

**Problem Solving (Strategies)**

Problem solving is integrated throughout the content strands. The development of problem-solving skills is a major goal of the mathematics program at every grade level. Instruction in the process of problem-solving, which should include problems involving Catholic Social Teaching, not just textbook word problems, will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

The student will apply the following problem solving strategies to solve real life situations (use of manipulatives is imperative):

**I. NUMBERS AND OPERATIONS**

Teachers should reinforce the process of estimation at each grade level. The use of a "Guessing Jar" containing an unknown number of objects is one way to do this.

**Goal:** For students to be able to count in a variety of ways, and to master one-to-one correspondence.

**A. Number Sense**

The student will:

- 1. \_\_\_\_\_ Count to 100 by: ones, five, tens
- 2. \_\_\_\_\_ Count backwards from 10
- 3. \_\_\_\_\_ Demonstrate one-to-one correspondence for numbers to 31
- 4. \_\_\_\_\_ Recognize the number of objects in a small group without counting
- 5. \_\_\_\_\_ Create a group of a given number of objects
- 6. \_\_\_\_\_ Read, order and write numbers 0 to 30
- 7. \_\_\_\_\_ Identify ordinal numbers from first to tenth
- 8. \_\_\_\_\_ Use language such as more than, less than, equal, before and after to compare small quantities
- 9. \_\_\_\_\_ Recognize number words to 10
- 10. \_\_\_\_\_ Identify one more and one less
- 11. \_\_\_\_\_ Demonstrate place value with manipulatives: ones and tens

**B. Addition and Subtraction**

The student will:

- 1. \_\_\_\_\_ Count the number in combined groups
- 2. \_\_\_\_\_ Use concrete objects to solve problems with sums and differences up to 10

**C. Multiplication and Division – No objectives****D. Properties – No objectives****E. Fractions/Decimals/Percents**

The student will:

- 1. \_\_\_\_\_ Represent commonly used fractions such as  $\frac{1}{4}$  and  $\frac{1}{2}$

**II. MEASUREMENT**

Students should be able to estimate and measure and in both customary and metric measurements of length, weight, capacity, temperature, time and money. As their ability to measure increases, they should be able to determine the reasonableness of their answers. Students should use appropriate labels for answers.

**A. Linear Measurement**

The student will:

- 1. \_\_\_\_\_ Identify by direct comparison the difference between longer and shorter
- 2. \_\_\_\_\_ Using a non-standard unit of measurement determine longer and shorter (using a shoe, a hand, etc)
- 3. \_\_\_\_\_ Order several objects according to length

**B. Weight**

The student will:

- 1. \_\_\_\_\_ Identify by direct comparison the difference between heavier and lighter

**C. Temperature**

The student will:

- 1. \_\_\_\_\_ Identify by direct comparison the difference between hotter and colder

**D. Time/Money**

The student will:

- 1. \_\_\_\_\_ Recite the 7 days of the week and the 12 months of the year
- 2. \_\_\_\_\_ Recognize parts of the calendar: day of the week, month, year, date
- 3. \_\_\_\_\_ Identify and determine the value of coins (penny, nickel, dime, quarter)
- 4. \_\_\_\_\_ Tell time to hour and half hour

**III. GEOMETRY**

The student will:

- 1. \_\_\_\_\_ Identify the difference between two-(circle, square, triangle, rectangle, oval, diamond, heart) and three-dimensional shapes (sphere, cube, cone, rectangular prism, pyramid)
- 2. \_\_\_\_\_ Demonstrate common language of spatial sense and show examples: inside, between, about, below, behind, near to, left, right, etc

**IV. STATISTICS, PROBABILITY AND DATA ANALYSIS**

The student will:

- 1. \_\_\_\_\_ Sort and classify objects according to their attributes (e.g., shape, size, color)
- 2. \_\_\_\_\_ Collect data about themselves and their surroundings (e.g., hair color, eye color, shoe color, birthdays)
- 3. \_\_\_\_\_ Construct and interpret graphs, real graphs (using physical objects), pictographs from previously collected data

**V. ALGEBRA**

The student will:

- 1. \_\_\_\_\_ Sort objects and pictures by attributes
- 2. \_\_\_\_\_ Describe sorting rules
- 3. \_\_\_\_\_ Identify, create, copy and extend patterns using numbers, pictures, manipulatives, etc.

**VOCABULARY**

Equal, length, height, weight, add, subtract, shortest, tallest, longest, fewer, whole, part, total, next, last, sum, difference, first, next, last, inside, between, below, behind, left, right, above, middle, over, under, beside, through, on top of, next to, outside

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The student will apply the following problem solving strategies to solve real life situations (use of manipulatives is imperative):

**I. NUMBERS AND OPERATIONS**

**Goal:** To teach students the concept of addition and subtraction and their inverse relationship to each other, whole number relationships including grouping in tens and ones. Students should be exposed to the appropriate vocabulary of the math concepts. Teachers should reinforce the process of estimation at each grade level.

**A. Number Sense:**

The student will:

- 1. \_\_\_\_\_ Read and write numbers 0 to 100
- 2. \_\_\_\_\_ Count by 2's to 100
- 3. \_\_\_\_\_ Compare sets of objects to show more than, less than, equal to using symbols
- 4. \_\_\_\_\_ Identify numbers that come before, after and between and represent them on a number line
- 5. \_\_\_\_\_ Identify place value of ones and tens up to 100
- 6. \_\_\_\_\_ Recognize two-digit numbers as groups of tens and ones

**B. Addition and Subtraction**

**Goal:** To demonstrate the relationship between addition and subtraction as an inverse relationship.

The student will:

- 1. \_\_\_\_\_ Use strategies (e.g., doubles, plus-minus-one, making 10, fact families, counting on, etc.) to generate basic facts and to demonstrate understanding of the inverse relationship between addition and subtraction
- 2. \_\_\_\_\_ Use objects, pictures, length-based model (e.g., connecting cubes), and number lines to illustrate addition and subtraction concepts
- 3. \_\_\_\_\_ Demonstrate single-digit addition and subtraction facts with automaticity (facts to 12)
- 4. \_\_\_\_\_ Add and subtract two-digit numbers without regrouping
- 5. \_\_\_\_\_ Choose the appropriate operation of addition or subtraction in word problems

**C. Multiplication and Division – No objectives****D. Properties**

The student will:

- 1. \_\_\_\_\_ Use the commutative and associative properties to add single-digit whole numbers (i.e.,  $2+5=5+2$ ,  $3+(4+1)=(3+4)+1$ ). Use the correct vocabulary when using this property.

**E. Fractions/Decimals/Percents – No objectives****II. MEASUREMENT**

Students should be able to estimate and measure in both customary and metric measurements of length, weight, capacity, temperature, time and money. As their ability to measure increases, they should be able to determine the reasonableness of their answers. Students should use appropriate labels for answers.

**A. Linear Measurement**

The student will:

- 1. \_\_\_\_\_ Measure length, width and height using non-standard and standard units
- 2. \_\_\_\_\_ Using non-standard units make and check estimates of length
- 3. \_\_\_\_\_ Compare and order lengths

**B. Weight**

The student will:

- 1. \_\_\_\_\_ Measure weight using non-standard and standard units
- 2. \_\_\_\_\_ Compare and order weights using non-standard and standard units
- 3. \_\_\_\_\_ Select an appropriate tool for measuring weight (i.e., a balance scale versus a ruler or a cup)

**C. Temperature – No objectives****D. Time/Money**

The student will:

- 1. \_\_\_\_\_ Read and identify dates and days of the week using a calendar
- 2. \_\_\_\_\_ Sequence days and months
- 3. \_\_\_\_\_ Tell time to the hour and half-hour
- 4. \_\_\_\_\_ Identify the value of coins including half-dollars and dollar coins
- 5. \_\_\_\_\_ Add total value of mixed coins; pennies, nickels, dimes and quarters

**E Capacity – No objectives****III. GEOMETRY**

The student will:

- 1. \_\_\_\_\_ Compare similarities and differences between common geometric shapes
- 2. \_\_\_\_\_ Compose (combine) and decompose (take apart) basic shapes
- 2. \_\_\_\_\_ Describe characteristics of two-and three-dimensional geometric shapes to include squares, rectangles, triangles, circles, cubes, pyramid, sphere, cylinder, rectangular prism and cone

**IV. STATISTICS, PROBABILITY, DATA ANALYSIS**

The student will:

- 1. \_\_\_\_\_ Use data collected to describe parts to whole
- 2. \_\_\_\_\_ Construct and interpret pictures and bar graphs

**V. ALGEBRA**

The student will:

- 1. \_\_\_\_\_ Use concrete objects and pictures to create patterns and describe them in a variety of ways
- 2. \_\_\_\_\_ Use number pairs to describe another number

**Problem Solving (Strategies)**

Problem solving is integrated throughout the content strands. The development of problem-solving skills is a major goal of the mathematics program at every grade level. Instruction in the process of problem-solving, includes problems involving Catholic Social Teaching, not just textbook word problems, and is integrated early and continuously into each student's mathematics education. Students are helped to develop a wide range of skills and strategies for solving a variety of problem types.

