chart of postal rate history to make a graph of the increases and then to try to predict what the cost will be to mail a oneounce letter in the year 2001.
- Students discuss how the Fibonacci sequence (1, 1, 2, 3, 5, 8, 13, ...) is related to the following problem: begin with two rabbits (one male and one female), each adult pair of rabbits produces two babies (one male and one female) each month, the babies themselves become adults (and start having their own babies) after one month, and none of the rabbits ever die. The students decide that

the Fibonacci sequence shows how many pairs of rabbits there are each month. The students explore other patterns in this sequence, noting that each term is the sum of the two preceding terms.

- Students look for infinite sequences in Pascal's triangle. Starting at the top 1 and moving diagonally to the left, there is a constant infinite sequence 1, 1, 1, 1, ... . Starting at the next 1 and moving diagonally to the left there is the sequence 1, 2, 3, 4, 5, ... of whole numbers. Starting at the next 1 and moving diagonally to the left, there is the sequence 1, 3, 6, 10, 15, ... of triangular numbers, which records the solutions to all handshake problems. Also the sum of the numbers in each row yield the exponential sequence 1, 2, 4, 8, 16, ... .
- Students investigate graphs without numbers. For example, they may study a graph that shows how far Olivia has walked on a trip from home to the store and back, where time is shown on the horizontal axis and the distance covered is on the vertical axis. Students tell a story about her trip, noting that where the graph is horizontal, she has stopped for some reason. In addition, their stories account for those parts of the graph that are steeper, by explaining why Olivia is walking faster (e.g., she is running from a dog), and those parts of the graph that are not as steep, by explaining why Olivia is walking slower (e.g., she is going up a hill).
- Given several nonlinear functions, such as  $y = x^2$ ,  $y = 3x^2$ ,  $y = x^2 + 1$ ,  $y = x^3$ , or  $y = 16/x$ , students create a table of values for each and use on line graphing calculators to graph them.
- Students measure the temperature of boiling water as it cools in a cup. They make a table showing the temperature at five-minute intervals for an hour. Then they graph the results and make observations about the shape of the graph, such as "the temperature went down the most in the first few minutes," "it cooled more slowly after more time had passed," or "it's not a linear relationship." The students also predict what the graph would look like if they continued to collect data for another twelve hours.
- Students compute the average speed of a toy car as it travels down a ramp by dividing the length of the ramp by the time the car takes to travel the ramp. They try different angles for the ramp, recording their results. They make a graph of average speed vs. angle and discuss whether this graph is linear.
- Students use the toll data for a highway and describe the relationship between the distance traveled and the cost
- Students develop a table showing the sales tax paid on different amounts of purchases, graph their results, note that the graph is a straight line, and recognize that this situation represents a constant rate of change, or linear growth
- Students make a table showing how much money they would have at the end of each of eight years if \$100 was invested at the beginning and the investment grew by 10% each year. They note that the graph of their data is not a straight line; this graph represents exponential growth.
- Students make a table showing the value of a car as it depreciates over time. They note that the graph of their data is not a straight line; this graph represents "exponential decay."
- Students measure the height of water in a beaker at five second intervals as it is being filled, being careful to leave the faucet on so that the water runs at a constant rate. They make a table of their results and generate a graph. They note that this is a linear function.
- Students compare different pay scales, deciding which is a better deal. *For example, is it better to be paid a salary of \$250 per week or to be paid \$6 per hour?* They realize that the answer to this question depends on the number of hours worked, so they create a table comparing the pay for different numbers of hours worked. They make a graph and decide at what point the hourly rate becomes a better deal.
- Students investigate how the temperature affects the number of chirps a cricket makes in a minute.
- Students investigate the effect of changing the radius or diameter of a circle upon its circumference by measuring the radius (or diameter) and the circumference of circular objects. They graph the values they have generated, notice that it is close to a straight line, and describe the relationship they have found in a paragraph. Then they develop a symbolic expression that describes that relationship.