The student will apply the following problem solving strategies to solve real life situations (use of manipulatives is imperative):

**I. NUMBERS AND OPERATIONS**

**Goal:** For students to have fluency with multi-digit addition and subtraction as well as develop an understanding of the base-ten numeration system and place value concepts. Students should be exposed to and be able to use the appropriate vocabulary of the math concepts. Teachers should reinforce the process of estimation at each grade level. The use of a "Guessing Jar" containing an unknown number of objects is one way to do this.

**A. Number Sense**

The student will:

- 1. \_\_\_\_\_ Count in units and multiples of hundreds, tens and ones (skip counting)
- 2. \_\_\_\_\_ Demonstrate understanding of place value up to and including the thousands place using expanded form
- 3. \_\_\_\_\_ Create equivalent representations of given numbers (such as 35 represented by 35 ones, 3 tens and 5 ones or 2 tens and 15 ones)
- 4. \_\_\_\_\_ Count, read and write numbers to 1,000
- 5. \_\_\_\_\_ Use a number line to round numbers to the nearest tens and hundreds
- 6. \_\_\_\_\_ Identify numbers as odd or even
- 7. \_\_\_\_\_ Compare and order numbers up to one thousand

**B. Addition and Subtraction**

The student will:

- 1. \_\_\_\_\_ Demonstrate addition and subtraction facts with fluency and automaticity (sums up to 20)
- 2. \_\_\_\_\_ Add and subtract whole numbers of at least four digits without renaming and regrouping
- 3. \_\_\_\_\_ Select and apply appropriate methods to estimate sums and differences or calculate them mentally depending on the context and number involved
- 4. \_\_\_\_\_ Add and subtract whole numbers of at least four digits, demonstrating fluency with standard algorithms (renaming and regrouping)
- 5. \_\_\_\_\_ Add more than two single and multi-digit numbers (numbers in a column)
- 6. \_\_\_\_\_ Explain why place value allows renaming and regrouping
- 7. \_\_\_\_\_ Add numbers with regrouping to the tens place (The focus is on the visualizing of making another group of ten, not on the algorithm procedure of lining up the numbers in place value spaces.)

**C. Multiplication and Division – No objectives**

**D. Properties**

The student will:

- 1. \_\_\_\_\_ Use the commutative and associative properties to add multiple-digit whole Numbers (i.e.,  $12+15-15+12$ ;  $25+(50+19)=(25+50)+19$ )

**II. MEASUREMENT**

Students should be able to estimate and measure in both customary and metric measurements of length, weight, capacity, temperature, time and money. As their ability to measure increases, they should be able to determine the reasonableness of their answers. Students should use appropriate labels for answers.

**A. Linear Measurement**

The student will:

- 1. \_\_\_\_\_ Use rulers and other measurement tools
- 2. \_\_\_\_\_ Select an appropriate tool for measuring length (i.e., a ruler, yard stick, meter stick)
- 3. \_\_\_\_\_ Estimate, measure, add and subtract lengths using inches, feet and yards, centimeters and meters
- 4. \_\_\_\_\_ Partition lengths into equal-sized segments

**B. Weight**

The student will:

- 1. \_\_\_\_\_ Measure weight using customary and metric units (ounces, pounds, grams)

**C. Temperature**

The student will:

- 1. \_\_\_\_\_ Read a Fahrenheit and Celsius thermometer
- 2. \_\_\_\_\_ Measure and record temperature using customary and metric thermometers (Fahrenheit and Celsius)

**D. Time/Money**

The student will:

- 1. \_\_\_\_\_ Identify the relationship between units of time (i.e., 24 hours/day; 7 days/week; 60 minutes/hour; 60 seconds/minute)
- 2. \_\_\_\_\_ Tell time and write it to the quarter hour and minute
- 3. \_\_\_\_\_ Describe time as A.M. or P.M., noon or midnight
- 4. \_\_\_\_\_ Add similar units of time (i.e., add 3 hours + 2 hours, etc.)
- 5. \_\_\_\_\_ Add total value of mixed coins; pennies, nickels, dimes, quarters, half-dollars (sums less than \$1), dollar coins and dollar bills

**E. Capacity:**

The student will:

- 1. \_\_\_\_\_ Identify and compare measure of capacity using cups, pints, quarts and gallons

**III. GEOMETRY**

The student will:

- 1. \_\_\_\_\_ Describe characteristics of three-dimensional geometric solids to include rectangles, prisms, pyramids, spheres, cylinders and cones
- 2. \_\_\_\_\_ Compare and contrast the properties of two-dimensional figures (circle, triangle, rectangle, square) and three-dimensional solids (sphere, square pyramid, cone, cylinder and cube)
- 3. \_\_\_\_\_ Investigate the concept of perimeter and area
- 4. \_\_\_\_\_ Compute the perimeter of both regular and irregular figures
- 5. \_\_\_\_\_ Identify the line of symmetry for various shapes (e.g., letters of the alphabet) along a line identify congruent shapes (mirror images)

**IV. STATISTICS, PROBABILITY AND DATA ANALYSIS**

No objectives in this grade but students should continue use graphic skills learned in previous grades.

**V. ALGEBRA**

The student will:

- 1. \_\_\_\_\_ Create and recognize patterns using numbers
- 2. \_\_\_\_\_ Solve problems using patterns
- 3. \_\_\_\_\_ Find the missing number in an addition or subtraction problem

**Problem Solving (Strategies)**

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The student will apply the following problem solving strategies to solve real life situations (use of manipulatives is imperative):

**I. NUMBERS AND OPERATIONS**

**Goal:** For students to develop the conceptual understanding of multiplication and division. The students will also gain a conceptual understanding of fractions. Teachers should reinforce the process of estimation at each grade level. Students should continue to determine the reasonableness of answers.

**A. Number Sense**

The student will:

- 1. \_\_\_\_\_ Recognize, read, count, compare and write numbers up to and including 100,000 (count by number patterns including tens and hundreds)
- 2. \_\_\_\_\_ Use expanded form to write numbers in numerals to 100,000
- 3. \_\_\_\_\_ Identify place value to 100,000
- 4. \_\_\_\_\_ Round numbers to 1,000
- 5. \_\_\_\_\_ Write word names for numbers with six digit numerals
- 6. \_\_\_\_\_ Identify Roman Numerals to 1,000 (using I,V,X, L, C, D and M)

**B. Addition and Subtraction**

The student will:

- 1. \_\_\_\_\_ Subtract across zeros with at least six digit numbers
- 2. \_\_\_\_\_ Add six digit numbers with and without regrouping

**C. Multiplication and Division**

The student will:

- 1. \_\_\_\_\_ Use repeated addition to model multiplication
- 2. \_\_\_\_\_ Use arrays, number lines, equal groups and area models to illustrate multiplication and division concepts and facts
- 3. \_\_\_\_\_ Demonstrate automaticity and fluency with multiplication and division facts 0-12
- 4. \_\_\_\_\_ Multiply multiplicands of up to six digits by a single digit
- 5. \_\_\_\_\_ Relate multiplication and division as inverse operations using a variety of strategies

**D. Properties**

The student will:

- 1. \_\_\_\_\_ Use the property of one in multiplication and division
- 2. \_\_\_\_\_ Use the property of zero in multiplication
- 3. \_\_\_\_\_ Use the associative and commutative properties of multiplication

**E. Fractions/Decimals/Percents**

The student will:

- 1. \_\_\_\_\_ Demonstrate that fractions are parts of unit wholes, parts of collections, and have locations on number lines
- 2. \_\_\_\_\_ Identify and write mixed numbers without simplification
- 3. \_\_\_\_\_ Identify and write proper and improper fractions without simplification
- 4. \_\_\_\_\_ Use models and number lines to identify equivalent fractions
- 5. \_\_\_\_\_ Compare and order simple fractions with common numerators, uncommon denominators, and benchmark fractions using models

**II. MEASUREMENT**

Students should be able to estimate and measure in both customary and metric measurements of length, weight, capacity, temperature, time and money. As their ability to measure increases, they should be able to determine the reasonableness of their answers. Students should use appropriate labels for answers.

**A. Linear Measurement**

The student will:

- 1. \_\_\_\_\_ Measure length to the nearest half unit

**B. Weight – No Objectives****C. Temperature – No Objectives****D. Time/Money**

The student will:

- 1. \_\_\_\_\_ Count up to ten dollars
- 2. \_\_\_\_\_ Make change to one dollar by counting up
- 3. \_\_\_\_\_ Round amounts to the nearest dollar; the nearest ten dollars
- 4. \_\_\_\_\_ Recognize that dollars and cents are decimals, and that money may be represented as fractions of dollars (i.e.,  $\frac{1}{4}$  of a dollar is a quarter)
- 5. \_\_\_\_\_ Write money appropriately as decimals OR with a cent sign, not both
- 6. \_\_\_\_\_ Calculate elapsed time using hours and minutes (i.e., from 2:15 until 3:15 is one hour)
- 7. \_\_\_\_\_ Convert smaller measures of time into larger (i.e., 63 minutes=1 hour and 3 minutes; 17 days=two weeks and three days)
- 8. \_\_\_\_\_ Recognize expressions of time before and after the hour as being the same (10:45 is the same as a quarter to eleven)
- 9. \_\_\_\_\_ Create and use a calendar to determine a date some time (i.e., two weeks) in the future or in the past

**E. Capacity**

The student will:

- 1. \_\_\_\_\_ Measure capacity using cups, pints, quarts and gallons
- 2. \_\_\_\_\_ Describe the relationship of standard measurement to metric measurement (i.e., quarts are similar to liters)

**III. GEOMETRY**

The student will:

- 1. \_\_\_\_\_ Describe characteristics of two-dimensional shapes (rhombus, irregular figures) and three-dimensional shapes
- 2. \_\_\_\_\_ Compare and contrast the properties of two-dimensional (parallelograms) and three-dimensional geometric figures to include the rectangular prism and triangular pyramid
- 3. \_\_\_\_\_ Use tiles to measure perimeter and area of various rectangles
- 4. \_\_\_\_\_ Identify parallel, perpendicular, and intersecting lines and rays. Define horizontal and vertical.
- 5. \_\_\_\_\_ Identify acute, obtuse, right and straight angles

**III. STATISTICS, PROBABILITY, AND DATA ANALYSIS**

The student will:

- 1. \_\_\_\_\_ Construct and analyze frequency tables, bar graphs, picture graphs and line plots and use them to solve problems
- 2. \_\_\_\_\_ Use spinners, coins and dice to predict outcomes and describe the concept of “chance” in terms of likely, unlikely or equally likely

**III. ALGEBRA**

The student will:

- 1. \_\_\_\_\_ Predict the next number in a pattern
- 2. \_\_\_\_\_ Name the previous number in a pattern

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The student will apply the following problem solving strategies to solve real life situations (use of manipulatives is imperative):

**I. NUMBERS AND OPERATIONS**

**Goal:** For students to develop fluency in multiplication and division. The students will extend their understanding of fractions and fractional parts. "Students will develop an understanding of decimals including the connections between fractions and decimals" Focal Points. Teachers should reinforce the process of estimation at each grade level. Students should continue to determine the reasonableness of answers.

**A. Number Sense**

The student will:

- 1. \_\_\_\_\_ Count, read, write, order, compare, estimate and round numbers to 1 million (<, >, +)
- 2. \_\_\_\_\_ Identify, place value and read and write numbers in word form from millionths to millions (i.e., Four thousand six hundred thirty-four and seven hundredths – 4,634.07)
- 3. \_\_\_\_\_ Define prime and composite numbers
- 4. \_\_\_\_\_ Identify prime numbers to 20
- 5. \_\_\_\_\_ Use factorization to express whole numbers as products of prime factors

**B. Addition and Subtraction – Students should continue to practice****C. Multiplication**

The student will:

- 1. \_\_\_\_\_ Multiply by two digit numbers and three digit numbers
- 2. \_\_\_\_\_ Demonstrate automaticity and fluency with multiplication and division facts (0-12)
- 3. \_\_\_\_\_ Divide two- and three-digit dividends by one digit
- 4. \_\_\_\_\_ Show a remainder when dividing by one digit

**D. Properties – No Objectives**

Students should continue to use and explore the property of zero, the property of one and the associative and commutative properties and use the correct vocabulary associated with them.

**E. Fractions/Decimals/Percents**

The student will:

- 1. \_\_\_\_\_ Change improper fractions to mixed numbers
- 2. \_\_\_\_\_ Change mixed numbers to improper fractions
- 3. \_\_\_\_\_ Simplify fractions to lowest terms
- 4. \_\_\_\_\_ Read, write and order fractions
- 5. \_\_\_\_\_ Read, write and order mixed numbers
- 6. \_\_\_\_\_ Generate many fractions for the same value
- 7. \_\_\_\_\_ Read, write and compare decimals as an extension of the base-ten system
- 8. \_\_\_\_\_ Understand decimals as a part of the whole
- 9. \_\_\_\_\_ Locate decimals on a number line
- 10. \_\_\_\_\_ Compare and order whole numbers, fractions, decimals and percents
- 11. \_\_\_\_\_ Write decimals as equivalent fractions to the thousandths place
- 12. \_\_\_\_\_ Add and subtract fractions with common denominators
- 13. \_\_\_\_\_ Add and subtract decimals

**II. MEASUREMENT**

Students should be able to estimate and measure in both customary and metric measurements of length, weight, capacity, temperature and time and money. As their ability to measure increases, they should be able to determine the reasonableness of their answers. Students should use appropriate labels for answers.

**A. Linear Measurement**

The student will:

- 1. \_\_\_\_\_ Measure length to the nearest  $\frac{1}{4}$  and  $\frac{1}{8}$  of an inch or to the nearest millimeter

**B. Weight – No Objectives****C. Temperature – No Objectives****D. Time/Money**

The student will:

- 1. \_\_\_\_\_ Count to one hundred dollars
- 2. \_\_\_\_\_ Make change to ten dollars
- 3. \_\_\_\_\_ Add and subtract elapsed time with regrouping (minutes greater than one hour becomes converted to an hour; days more than seven become a week)
- 4. \_\_\_\_\_ Use time applications to solve problems (elapsed time)

**E. Capacity**

The student will:

- 1. \_\_\_\_\_ Measure capacity using fluid ounces, cups, pints, quarts, gallons and liters

**III. GEOMETRY**

The student will:

- 1. \_\_\_\_\_ Compare and contrast the characteristics and properties of two-dimensional shapes (regular hexagon, pentagon, etc) and their corresponding three-dimensional solids
- 2. \_\_\_\_\_ Classify two-dimensional figures- i.e., squares – as subsets of rectangles, and rectangles as subsets of parallelograms
- 3. \_\_\_\_\_ Predict and describe the result of the geometric transformations, such as reflection, translation and rotation using concrete objects (i.e., mirrors, paper folding, tracing)
- 4. \_\_\_\_\_ Identify equilateral, isosceles, scalene and right triangles
- 5. \_\_\_\_\_ Measure volume of rectangular prisms using cubes
- 6. \_\_\_\_\_ Measure surface area with tiles
- 7. \_\_\_\_\_ Derive the formula for perimeter and area of polygons

**IV. STATISTICS, PROBABILITY, AND DATA ANALYSIS**

Students continue to use skills and tools from Grade 3.

The student will:

- 1. \_\_\_\_\_ Apply place value to use stem/leaf plots
- 2. \_\_\_\_\_ Model situations using experiments to determine probability and predict results
- 3. \_\_\_\_\_ Represent probability as a fraction

**V. ALGEBRA**

The student will:

- 1. \_\_\_\_\_ Find the missing number in a pattern
- 2. \_\_\_\_\_ Identify missing operational signs in equations
- 3. \_\_\_\_\_ Recognize and use a variable in a number sentence

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The student will apply the following problem solving strategies to solve real life situations (use of manipulatives is imperative):

**I. NUMBERS AND OPERATIONS**

**Goal:** For students to develop fluency with division of whole numbers, with addition and subtraction of fractions, and addition and subtraction of decimals. The students will extend their understanding of fractions and fractional parts. "Students will develop an understanding of decimals including the connections between fractions and decimals" Focal Points. Teachers should reinforce the process of estimation at each grade level. Students should continue to determine the reasonableness of answers.

**A. Number Sense – No Objectives****B. Addition and Subtraction – No Objectives**

Students should continue to practice skills.

**C. Multiplication and Division**

The student will:

- 1. \_\_\_\_\_ Write remainders as fractions
- 2. \_\_\_\_\_ Divide when zeros are present in the dividend
- 3. \_\_\_\_\_ Divide multi-digit dividends by multi-digit divisors
- 4. \_\_\_\_\_ Recite and use divisibility rules for 2,3,4,5,6,9 and 10

**D. Properties – No Objectives**

Students should continue to use and explore the property of zero, the property of one and the associative and commutative properties.

**E. Fractions/Decimals/Percents**

The student will:

- 1. \_\_\_\_\_ Find the least common multiple and the greatest common factor
- 2. \_\_\_\_\_ Find the least common denominator for two or more fractions
- 3. \_\_\_\_\_ Add and subtract fractions with like and unlike denominators
- 4. \_\_\_\_\_ Add and subtract mixed numbers with like and unlike denominators
- 5. \_\_\_\_\_ Change terminating decimals to fractions and fractions with decimals
- 6. \_\_\_\_\_ Add and subtract decimals
- 7. \_\_\_\_\_ Round numbers less than 1 to tenths, hundredths and thousandths
- 8. \_\_\_\_\_ Multiply and divide decimals (with both whole numbers and decimals in the divisor)
- 9. \_\_\_\_\_ Reduce fractions to lowest terms

**II. MEASUREMENT**

Students should be able to estimate and measure and in both customary and metric measurements of length, weight, capacity, temperature and time and money. As their ability to measure increases, they should be able to determine the reasonableness of their answers. Students should use appropriate labels for answers.