- Students investigate the effect on the perimeters of given shapes if each side is doubled or tripled. They summarize their findings.
- Students investigate how the areas of rectangles change as the length is doubled, or the width is doubled, or both are doubled. They discuss their findings.
- Students work on problems like this one from the New Jersey Department of Education's *Mathematics Instructional Guide* (p. 7-69): *Two of the opposite sides of a square are increased by 20% and the other two sides are decreased by 10%. What is the percent of change in the area of the original square to the area of the newly formed rectangle? Explain the process you used to solve the problem.*
- Students investigate how the areas of triangles change if the base is kept the same, but the height is repeatedly increased by one unit.
- Students make models of cubes using blocks or other manipulatives, and investigate how the volume changes if the length, width, and height are all doubled
- Using a spreadsheet, students investigate how adding (or subtracting) values to given data can affect the mean, median, mode, or range of the data. They discuss how various other changes to the data would affect the mean, the median, the mode, or the range.
- Groups of students pretend that they work for construction companies bidding on a federal project to build a monument. The monument is to be built from marble cubes, with each cube being one cubic foot. The monument is to have a "triangular" shape, with one cube on top, then two cubes in the row below, then three cubes, four cubes, and so on. The monument is to be 100 feet high. The students make a chart and look for a pattern to help them predict how many cubes they will need to buy so that they can include the cost of the cubes in their bid.
- Students look at the Sierpinski triangle as an example of a fractal. Stage 0 is an unshaded triangle. To get Stage 1, you take the three midpoints of the sides of the unshaded triangle, connect them, and shade the new triangle in the middle. To get Stage 2, you repeat this process for each of the unshaded triangles in Stage 1. This process continues an infinite number of times. The students make a table that records the number of unshaded triangles at each stage, look for a pattern, and use their results to predict the number of unshaded triangles there will be at the tenth ( $3^9$ ) and twentieth ( $3^{19}$ ) stages.



- Students use the constant function on the calculator to determine when an item will be on sale for half price. If the price goes down by a constant dollar amount each week, then they record successive prices, such as  $95 - 15 = \dots$  (or  $15 - - 95 = \dots$  on other calculators). If the price is reduced by a certain percent each week, then they use the constant function on the calculator to obtain successive discounts as percents by multiplying. For example, if a \$95 item is reduced by 10% each week, they key in  $95 \times .9 = \dots$  (or as  $.9 \times \times 95 = \dots$  on other calculators).
- Students use coins to simulate boys (tails) and girls (heads) in a family with five children. They make a list of all of the possible combinations, use patterns to help them organize all of the possibilities, and find the probability that all five children are girls or that exactly three are girls. As a question on a test, they are asked to react to an argument between Pam and Jerry, a couple who want to have four children. Jerry thinks that they will probably end up with two boys and two girls, while Pam thinks that they will probably wind up with an unequal number of boys and girls.
- Presented with an absolute value equation such as  $|x - 5| \leq 3$ , the students use the idea that this means identifying all the points which are 3 units or less from 5. They represent the solution set with dots at 2 and 8 and a line connecting them.
- Presented with a picture of a balance scale showing objects with unknown weights on both sides as well as known weights (e.g.,  $3x + 12 = 7x + 4$ ), students identify the standard algebraic equation related to the picture, describe in words how it would be solved using the concrete objects on the balance scale, and record their actions symbolically