**A. Linear Measurement**

The student will:

- 1. \_\_\_\_\_ Convert within customary units and metric units of measurement using multiplication and division (How many inches are in two feet? How many cm are in 36 meters? What fractional part of a foot is 3 inches?)

**B. Weight**

The student will:

- 1. \_\_\_\_\_ Convert within the same system of weight using multiplication and division (How many ounces are in two pounds? How many grams are in 32 Kg? What fractional part of a pound is 4 ounces?)

**C. Temperature – No Objectives****D. Time/Money**

The student will:

- 1. \_\_\_\_\_ Add, subtract, multiply and divide money amounts
- 2. \_\_\_\_\_ Make change to values greater than ten dollars
- 3. \_\_\_\_\_ Use time applications to solve problems (elapsed time)

**III. GEOMETRY**

The student will:

- 1. \_\_\_\_\_ Identify and use formulas for area and perimeter for rectangles and triangles
- 2. \_\_\_\_\_ Identify three-dimensional figures including faces, vertices, edges of cubes and pyramids
- 3. \_\_\_\_\_ Identify the effects of combining basic shapes (i.e., the area and perimeter of a square and an adjacent triangle)
- 4. \_\_\_\_\_ Draw a pattern for a three-dimensional figure
- 5. \_\_\_\_\_ Find the surface area and volume of three-dimensional shapes (rectangular prisms)
- 6. \_\_\_\_\_ Derive the formula for the area of a triangle and shapes made from triangles

**IV. STATISTICS, PROBABILITY AND DATA ANALYSIS****Goal:** The student will display and interpret data and predict outcomes

The student will:

- 1. \_\_\_\_\_ Construct, interpret and analyze bar graphs, line graphs and pictographs using whole numbers
- 2. \_\_\_\_\_ Compare data and predict outcomes for the data
- 3. \_\_\_\_\_ Create a scatter plot using ordered pairs to graph points on a coordinate grid
- 4. \_\_\_\_\_ Compute the mean, median, mode and range of data sets

**V. ALGEBRA**

The student will:

- 1. \_\_\_\_\_ Find the missing numbers in a sequence
- 2. \_\_\_\_\_ Identify the order of operations for simplifying mathematical equations
- 3. \_\_\_\_\_ Simplify expressions using order of operations
- 4. \_\_\_\_\_ Write and solve equation using a variable

**Middle School Math**

Since not all students are ready to take a high school course in Algebra I, there are two pathways for math instruction to follow.

**Non-Algebra Sequence**

This math curriculum is designed to prepare students to take Algebra in the 9<sup>th</sup> grade. It provides students with a solid pre-algebra program before they enter the Algebra program over a three-year period.

**Algebra I Sequence****Grade 6, Grade 7 (Pre-Algebra), Grade 8 (Algebra I)**

This math curriculum is designed to prepare students to take Algebra I in the 8<sup>th</sup> grade. It provides students with a solid pre-algebra program before they enter the Algebra I high school course.

**Non-Algebra Sequence****6<sup>th</sup> Grade****I. NUMBERS AND OPERATIONS****A. Number Sense**

The student will:

- 1. \_\_\_\_\_ Define and demonstrate exponential notation
- 2. \_\_\_\_\_ Write large and small numbers using scientific notation
- 3. \_\_\_\_\_ Read, write and plot real numbers on a number line, including solved inequalities
- 4. \_\_\_\_\_ Demonstrate an understanding of the relationship between the absolute value of a rational number and distance on a number line. Use the symbol for absolute value.
- 5. \_\_\_\_\_ Identify the natural, whole and integer components of the real number system
- 6. \_\_\_\_\_ Apply order of operations to simplify expressions

**B. Addition and Subtraction**

The student will:

- 1. \_\_\_\_\_ Add and subtract integers with models and manipulation
- 2. \_\_\_\_\_ Multiply and divide integers with models and manipulation

**C. Multiplication and Division**

The student will:

- 1. \_\_\_\_\_ Use multiplication and division of fractions and decimals specifically to use, understand and interpret rates and ratios

**D. Properties**

The student will:

- 1. \_\_\_\_\_ Identify and use the inverse property of multiplication (i.e.,  $\frac{1}{2} * 2 = 1$ )
- 2. \_\_\_\_\_ Use the commutative, associative and identity properties and zero property of multiplication to demonstrate that expressions in different forms can be equivalent

**E. Fractions/Decimals/Percents**

The student will:

- 1. \_\_\_\_\_ Find the least common multiple and the greatest common factor
- 2. \_\_\_\_\_ Find the least common denominator for two or more fractions
- 3. \_\_\_\_\_ Add and subtract fractions with like and unlike denominators
- 4. \_\_\_\_\_ Add and subtract mixed numbers with like and unlike denominators
- 5. \_\_\_\_\_ Change terminating decimals to fractions and fractions to decimals
- 6. \_\_\_\_\_ Add and subtract decimals
- 7. \_\_\_\_\_ Round numbers less than 1 to tenths, hundredths and thousandths
- 8. \_\_\_\_\_ Multiply and divide decimals (with both whole numbers and decimals in the divisor)

The student will:

- 1. \_\_\_\_\_ Multiply fractions and mixed numbers
- 2. \_\_\_\_\_ Identify and use reciprocal numbers
- 3. \_\_\_\_\_ Divide fractions and mixed numbers
- 4. \_\_\_\_\_ Round decimals and fractions
- 5. \_\_\_\_\_ Convert between fractions, decimals and percent

**II. MEASUREMENT**

The student will:

- 1. \_\_\_\_\_ Continue to measure with accuracy to the nearest  $\frac{1}{16}$ <sup>th</sup> inch and millimeter
- 2. \_\_\_\_\_ Continue to convert customary units of measure
- 3. \_\_\_\_\_ Convert metric units of measurement using multiplication and division

**III. GEOMETRY**

**Goal:** Students will identify, define and calculate area, perimeter, volume and surface area of two-dimensional and three-dimensional figures using the proper formulas and tools, in real-world and mathematical problems. Students will use formulas appropriately.

The student will:

- 1. \_\_\_\_\_ Identify properties of supplementary and complementary angles
- 2. \_\_\_\_\_ Define properties of triangles as a figure whose interior angles add up to 180 degrees
- 3. \_\_\_\_\_ Define basic transformations to include translation, reflection and rotation
- 4. \_\_\_\_\_ Use geometric tools (protractor, straight edge) to draw and measure angles

- 5. \_\_\_\_\_ Define similar and congruent figures and their corresponding line segments and angles
- 6. \_\_\_\_\_ Identify properties of vertical, adjacent and straight angle
- 7. \_\_\_\_\_ Calculate the area of squares, triangles, rectangles, parallelograms and circles and show why the formulas are valid (with manipulatives and concrete examples)
- 8. \_\_\_\_\_ Understand and graph in the coordinate plane in all quadrants
- 9. \_\_\_\_\_ Identify properties of quadrilaterals

#### IV. STATISTICS, PROBABILITY AND DATA ANALYSIS

**Goal:** Represent probabilities using whole numbers, fractions, decimals and percents.

The student will:

- 1. \_\_\_\_\_ Construct, interpret and analyze bar graphs, line graphs, pictographs, histograms and circle graphs using fractions, decimals and percents
- 2. \_\_\_\_\_ Calculate probabilities of dependent and independent events using real-world and mathematical problems with fractions, decimals and percents
- 3. \_\_\_\_\_ Theoretical probability
- 4. \_\_\_\_\_ Measures of central tendency: mean, median, mode and range

#### V. ALGEBRA

The student will:

- 1. \_\_\_\_\_ Write mathematical expressions and equations that correspond to given situations
- 2. \_\_\_\_\_ Evaluate expressions by plugging in for variables
- 3. \_\_\_\_\_ Use expressions and formulas to solve problems
- 4. \_\_\_\_\_ Understand and use variables appropriately to represent unknown values
- 5. \_\_\_\_\_ Prove that the solutions to an equation are those values that make the equations true
- 6. \_\_\_\_\_ Estimate and solve simple one-step equations
- 7. \_\_\_\_\_ Construct and analyze tables and use equations to describe simple relationships (such as  $3x = y$ )
- 8. \_\_\_\_\_ Identify and extend geometric and arithmetic sequences
- 9. \_\_\_\_\_ Write, solve and apply proportions

7<sup>th</sup> Grade

## I. NUMBERS AND OPERATIONS

## A. Number Sense

The student will:

- 1. \_\_\_\_\_ Identify squares of numbers from 1-20
- 2. \_\_\_\_\_ Define a square root as the inverse operation to squaring a number
- 3. \_\_\_\_\_ Find the square roots using tables, estimation and calculators
- 4. \_\_\_\_\_ Apply order of operations to simplify expressions

## B. Addition and Subtraction – No objectives

*Students should continue to add and subtract signed numbers with and without manipulatives.*

## C. Multiplication and Division

- 1. \_\_\_\_\_ Solve multi-step equations with signed numbers
- 2. \_\_\_\_\_ Understand and use exponential form, including the laws of zero and positive exponents
- 3. \_\_\_\_\_ Use scientific notation to multiply and divide large and small numbers

## D. Properties – No objectives

*Students should continue to practice skills.*

- 1. \_\_\_\_\_ Use the commutative, associative and distributive properties to demonstrate that expressions in different forms can be equivalent

## E. Fractions/Decimals/Percents

The student will:

- 1. \_\_\_\_\_ Develop meaning for percent greater than 100% and smaller than 1%
- 2. \_\_\_\_\_ Solve a wide variety of percent problems including problems involving discounts, simple interest, taxes, tips and percent increase/decrease
- 3. \_\_\_\_\_ Compute addition, subtraction, multiplication and division of rational numbers
- 4. \_\_\_\_\_ Divide fractions to solving equations of the form  $ax = b$  where  $a$  and  $b$  are fractions
- 5. \_\_\_\_\_ Use division to express any fraction as a decimal including infinite (or non-terminating) decimals
- 6. \_\_\_\_\_ Calculate the percent of number

**II. MEASUREMENT**

The student will:

- 1. \_\_\_\_\_ Continue to measure with accuracy to the nearest  $1/16^{\text{th}}$  inch and millimeter
- 2. \_\_\_\_\_ Continue to convert customary units of measure
- 3. \_\_\_\_\_ Continue to convert metric units of measurement using multiplication and division
- 4. \_\_\_\_\_ Convert between customary and metric units of measure

**III. GEOMETRY**

*Students will use formulas appropriately.*

The student will:

- 1. \_\_\_\_\_ Identify basic elements of geometric figures using geometric tools (use compass protractor, straight edge where appropriate) – altitudes, midpoints, diagonals, perpendicular bisectors, central angles, radii, diameters and chords
- 2. \_\_\_\_\_ Use geometric tools (protractor, straight edge) to draw and measure angles, triangles, squares and rectangles
- 3. \_\_\_\_\_ Continue to use and recognize similar and congruent figures
- 4. \_\_\_\_\_ Calculate area and circumference of circles, in terms of pi and with pi approximations
- 5. \_\_\_\_\_ Compute the perimeter and area of regular and composite figures
- 6. \_\_\_\_\_ Estimate the perimeter and area of irregular figures
- 7. \_\_\_\_\_ Compute the volumes and surface areas of regular prisms and cylinders using a variety of methods
- 8. \_\_\_\_\_ Solve area and volume problems where the area or volume is given, but one length is missing
- 9. \_\_\_\_\_ Calculate the interior and exterior angles of various regular polygons
- 10. \_\_\_\_\_ Use deductive reasoning to determine the measure of an angle where the measure of one or more other angles in a figure are given
- 11. \_\_\_\_\_ Define and apply the Pythagorean Theorem in a variety of situations
- 12. \_\_\_\_\_ Use tessellations to rotate and reflect geometric figures
- 13. \_\_\_\_\_ Create, describe and extend visual geometric patterns

**IV. STATISTICS, PROBABILITY AND DATA ANALYSIS**

*Students will use formulas appropriately. The student will:*

- 1. \_\_\_\_\_ Choose the most appropriate way to display and interpret a variety of data sets such as bar graphs, line graphs, pictographs, histograms, stem-and-leaf and circle graphs
- 2. \_\_\_\_\_ Make comparisons, predictions, inferences using information displayed in all types of graphs
- 3. \_\_\_\_\_ Use mean, median, mode and range to draw conclusions about data and to make predictions
- 4. \_\_\_\_\_ Recognize and be able to give examples of how the display of data sets can be manipulated to be misleading
- 5. \_\_\_\_\_ Calculate and analyze probabilities of multiple events (dependent and independent) using a variety of methods such as organized lists, tree diagrams, fundamental counting principal and area models; record results as fractions, decimals and percents
- 6. \_\_\_\_\_ Recognize probability of multiple events as either multiplication or addition Problems
- 7. \_\_\_\_\_ Continue to use probabilities and to make predictions using real-world and mathematical problems with fractions, decimals and percents
- 8. \_\_\_\_\_ Define and accurately use the terms probability, odds and chance
- 9. \_\_\_\_\_ Compare theoretical and experimental probability

**V. ALGEBRA**

*Students will use formulas appropriately. The student will:*

- 1. \_\_\_\_\_ Solve problems about similar objects by using the scale factors that relate corresponding lengths
- 2. \_\_\_\_\_ Use proportions to solve problems about similar objects by using the knowledge that the relationships of lengths within an object are preserved in similar objects
- 3. \_\_\_\_\_ Use and understand proportional relationships to solve a variety of problems
- 4. \_\_\_\_\_ Solve linear multi-step equations with one variable using inverse operations and identify those as properties of equality
- 5. \_\_\_\_\_ Use linear multi-step equations with one variable to solve problems
- 6. \_\_\_\_\_ Use the properties of equality to express an equation in a new way, and then demonstrate that the solutions obtained for the new equation also serve the original equation
- 7. \_\_\_\_\_ Use linear graphing, in slope-intercept form, to represent and solve problems
- 8. \_\_\_\_\_ Write and evaluate an algebraic expression for a given situation using up to two variables
- 9. \_\_\_\_\_ Recognize irrational numbers
- 10. \_\_\_\_\_ Write, solve and graph solutions of one-step inequalities with a single variable
- 11. \_\_\_\_\_ Recognize connections between any two representations (tables, graphs, words and equations of a given relationship, especially functions); determine whether a relation is a function
- 12. \_\_\_\_\_ Create and extend patterns to represent and solve problems (including nonlinear patterns)
- 13. \_\_\_\_\_ Write a function rule for arithmetic sequences (these are linear functions)

**8<sup>th</sup> Grade****I. NUMBERS AND OPERATIONS****A. Number Sense**

The student will:

- 1. \_\_\_\_\_ Identify squares roots of perfect squares from 1 to 400
- 2. \_\_\_\_\_ Find the square roots of non perfect squares using tables, estimation and calculators
- 3. \_\_\_\_\_ Identify and describe the real number system subsets
- 4. \_\_\_\_\_ Apply order of operations to simplify expressions, including exponents and Square roots

**B. Addition and Subtraction – No objectives**

*Students should continue to add and subtract signed numbers.*

**C. Multiplication and Division**

- 1. \_\_\_\_\_ Continue to solve multi-step equations with signed numbers
- 2. \_\_\_\_\_ Continue to understand and use exponential form, laws of positive and negative integer exponents
- 3. \_\_\_\_\_ Continue to use scientific notation to multiply and divide large and small Numbers, including the use of calculators

**D. Properties – No objectives**

*Students should continue to practice skills.*

- 1. \_\_\_\_\_ Factor and expand algebraic expressions using the distributive property
- 2. \_\_\_\_\_ Recognize and use number properties (associative, commutative, identity, zero, distributive and closure)

**E. Fractions/Decimals/Percents**

The student will:

- 1. \_\_\_\_\_ Continue to develop meaning for percent greater than 100% and smaller than 1%
- 2. \_\_\_\_\_ Continue to solve a wide variety of percent problems including problems involving discounts, simple interest, taxes, tips and percent increase/decrease
- 3. \_\_\_\_\_ Continue to compute addition, subtraction, multiplication and division of Rational numbers
- 4. \_\_\_\_\_ Continue to divide fractions to solving equations of the form  $ax = b$  where  $a$  and  $b$  are fractions
- 5. \_\_\_\_\_ Continue to use division to express any fraction as a decimal including infinite (or non-terminating) decimals
- 6. \_\_\_\_\_ Continue to calculate the percent of number
- 7. \_\_\_\_\_ Introduce converting repeating decimals into fractions and percents

**II. MEASUREMENT**

The student will:

- 1. \_\_\_\_\_ Continue to measure with accuracy to the nearest  $1/16^{\text{th}}$  inch and millimeter
- 2. \_\_\_\_\_ Continue to convert customary units of measure
- 3. \_\_\_\_\_ Continue to convert metric units of measurement using multiplication and division
- 4. \_\_\_\_\_ Continue to convert between customary and metric units of measure

**III. GEOMETRY**

*Students will use formulas appropriately.*

The student will:

- 1. \_\_\_\_\_ Continue to identify basic elements of geometric figures using geometric tools (use compass protractor, straight edge where appropriate) – altitudes, midpoints, diagonals, perpendicular bisectors, central angles, radii, diameters and chords
- 2. \_\_\_\_\_ Continue to use geometric tools (protractor, straight edge) to draw and measure angles, triangles, squares and rectangles
- 3. \_\_\_\_\_ Continue to use and recognize similarity and congruence
- 4. \_\_\_\_\_ Continue to calculate area and circumference of circles, in terms of pi and with pi approximations
- 5. \_\_\_\_\_ Continue to compute the perimeter and area of regular and composite figures
- 6. \_\_\_\_\_ Continue to estimate the perimeter and area of irregular figures
- 7. \_\_\_\_\_ Compute the volumes and surface areas of regular pyramids, cones and sphere using a variety of methods
- 8. \_\_\_\_\_ Continue to calculate the interior and exterior angles of various regular polygons
- 9. \_\_\_\_\_ Continue to use deductive reasoning to determine the measure of an angle where the measure of one or more other angles in a figure are given
- 10. \_\_\_\_\_ Continue to define and apply the Pythagorean Theorem in a variety of situations
- 11. \_\_\_\_\_ Apply transformations to plane figures, including graphing pre-image and image in the coordinate plane using appropriate notation and patty paper and other manipulatives
- 12. \_\_\_\_\_ Construct 3-D models given the top or bottom, side and front views (isometric drawings)
- 13. \_\_\_\_\_ Use tessellations to rotate and reflect geometric figures
- 14. \_\_\_\_\_ Solve area and volume problems where the area or volume is given, but one length is missing
- 15. \_\_\_\_\_ Find volume and surface area of rectangular and triangular patterns
- 16. \_\_\_\_\_ Describe and apply relationships created by two parallel lines cut by a transversal

**IV. STATISTICS, PROBABILITY AND DATA ANALYSIS**

*Students will use formulas appropriately. The student will use a graphing calculator where appropriate. The student will:*

- 1. \_\_\_\_\_ Continue to choose the most appropriate way to display, interpret and make predictions with a variety of data, using measures of central tendency when appropriate
- 2. \_\_\_\_\_ Continue to recognize and be able to give examples of how the display of data sets can be manipulated to be misleading
- 3. \_\_\_\_\_ Apply and analyze probabilities of multiple events (dependent and independent) using a variety of methods such as organized lists, tree diagrams and area models; record results as fractions, decimals and percents
- 4. \_\_\_\_\_ Construct and analyze a scatter plot; draw a trend line through the data to make predictions, define and accurately use the terms positive correlation, negative correlation and no correlation
- 5. \_\_\_\_\_ Continue to identify and describe permutations or combinations using the Counting Principle or a tree diagram

**V. ALGEBRA**

*Students will use formulas appropriately. The student will:*

- 1. \_\_\_\_\_ Continue to solve problems about similar objects by using the scale factors and proportions that relate corresponding lengths
- 2. \_\_\_\_\_ Continue to use and understand proportional relationships to solve a variety of problems
- 3. \_\_\_\_\_ Continue to solve and graph linear multi-step equations with one or two variables
- 4. \_\_\_\_\_ Continue to use the properties of equality to express an equation in a new way, and then demonstrate that the solutions obtained for the new equation also serve the original equation
- 5. \_\_\_\_\_ Continue to use linear graphing to represent and solve problems, using slope-intercept form
- 6. \_\_\_\_\_ Continue to write, evaluate and simplify an algebraic expression for a given situation using any number of variables
- 7. \_\_\_\_\_ Write, solve and graph solutions of two-step inequalities with a single variable
- 8. \_\_\_\_\_ Introduce solving two variable inequalities and graphing solutions on a coordinate plane
- 9. \_\_\_\_\_ Continue to recognize connections between any two representations (tables, graphs, words and equations of a given relationship, especially functions); determine whether a relation is a function
- 10. \_\_\_\_\_ Write a function rule for arithmetic sequences
- 11. \_\_\_\_\_ Identify domain and range of a relation; identify independent and dependent variable in a relation
- 12. \_\_\_\_\_ Solve literal linear equations for a given variable

**Algebra I Sequence****Grade 6, Grade 7 (Pre-Algebra), Grade 8 (Algebra I)****6<sup>th</sup> Grade****I. NUMBERS AND OPERATIONS****A. Number Sense**

The student will:

- 1. \_\_\_\_\_ Define and demonstrate exponential notation
- 2. \_\_\_\_\_ Write large and small numbers using scientific notation
- 3. \_\_\_\_\_ Read, write and plot real numbers on a number line, including solved inequalities
- 4. \_\_\_\_\_ Demonstrate an understanding of the relationship between the absolute value of a rational number and distance on a number line. Use the symbol for absolute value.
- 5. \_\_\_\_\_ Identify the natural, whole, integer, rational and irrational components of the real number system
- 6. \_\_\_\_\_ Apply order of operations to simplify expressions

**B. Addition and Subtraction**

The student will:

- 1. \_\_\_\_\_ Add and subtract integers with models and manipulation
- 2. \_\_\_\_\_ Multiply and divide integers with models and manipulation

**C. Multiplication and Division**

The student will:

- 1. \_\_\_\_\_ Use multiplication and division of fractions and decimals specifically to use, understand and interpret rates and ratios

**D. Properties**

The student will:

- 1. \_\_\_\_\_ Identify and use the inverse property of multiplication (i.e.,  $\frac{1}{2} * 2 = 1$ )
- 2. \_\_\_\_\_ Use the commutative, associative and identity properties and zero property of multiplication to demonstrate that expressions in different forms can be equivalent

**E. Fractions/Decimals/Percents**

The student will:

- 1. \_\_\_\_\_ Multiply fractions and mixed numbers
- 2. \_\_\_\_\_ Identify and use reciprocal numbers
- 3. \_\_\_\_\_ Divide fractions and mixed numbers
- 4. \_\_\_\_\_ Round decimals and fractions
- 5. \_\_\_\_\_ Convert between fractions, decimals and percent
- 6. \_\_\_\_\_ Calculate the percent of a number
- 

**II. MEASUREMENT**

The student will:

- 1. \_\_\_\_\_ Continue to measure with accuracy to the nearest  $1/16^{\text{th}}$  inch and millimeter
- 2. \_\_\_\_\_ Continue to convert customary units of measure
- 3. \_\_\_\_\_ Convert metric units of measurement using multiplication and division

**III. GEOMETRY**

**Goal:** Students will identify, define and calculate area, perimeter, volume and surface area of two-dimensional and three-dimensional figures using the proper formulas and tools, in real-world and mathematical problems. Students will use formulas appropriately.

The student will:

- 1. \_\_\_\_\_ Identify properties of supplementary and complementary angles
- 2. \_\_\_\_\_ Define properties of triangles as a figure whose interior angles add up to 180 degrees
- 3. \_\_\_\_\_ Define basic transformations to include translation, reflection and rotation
- 4. \_\_\_\_\_ Use tessellations to rotate and reflect geometric figures
- 5. \_\_\_\_\_ Use geometric tools (protractor, straight edge) to draw and measure angles, triangles, squares and rectangles
- 6. \_\_\_\_\_ Define similar and congruent figures and their corresponding line segments and angles
- 7. \_\_\_\_\_ Identify properties of vertical, adjacent and straight angle
- 8. \_\_\_\_\_ Calculate the area of squares, triangles, rectangles, parallelograms and circles and explain why the formulas are valid (with manipulatives and concrete examples)
- 9. \_\_\_\_\_ Find volume and surface area of rectangular and triangular prisms
- 10. \_\_\_\_\_ Solve area and volume problems where the area or volume is given, but one length is missing
- 11. \_\_\_\_\_ Understand and graph in the coordinate plane in all quadrants
- 12. \_\_\_\_\_ Identify properties of quadrilaterals

**IV. STATISTICS, PROBABILITY AND DATA ANALYSIS**

**Goal:** Represent probabilities using whole numbers, fractions, decimals and percents.

The student will:

- 1. \_\_\_\_\_ Construct, interpret and analyze bar graphs, line graphs, pictographs, histograms and circle graphs using fractions, decimals and percents
- 2. \_\_\_\_\_ Calculate probabilities of dependent and independent events and make Predictions using real-world and mathematical problems with fractions, decimals and percents
- 3. \_\_\_\_\_ Theoretical and experimental probability
- 4. \_\_\_\_\_ Measures of central tendency: mean, median, mode and range

**V. ALGEBRA**

The student will:

- 1. \_\_\_\_\_ Write mathematical expressions and equations that correspond to given situations
- 2. \_\_\_\_\_ Evaluate expressions by plugging in for variables
- 3. \_\_\_\_\_ Use expressions and formulas to solve problems
- 4. \_\_\_\_\_ Understand and use variables appropriately to represent unknown values
- 5. \_\_\_\_\_ Prove that the solutions to an equation are those values that make the equations true
- 6. \_\_\_\_\_ Estimate and solve simple one-step equations
- 7. \_\_\_\_\_ Construct and analyze tables and use equations to describe simple relationships (such as  $3x = y$ )
- 8. \_\_\_\_\_ Identify and extend geometric and arithmetic sequences; write a function rule for arithmetic sequences
- 9. \_\_\_\_\_ Write, solve and apply proportions