- Students use algebra tiles to solve an equation like  $3(2x + 5) = 21$ . They first place 21 units on the right and three groups of two strips and five units on the left. They then note that this is the same as saying 6 strips and 15 units balance 21 units ( $6x + 15 = 21$ ). Then they take 15 units off both sides, leaving 6 strips balanced with 6 units ( $6x = 6$ ). They conclude that one strip must equal one unit ( $x = 1$ ).
- As part of a regular exam, students write a verbal explanation describing the relationship between the function  $y=2x+4$ , its graph, and the equation  $2=2x+4$ .
- Presented with the information that the Cape May-Lewes Ferry has space for 20 cars, and a bus takes up the space of 3 cars, students are asked to draw a graph which represents how many cars and how many buses can be taken across on one trip. Students use variables to represent the unknowns ( $x$  for cars and  $y$  for buses) and develop the inequality  $x+3y \leq 20$  as a model for the situation. Recognizing that the solutions have to be whole numbers, they identify the points whose coefficients are non-negative integers and in the first quadrant on or below the line.
- In the compound interest formula  $A = P(1 + r/n)^{nt}$ ,  $A$  represents the value of the investment in the future,  $P$  is the amount of the original investment,  $r$  is the annual interest rate,  $t$  is the number of years of the investment, and  $n$  is the number of times the interest is compounded each year. Find the total amount after \$2500 is invested for 18 years at a rate of 6%, compounded quarterly.

#### **Standard 4.4 Mathematics:**

- In the spring, the social studies teacher and the mathematics teacher plan a unit on the school board elections. Students are broken into groups to study questions such as *What percent of the registered voters can be expected to vote? Will the budget pass? and Who will be elected to the board of education?* Students plan their survey, how they will choose the sample, how best to gather the data, and how best to report the information to the class.
- Students are presented with data from *The World Almanac* showing the number of cigarettes smoked per year per adult and the rate of coronary heart disease in 21 countries. They produce a scatterplot and recognize a relatively high correlation between the two factors. They write an essay on the possible causes of this relationship and their interpretation of it.
- Students are asked to predict how many drops of water will fit on a penny. They write their prediction on a postit note along with an explanation of their reasoning. The predictions are collected and displayed on bar graphs or stemandleaf plots. Students perform the experiment and record their results on another postit note. They compare their hypotheses with the conclusions. A science lesson on surface tension can easily be integrated with this lesson.
- Given some of the winning times for the Men's and Women's Olympic 100 meter freestyle events during the past century, students plot the data and produce a line of best fit for each event. They use their equations to estimate the winning times in those years for which the information was not recorded, and they predict when the women's winning times will equal the men's current winning times.
- Students examine uses of probability expressed as percentages in such things as weather forecasting, risks in medical operations, and reporting the confidence interval of surveys.
- Students work on problems like this one from the New Jersey State Department of Education's *Mathematics Instructional Guide* (p. 7-103):

*A dart board is composed of three concentric circles with radii 2 cm, 10 cm, and 20 cm [as indicated in an accompanying diagram]. A grand prize is earned if a dart is thrown in the 2 cm circle (bull's-eye). Given that a person is blindfolded and throws a dart somewhere on the board, find the probability that the grand prize will be won when the first dart is thrown. Explain the process you used to solve the problem.*

and

Weatherpersons predict tomorrow's weather based on what has happened in the past on the days following days just like today. During the past 50 years, there have been 380 days that have been just like today, and of those, 200 have been followed by a clear day. Which of the following is the approximate probability of a clear day tomorrow that would be given by a weatherperson using the prediction rule described in this problem?

- a) 13%
- b) 34%
- c) 53%
- d) 66%

The correct answer is C.

- Students watch the long range weekend weather forecast and learn that the probability of rain is 40% on Saturday and 50% on Sunday. They determine that the probability that it will rain on both days is 20% by multiplying the two percentages together ( $.40 \times .50 = .20$  or 20%), and similarly then find that the probability that it will not rain on either day is 30%. Following the weekend, they discuss the success or failure of their prediction methods
- Two teams are in a playoff for the division title. If the probability of the Eagles defeating the Falcons in an individual game is 40%, what is the probability that they will win a three game playoff? What about a five-game playoff?
- Students study the chances of winning the New Jersey Pick 3 lottery. They model the problem by using spinners with 10 numbers and calculate the theoretical probability. They may also use a computer program to randomly generate a million 3-digit numbers and see how close to 1 out of 1000 times their favorite number comes up.
- During an integrated unit with their science and health classes, students discuss the various gender possibilities for children within a family. For each large family, that is, number of children, up to 6, they calculate the probability of each possible gender mix. Three groups of students conduct simulations - one with coins, one with dice (1, 2, or 3 on a die represent a female) and one with spinners. They also collect this data for all of the students in their school. They report their findings and compare the theoretical possibilities, the simulated probabilities, and the actual outcomes, and discuss the differences and similarities.
- Students determine the number of possible different sandwiches or hamburgers that can be created at local eateries using a combination of specified ingredients. They find the number of pizzas that can be made with three out of eight available toppings and relate the result to the numbers in Pascal's triangle.
- Students design different license plate systems for different population sizes; for example, *how large would the population be before you would run out of plates which had only three numbers, or only five numbers, or two letters followed by three numbers?*
- Students determine the number of handshakes that take place if each person in a room shakes hands with every other person exactly once, and relate this total to the number of line segments joining the vertices in a polygon, to the number of two-flavor ice-cream cones, and to triangular numbers.

#### **Standard 4.5 Mathematics:**

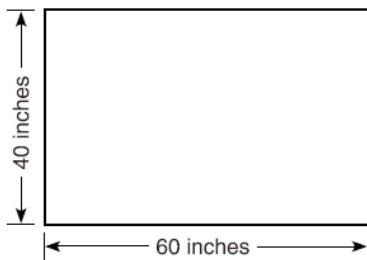
- Several times each week students should complete open ended problems that can be found on the NJDOE website. Some examples include:

At 9:00 a.m. on the super-sale day at Clothing City, Amy saw the coat she wants priced at \$65. Amy has only \$46. Every hour the price on coats will be reduced 10% from the previous hour's price.

- At what time will Amy be able to buy the coat for \$46 or less, provided the coat is still available?
- Explain in detail how you found your answer.

### Painting Enlargement

Jaime saw a painting at the Artworks Gallery in Hartford. The painting is on a rectangular canvas that measures 40 inches by 60 inches.



Jaime wants to make a copy of the painting with the same proportions but twice the area. What dimensions should he use for his painting? Draw a rectangle in the space provided in your answer booklet that shows the dimensions for the new painting. Show your work or explain how you found your answer.

## Carnival Spinner

At a carnival booth, contestants pick a color on a large spinner. A prize is won if the arrow stops on the color they pick. The spinner is divided into 8 equal sections, as shown in your answer booklet. Each section is colored green, yellow, red, or blue.

The results for a sample of spins are shown in the chart below.

Result	Number of Spins
Green	38
Yellow	58
Red	35
Blue	19

Use the results to predict the color of each of the sections on the spinner, and label each section of the spinner with the letter of a color: (G) green, (Y) yellow, (R) red, or (B) blue. Show the mathematics you used or explain how you decided how many sections should be labeled with each letter.

## **INSTRUCTIONAL STRATEGIES:**

**Unit - Integers and Algebraic Expressions:** Algebraic Expressions and the Order of Operations, Using a Problem Solving Plan, Integers and Absolute Value, Adding and Subtracting Integers, Multiplying and Dividing Integers, Using Integers with Mean, Median, and Mode, Powers and Exponents, Properties of Numbers

### **The students will be able to:**

- Write and evaluate algebraic expressions
- Use the order of operations
- Develop a plan for solving a problem
- Find the absolute value of an integer
- Compare and order integers
- Add and Subtract integers
- Multiply and divide integers
- Find measures of central tendency
- Chose the best measure of central tendency
- Write and simplify expressions with exponents
- Use the order of operations with exponents
- Identify and use the Commutative, Associative, and Distributive properties

### **Traditional Instructional Strategies:**

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

### **Alternative Instructional Strategies:**

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Use of Venn Diagrams to show problem relationships.
- Use of technology based resources
- Smartboard software
- Geometer's Sketchpad

## **EVALUATION/ASSESSMENT OF STUDENTS:**

### **Integers and Algebraic Expressions**

- Teacher generated quizzes and tests.
- Multiple Choice Questions
- Open-ended Questions
- Journal Writing Exercises
- Exam View Software Questions
- Quiz Show
- Clickers
- Book generated activities, quizzes, and tests.
- Homework

- Seat Work
- Class Participation

**Alternative Assessment:**

- Selected items from the Suggested Activities above

**Unit - Equations and Inequalities:** Solving One Step Equations, Solving Two Step Equations, Simplifying Algebraic Expressions, Solving multi-step equations, Draw a diagram and write an equation, Solving inequalities by adding or subtracting, Solving inequalities by multiplying or dividing, Solving two-step inequalities

**The student will be able to:**

- Solve equations by adding or subtracting
- Solve equations by multiplying or dividing
- Solve equations using two steps
- Combine like terms and simplify algebraic expressions
- Simplify before solving an equation
- Solve equations with variables on both sides
- Solve a problem using a variety of methods
- Graph and write inequalities
- Solve inequalities by adding or subtracting
- Multiply or divide an inequality by a positive number
- Multiply or divide an inequality by a negative number
- Solve inequalities using two steps

**Traditional Instructional Strategies:**

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

**Alternative Instructional Strategies:**

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Use of Venn Diagrams to show problem relationships.
- Use of technology based resources
- Smartboard software
- Geometer's Sketchpad

**EVALUATION/ASSESSMENT OF STUDENTS:**

**Equations and Inequalities**

- Teacher generated quizzes and tests.
- Multiple Choice Questions

- Open-ended Questions
- Journal Writing Exercises
- Exam View Software Questions
- Quiz Show
- Clickers
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation

**Alternative Assessment:**

- Selected items from the Suggested Activities above

**Unit – Graphing in the Coordinate Plane:** Graphing points, Graphing equations with two variables, Understanding Slope, Using the Y-Intercept, Write an Equation and Make a graph, Using Graphs of Equations, Solving Linear Systems by Graphing, Translations, Reflections and Symmetry, Rotations

**The student will be able to:**

- Identify and graph points on a coordinate plane
- Solve equations with two variables
- Graph equations with two variables
- Find the slope of a line from a graph
- Find the slope of a line from a table
- Graph an equation in slope intercept form
- Write an equation for a line
- Solve a problem by combining strategies
- Graph an equation using x and y intercepts
- Write and graph an equation
- Solve linear systems by graphing
- Graph translations
- Describe translations
- Graph reflections
- Identify lines of symmetry
- Graph rotations
- Identify rotational symmetry

**Traditional Instructional Strategies:**

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

### **Alternative Instructional Strategies:**

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Use of Venn Diagrams to show problem relationships.
- Use of technology based resources
- Smartboard software
- Geometer's Sketchpad

### **EVALUATION/ASSESSMENT OF STUDENTS:**

#### **Graphing in the Coordinate Plane**

- Teacher generated quizzes and tests.
- Multiple Choice Questions
- Open-ended Questions
- Journal Writing Exercises
- Exam View Software Questions
- Quiz Show
- Clickers
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation

#### **Alternative Assessment:**

- Selected items from the Suggested Activities above

**Unit - Real Numbers:** Factors, Equivalent forms of rational numbers, Comparing and ordering rational numbers, Adding and subtracting rational numbers, Multiplying and dividing rational numbers, Using formulas, Try-Check-Revise-Work Backward, Exploring square roots and irrational numbers, The Pythagorean Theorem

#### **The student will be able to:**

- Identify prime and composite numbers
- Find the greatest common factor of two numbers
- Simplify fractions and write decimals as fractions
- Compare and order rational numbers
- Add and subtract rational numbers
- Solve equations with rational numbers
- Multiply and divide rational numbers
- Use formulas to solve problems
- Solve formulas for any variable
- Solve a problem using two different strategies
- Find square roots of numbers

- Explore real numbers
- Use the Pythagorean Theorem
- Identify Right Triangles

**Traditional Instructional Strategies:**

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

**Alternative Instructional Strategies:**

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Use of Venn Diagrams to show problem relationships.
- Use of technology based resources
- Smartboard software
- Geometer's Sketchpad

**EVALUATION/ASSESSMENT OF STUDENTS:**

**Real Numbers**

- Teacher generated quizzes and tests.
- Multiple Choice Questions
- Open-ended Questions
- Journal Writing Exercises
- Exam View Software Questions
- Quiz Show
- Clickers
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation

**Alternative Assessment:**

- Selected items from the Suggested Activities above

**Unit - Applications of Proportions:** Ratios and Rates, Choosing and Converting Units, Write and Equation, Solving Proportions, Similar Figures and Proportions, Similarity Transformations, Scale Models and Maps, Similarity and Indirect Measurement

**The student will be able to:**

- Write and express ratios in simplest form
- Find unit rates
- Develop measurement sense
- Use dimensional analysis
- Solve problems by writing an equation
- Solve proportions
- Identify similar figures
- Find unknown lengths in similar figures
- Locate dilation images
- Find the scale factor for a dilation
- Use proportions to solve word problems
- Measure indirectly using similar triangles

**Traditional Instructional Strategies:**

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

**Alternative Instructional Strategies:**

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Use of Venn Diagrams to show problem relationships.
- Use of technology based resources
- Smartboard software
- Geometer's Sketchpad

**EVALUATION/ASSESSMENT OF STUDENTS:****Applications of Proportions**

- Teacher generated quizzes and tests.
- Multiple Choice Questions
- Open-ended Questions
- Journal Writing Exercises
- Exam View Software Questions
- Quiz Show
- Clickers
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation

**Alternative Assessment:**

- Selected items from the Suggested Activities above

**Unit – Applications of Percent:** Fractions-Decimals-Percents, Estimating with Percents, Percents and Proportions, Percents and Equations, Percents of Change, Markup and Discounts, Write and Equation, Simple and Compound Interest, Probability

**The student will be able to:**

- Write fractions as decimals and percents
- Write percents as fractions and decimals
- Estimate percents using decimals
- Estimate percents using fractions
- Use proportions to find part of a whole
- Use proportions to find a whole amount of a percent
- Use equations to find part of a whole
- Use equations to find the whole amount or a percent
- Find the percent of increase
- Find the percent of decrease
- Solve problems involving markup
- Solve problems involving discount
- Solve problems by writing equations
- Find simple interest and compound interest
- Find the probability that an event will occur
- Find the sample space for an event

**Traditional Instructional Strategies:**

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

**Alternative Instructional Strategies:**

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Use of Venn Diagrams to show problem relationships.
- Use of technology based resources
- Smartboard software
- Geometer's Sketchpad

**EVALUATION/ASSESSMENT OF STUDENTS:**

**Applications of Percent**

- Teacher generated quizzes and tests.
- Multiple Choice Questions
- Open-ended Questions
- Journal Writing Exercises
- Exam View Software Questions
- Quiz Show
- Clickers
- Book generated activities, quizzes, and tests.
- Homework

- Seat Work
- Class Participation

**Alternative Assessment:**

- Selected items from the Suggested Activities above

**Unit – Exponents and Powers:** Scientific Notation, Exponents and Multiplication, Exponents and Division, Power Rules, Write and Equation, Number Systems

**The student will be able to:**

- Write numbers in Standard Form and in Scientific Notation
- Order numbers written in Scientific Notation
- Multiply powers with the same base
- Multiply numbers in Scientific Notation
- Divide powers with the same base
- Use negative and zero exponents
- Raise a power to a power and raise a product to a power

**Traditional Instructional Strategies:**

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

**Alternative Instructional Strategies:**

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Use of Venn Diagrams to show problem relationships.
- Use of technology based resources
- Smartboard software
- Geometer's Sketchpad

**EVALUATION/ASSESSMENT OF STUDENTS:**

**Exponents and Powers**

- Teacher generated quizzes and tests.
- Multiple Choice Questions
- Open-ended Questions
- Journal Writing Exercises
- Exam View Software Questions
- Quiz Show
- Clickers
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation

### **Alternative Assessment:**

- Selected items from the Suggested Activities above

**Unit – Geometry:** Pairs of Angles, Angles and Parallel lines, Congruent Polygons, Solve a Simpler Problem and Look for a Pattern, Classifying Triangles and Quadrilaterals, Angles and Polygons, Areas of Polygons, Circumference and Areas of Circles

### **The student will be able to:**

- Use adjacent, vertical, complementary, and supplementary angles
- Find the measures of angles formed by parallel line
- Identify parallel lines
- Identify parts of congruent figures
- Identify congruent triangles
- Solve a simpler problem by looking for patterns
- Classify triangles and quadrilaterals
- Find the angle measures of a polygon
- Find the areas of polygons
- Find the circumference and area of circles

### **Traditional Instructional Strategies:**

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

### **Alternative Instructional Strategies:**

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Use of Venn Diagrams to show problem relationships.
- Use of technology based resources
- Smartboard software
- Geometer's Sketchpad

### **EVALUATION/ASSESSMENT OF STUDENTS:**

#### **Geometry**

- Teacher generated quizzes and tests.
- Multiple Choice Questions
- Open-ended Questions
- Journal Writing Exercises
- Exam View Software Questions

- Quiz Show
- Clickers
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation

**Alternative Assessment:**

- Selected items from the Suggested Activities above

**Unit – Geometry and Measurement:** Solids, Drawing Views of Solids, Nets and Solids, Surface Area of Prisms and Cylinders, Surface Area of Pyramids and Cones, Volumes of Prisms and Cylinders, Volumes of Pyramids and Cones, Exploring Similar Solids, Significant Digits

**The student will be able to:**

- Name solids and recognize skew lines
- Draw a base plan and the top, front, and right views
- Identify nets of solids
- Find the surface area of prisms and cylinders
- Find the surface area of pyramids and cones
- Find the volumes of prisms and cylinders
- Find the volumes of pyramids and cones
- Find the dimensions of similar solids using proportions
- Find the areas and volumes of similar solids
- Identify the significant digits in a number
- Multiply with significant digits

**Traditional Instructional Strategies:**

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

**Alternative Instructional Strategies:**

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Use of Venn Diagrams to show problem relationships.
- Use of technology based resources
- Smartboard software
- Geometer's Sketchpad

**EVALUATION/ASSESSMENT OF STUDENTS:**

**Geometry and Measurement**

- Teacher generated quizzes and tests.
- Multiple Choice Questions
- Open-ended Questions
- Journal Writing Exercises

- Exam View Software Questions
- Quiz Show
- Clickers
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation

**Alternative Assessment:**

- Selected items from the Suggested Activities above

**Using Graphs to Analyze Data:** Displaying Frequency, Reading Graphs Critically, Stem and Leaf Plots, Box and Whisker Plots, Making Predictions from Scatter Plots, Circle Graphs, Choosing an Appropriate Graph, Use Venn Diagrams to solve problems

**The student will be able to:**

- Make frequency tables and line plots
- Display data using intervals
- Recognize and select an appropriate scale
- Make and use stem and leaf plots
- Make and use box and whisker plots
- Make scatter plots and use them to find trends
- Make and read circle graphs
- Choose an appropriate graph
- Use Venn Diagrams to solve problems

**Traditional Instructional Strategies:**

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

**Alternative Instructional Strategies:**

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Use of Venn Diagrams to show problem relationships.
- Use of technology based resources
- Smartboard software
- Geometer's Sketchpad

**EVALUATION/ASSESSMENT OF STUDENTS:**

**Using Graphs to Analyze Data**

- Teacher generated quizzes and tests.
- Multiple Choice Questions
- Open-ended Questions
- Journal Writing Exercises

- Exam View Software Questions
- Quiz Show
- Clickers
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation

**Alternative Assessment:**

- Selected items from the Suggested Activities above

**Unit – Probability:** Counting Outcomes, Permutations, Combinations, Theoretical and Experimental Probability, Independent and Dependent Events, Compound Event Probability, Plan and Conduct a Survey

**The student will be able to:**

- Use tree diagrams and the counting principle
- Find the number of permutations of a set of objects
- Use permutation notation
- Find combinations by using a list
- Use combination notation
- Find experimental probability
- Find the complements and odds of events
- Find the probability of independent events
- Find the probability of dependent events
- Find the probability of compound events
- Plan a survey and determine the bias of questions

**Traditional Instructional Strategies:**

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

**Alternative Instructional Strategies:**

- Cooperative Learning
- Do-Now Problems
- Problem Solving
- Use of Venn Diagrams to show problem relationships.
- Use of technology based resources
- Smartboard software
- Geometer's Sketchpad

**EVALUATION/ASSESSMENT OF STUDENTS:**

## **Probability**

- Teacher generated quizzes and tests.
- Multiple Choice Questions
- Open-ended Questions
- Journal Writing Exercises
- Exam View Software Questions
- Quiz Show
- Clickers
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation

### **Alternative Assessment:**

- Selected items from the Suggested Activities above

**Unit – Algebraic Relationships:** Sequences, Functions, Graphing Linear Functions, Writing Rules for Linear Functions, Relating Graphs to Events, Non Linear Functions, Write an Equation, Exploring Polynomials, Adding and Subtracting Polynomials, Multiplying Polynomials

### **The student will be able to:**

- Evaluate and algebraic expression
- Write and describe sequences
- Represent functions with equations and tables
- Use function notation
- Use a table to graph a function
- Use a rule to graph a function
- Write a rule from words, a table, or a graph
- Interpret and sketch a graph of a situation
- Graph and write quadratic functions
- Graph other non linear functions
- Solve problems by writing equations
- Write variable expressions and simplify polynomials
- Add and Subtract polynomials
- Multiply and divide polynomials

### **Traditional Instructional Strategies:**

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

### **Alternative Instructional Strategies:**

- Cooperative Learning
- Do-Now Problems
- Problem Solving

- Use of Venn Diagrams to show problem relationships.
- Use of technology based resources
- Smartboard software
- Geometer's Sketchpad

## **EVALUATION/ASSESSMENT OF STUDENTS:**

### **Algebraic Relationships**

- Teacher generated quizzes and tests.
- Multiple Choice Questions
- Open-ended Questions
- Journal Writing Exercises
- Exam View Software Questions
- Quiz Show
- Clickers
- Book generated activities, quizzes, and tests.
- Homework
- Seat Work
- Class Participation

### **Alternative Assessment:**

- Selected items from the Suggested Activities above

## **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:**

“Mathematics Course 3” Randall I. Charles, Judith C. Branch-Boyd, Mark Illingworth, Darwin Mills, Andy Reeves. Prentice Hall 2006

Mathematics Curriculum Framework Activities

URL: <http://www.nj.gov/education/njpep/frameworks/math/>

“New Jersey Core Curriculum Content Standards” New Jersey State Department Of Education

“New Jersey Mathematics Curriculum Framework”, Joseph G. Rosentein, Janet H. Caldwell, Warren D. Crown, 2007