**(7<sup>th</sup> Grade – Pre-Algebra)****I. NUMBERS AND OPERATIONS****A. Number Sense**

The student will:

- 1. \_\_\_\_\_ Identify squares of numbers from 1-20
- 2. \_\_\_\_\_ Define a square root as the inverse operation to squaring a number
- 3. \_\_\_\_\_ Find the square roots using tables, estimation and calculators
- 4. \_\_\_\_\_ Apply order of operations to simplify expressions

**B. Addition and Subtraction – No objectives**

*Students should continue to practice skills.*

**C. Multiplication and Division**

- 1. \_\_\_\_\_ Solve multi-step equations with signed numbers
- 2. \_\_\_\_\_ Understand and use exponential form, laws of exponents and integer exponents
- 3. \_\_\_\_\_ Use scientific notation to multiply and divide large and small numbers

**D. Properties – No objectives**

*Students should continue to practice skills.*

**E. Fractions/Decimals/Percents**

The student will:

- 1. \_\_\_\_\_ Develop meaning for percent greater than 100% and smaller than 1%
- 2. \_\_\_\_\_ Solve a wide variety of percent problems including problems involving discounts, simple interest, taxes, tips and percent increase/decrease
- 3. \_\_\_\_\_ Compute addition, subtraction, multiplication and division of rational numbers
- 4. \_\_\_\_\_ Divide fractions to solving equations of the form  $ax = b$  where  $a$  and  $b$  are fractions
- 5. \_\_\_\_\_ Use division to express any fraction as a decimal including infinite (or non-terminating) decimals

**II. MEASUREMENT**

The student will:

- 1. \_\_\_\_\_ Continue to measure with accuracy to the nearest  $1/16^{\text{th}}$  inch and millimeter
- 2. \_\_\_\_\_ Continue to convert customary units of measure
- 3. \_\_\_\_\_ Continue to convert metric units of measurement using multiplication and division
- 4. \_\_\_\_\_ Convert between customary and metric units of measure

**III. GEOMETRY**

*Students will use formulas appropriately.*

The student will:

- 1. \_\_\_\_\_ Identify basic elements of geometric figures using geometric tools (use compass protractor, straight edge where appropriate) – altitudes, midpoints, diagonals, perpendicular bisectors, central angles, radii, diameters and chords
- 2. \_\_\_\_\_ Calculate area and circumference of circles, in terms of pi and with pi approximations
- 3. \_\_\_\_\_ Compute the perimeter and area of regular and composite figures
- 4. \_\_\_\_\_ Estimate the perimeter and area of irregular figures
- 5. \_\_\_\_\_ Compute the volumes and surface areas of regular pyramids and cylinders using a variety of methods
- 6. \_\_\_\_\_ Calculate the interior and exterior angles of various regular polygons
- 7. \_\_\_\_\_ Use deductive reasoning to determine the measure of an angle where the measure of one or more other angles in a figure are given
- 8. \_\_\_\_\_ Define and apply the Pythagorean Theorem in a variety of situations
- 9. \_\_\_\_\_ Apply transformations to plane figures, including graphing pre-image and image in the coordinate plane using appropriate notation
- 10. \_\_\_\_\_ Construct 3-D models given the top or bottom, side and front views (isometric drawings)
- 11. \_\_\_\_\_ Describe and apply relationships created by two parallel lines cut by a transversal

**IV. STATISTICS, PROBABILITY AND DATA ANALYSIS**

*Students will use formulas appropriately. The student will:*

- 1. \_\_\_\_\_ Choose the most appropriate way to display and interpret a variety of data sets such as bar graphs, line graphs, pictographs, histograms and circle graphs
- 2. \_\_\_\_\_ Make comparisons, predictions, inferences using information displayed in all types of graphs
- 3. \_\_\_\_\_ Use mean, median, mode and range to draw conclusions about data and to make predictions
- 4. \_\_\_\_\_ Recognize and be able to give examples of how the display of data sets can be manipulated to be misleading
- 5. \_\_\_\_\_ Calculate and analyze probabilities of multiple events (dependent and independent) using a variety of methods such as organized lists, tree diagrams and area models; record results as fractions, decimals and percents
- 6. \_\_\_\_\_ Recognize probability of multiple events as either multiplication or addition problems
- 7. \_\_\_\_\_ Continue to use probabilities and to make predictions using real-world and mathematical problems with fractions, decimals and percents
- 8. \_\_\_\_\_ Organize and interpret in a scatter plot; Draw a trend line through the data to make predictions
- 9. \_\_\_\_\_ Define and accurately use the terms positive correlation, negative correlation and no correlation
- 10. \_\_\_\_\_ Define and accurately use the terms probability, odds and chance

**V. ALGEBRA**

*Students will use formulas appropriately. The student will:*

- 1. \_\_\_\_\_ Solve problems about similar objects by using the scale factors that relate corresponding lengths
- 2. \_\_\_\_\_ Use proportions to solve problems about similar objects by using the knowledge that the relationships of lengths within an object are preserved in similar objects
- 3. \_\_\_\_\_ Use and understand proportional relationships to solve a variety of problems
- 4. \_\_\_\_\_ Solve linear multi-step equations with one variable using inverse operations
- 5. \_\_\_\_\_ Use linear multi-step equations with one variable to solve problems
- 6. \_\_\_\_\_ Use the properties of equality to express an equation in a new way, and then demonstrate that the solutions obtained for the new equation also serve the original equation
- 7. \_\_\_\_\_ Use linear graphing to represent and solve problems, including problems about the intersection point of two lines
- 8. \_\_\_\_\_ Write and evaluate an algebraic expression for a given situation using up to three variables
- 9. \_\_\_\_\_ Recognize irrational numbers
- 10. \_\_\_\_\_ Write, solve and graph solutions of one-step inequalities with a single variable
- 11. \_\_\_\_\_ Recognize connections between any two representations (tables, graphs, words and equations of a given relationship, especially functions); determine whether a relation is a function

**I. EXPRESSIONS AND EQUATIONS**

The student will:

- 1. \_\_\_\_\_ Use the order of operations to simplify numerical expressions (with and without grouping symbols)
- 2. \_\_\_\_\_ Use the order of operations to simplify variable expressions
- 3. \_\_\_\_\_ Evaluate algebraic expressions
- 4. \_\_\_\_\_ Translate phrases into variable expressions
- 5. \_\_\_\_\_ Translate word sentences into equations
- 6. \_\_\_\_\_ Define and use opposites and absolute values
- 7. \_\_\_\_\_ Define and use the equality properties
- 8. \_\_\_\_\_ Define and use number properties to simplify expressions:
  - closure properties
  - commutative properties
  - associative properties
  - distributive properties
  - identity properties
  - property of reciprocals
  - property of opposites
  - property of opposites of a sum

**II. REAL NUMBERS**

The student will:

- 1. \_\_\_\_\_ Identify real numbers on a number line
- 2. \_\_\_\_\_ Add, subtract, multiply and divide rational and irrational numbers
- 3. \_\_\_\_\_ Estimate square roots
- 4. \_\_\_\_\_ Identify the locations of square roots within the real number set
- 5. \_\_\_\_\_ Add, subtract, multiply and divide monomials with rational and irrational coefficients

**III. LINEAR FUNCTIONS**

The student will:

- 1. \_\_\_\_\_ Solve equations using addition, subtraction, multiplication and division
- 2. \_\_\_\_\_ Solve multi-step equations to include word problems and literal equations
- 3. \_\_\_\_\_ Solve equations with the variable on both sides
- 4. \_\_\_\_\_ Solve equations using area/perimeter formulas of geometric figures
- 3. \_\_\_\_\_ ^Solve equations involving formulas for:
  - age
  - cost-income-value
  - uniform motion
  - percent
  - work
  - mixture problems

**IV. PROPORTIONAL REASONING**

The student will:

- 1. \_\_\_\_\_ Solve problems using ratio and proportion
- 2. \_\_\_\_\_ Use proportions and similar triangles to reduce and enlarge figures
- 3. \_\_\_\_\_ Solve percent problems using ratio and proportion
- 4. \_\_\_\_\_ Solve direct, inverse and joint variation problems
- 5. \_\_\_\_\_ Solve percent problems using ratio and proportion

**V. RELATIONS AND FUNCTIONS**

The student will:

- 1. \_\_\_\_\_ Compare and contrast concepts of relations and functions
- 2. \_\_\_\_\_ ^Determine the domain and range using graphs, ordered pairs and symbolic expressions
- 3. \_\_\_\_\_ Define a function through the use of tables and graphs

**VI. LINEAR FUNCTIONS**

The student will:

- 1. \_\_\_\_\_ Determine whether a point lies on a given line
- 2. \_\_\_\_\_ Graph lines from an  $xy$  table of values
- 3. \_\_\_\_\_ Identify and graph vertical and horizontal lines to include the concept of zero and undefined slope
- 4. \_\_\_\_\_ Define and determine the slope of a line
- 5. \_\_\_\_\_ Graph lines using the slope-intercept form of an equation
- 6. \_\_\_\_\_ Graph parallel and perpendicular lines and identify their slope relations
- 7. \_\_\_\_\_ Write linear equations in point-slope, slope-intercept and standard form

**VII. LINEAR INEQUALITIES**

The student will:

- 1. \_\_\_\_\_ Solve simple inequalities using addition, subtraction, multiplication and division
- 2. \_\_\_\_\_ Solve multi-step inequalities to include those with the variable on both sides
- 3. \_\_\_\_\_ Solve combined inequalities
- 4. \_\_\_\_\_ ^Solve equations and inequalities involving absolute value
- 5. \_\_\_\_\_ Graph linear inequalities to include one or two variables

**VIII. SYSTEMS OF EQUATIONS/INEQUALITIES**

The student will:

- 1. \_\_\_\_\_ ^Use graphs to solve systems of linear equations
- 2. \_\_\_\_\_ Use the substitution method to solve systems of linear equations
- 3. \_\_\_\_\_ Use addition or subtraction (elimination method) to solve systems of linear equations in two variables
- 4. \_\_\_\_\_ Use multiplication with the addition or subtraction (elimination method) to solve systems of linear equations in two variables
- 5. \_\_\_\_\_ ^Use systems of linear equations in two variables to solve wind and water current problems
- 6. \_\_\_\_\_ Graph systems of inequalities
- 7. \_\_\_\_\_ ^Solve linear systems containing one or two variables algebraically, to include Inequalities

**IX. POLYNOMIALS**

The student will:

- 1. \_\_\_\_\_ Add and subtract polynomials
- 2. \_\_\_\_\_ Multiply polynomials, to include horizontal and vertical form
- 3. \_\_\_\_\_ Understand and apply rules of exponents involving monomials
- 

**X. FACTORING**

The student will:

- 1. \_\_\_\_\_ Simplify quotients of monomials using the greatest common factor
- 2. \_\_\_\_\_ Divide polynomials by monomials
- 3. \_\_\_\_\_ Factor polynomials using the greatest common factor
- 4. \_\_\_\_\_ Find the product of two binomials mentally
- 5. \_\_\_\_\_ Factor differences of two squares
- 6. \_\_\_\_\_ Factor perfect square trinomials
- 7. \_\_\_\_\_ Factor trinomials whose quadratic coefficients are one
- 8. \_\_\_\_\_ Factor trinomials whose quadratic coefficients are greater than one
- 9. \_\_\_\_\_ Factor by grouping terms
- 

**XI. QUADRATIC FUNCTIONS**

The student will:

- 1. \_\_\_\_\_ Use the general properties of the parent graph of a parabola to include the horizontal shift, vertical shift and stretch factor
- 2. \_\_\_\_\_ ^Graph quadratic equations
- 3. \_\_\_\_\_ Solve quadratic equations by graphing
- 4. \_\_\_\_\_ Solve quadratic equations by factoring, to include the zero-product property
- 5. \_\_\_\_\_ Solve application problems by writing and factoring quadratic equations
- 6. \_\_\_\_\_ Solve quadratic equations by using the quadratic formula
- 7. \_\_\_\_\_ ^Solve quadratic equations by completing the square

**XII. OTHER NONLINEAR FUNCTIONS**The student will: (Using an  $xy$  table)

- 1. \_\_\_\_\_ Plot cubic functions
- 2. \_\_\_\_\_ Plot exponential functions
- 3. \_\_\_\_\_ Plot the square root functions
- 4. \_\_\_\_\_ Plot the rectangular hyperbolic (a.k.a. the reciprocal) functions
- 5. \_\_\_\_\_ Graph absolute value functions

**XIII. RATIONAL EXPRESSIONS AND EQUATIONS**

The student will:

- 1. \_\_\_\_\_ Simplify rational expressions
- 2. \_\_\_\_\_ Multiply and divide rational expressions
- 3. \_\_\_\_\_ Add and subtract rational expressions with like denominators using variables
- 4. \_\_\_\_\_ Add and subtract rational expressions with unlike denominators using variables
- 5. \_\_\_\_\_ Simplify mixed expressions and complex fractions
- 6. \_\_\_\_\_ Solve rational equations
- 7. \_\_\_\_\_ Simplify expressions using negative exponents

**XIV. RADICAL EXPRESSIONS AND EQUATIONS**

The student will:

- 1. \_\_\_\_\_ Simplify radical expressions
- 2. \_\_\_\_\_ Add, subtract, multiply and divide radical expressions
- 3. \_\_\_\_\_ Apply the Pythagorean Theorem and its converse to solve geometric problems
- 4. \_\_\_\_\_ Apply the Pythagorean Theorem to find the distance between two points
- 5. \_\_\_\_\_ Solve radical equations
- 6. \_\_\_\_\_ Solve quadratic equations involving perfect squares
- 7. \_\_\_\_\_ ^Apply the quadratic formula to solve problems
- 8. \_\_\_\_\_ Use the discriminant to find the nature of the roots and the number of  $x$ -intercepts of the graph of quadratic equations

**XV. ALGEBRAIC LOGIC**

The student will:

- 1. \_\_\_\_\_ Use properties of the number system to judge the validity of results, justify steps in a procedure and prove/disprove statements
- 2. \_\_\_\_\_ Use simple aspects of logical argumentation
- 3. \_\_\_\_\_ Solve problems using patterns

**\*\*XVI. STATISTICS**

The student will:

- 1. \_\_\_\_\_ \*\*Interpret variation and central measures of tendency in real-world contexts
- 2. \_\_\_\_\_ \*\*Calculate and interpret mean absolute deviation, standard deviation and z-scores
- 3. \_\_\_\_\_ \*\*Use box-and-whisker plots to compare and contrast multiple univariate data sets
- 4. \_\_\_\_\_ \*\*Determine the equation of best fit in order to make predictions
- 2. \_\_\_\_\_ \*\*Solve real-world problems using mathematical models. Models will include linear and quadratic functions

**Technology and Graphic Calculators**

Students should also develop the strategic use of technology including graphing calculators. Graphing calculator use should be explicitly taught and used appropriately within the curriculum. Graphing calculators should be used judiciously only after the students have mastered the ability to manipulate the essential objectives by hand: this, of course, is handled by each individual teacher at the school level. Curriculum skills marked with an \*\* require the use of a graphing calculator, Computer Algebra System (CAS), or basic coding program such as Microsoft Excel. In addition, the graphing calculator or a CAS may be of benefit when completing objectives pertaining to the real-world application of algebraic concepts, which are marked with a ^.

Again, as with all technology, extreme discretion should be used when integrating a graphing calculator or CAS into the Algebra 1 curriculum. The goal is to provide students with a strong foundation for upper level mathematics.

Selection of a graphing calculator must be limited to those approved by the College Board for use on the SAT, ACT, AP.

**I. REVIEW OF BASIC ALGEBRAIC CONCEPTS**

The student will:

- 1. \_\_\_\_\_ Identify, distinguish among, compare, order, and use various subsets of the real number system:
  - natural numbers
  - whole numbers
  - integers
  - rational numbers
  - irrational numbers
  - real numbers
- 2. \_\_\_\_\_ Understand basic algebraic properties and use them efficiently to simplify algebraic expressions:
  - reflexive, symmetric, and transitive properties
  - associative properties
  - commutative properties
  - closure properties
  - identity properties
  - property of reciprocals
  - property of opposites
  - property of opposites of a sum
  - multiplicative and additive properties of equalities and inequalities
- 3. \_\_\_\_\_ Apply the order of operations to simplify and evaluate expressions with and without variables and grouping symbols involving:
  - fractions
  - decimals
  - negatives
  - absolute value
  - exponents

**II. SOLVING EQUATIONS AND PROBLEMS**

The student will:

- 1. \_\_\_\_\_ Use appropriate algebraic vocabulary:
  - equation
  - solve
  - like (similar) terms
  - combine like terms
  - replacement set
  - solution set
- 2. \_\_\_\_\_ Translate verbal statements into algebraic expressions/equations and vice versa
- 3. \_\_\_\_\_ Solve equations in one variable by applying real number properties
- 4. \_\_\_\_\_ Solve multiple variable equations for a specific variable (literal equations)
- 5. \_\_\_\_\_ Solve equations and problems with variables on both sides

6. \_\_\_\_\_ Solve real-life application problems including the following types:
- multi-step problems
  - age problems (including those involving age now, age in the past, and age in the future)
  - percent problems
  - consecutive integers / multiples
  - rate-time-distance problems:
    - motion in the same direction
    - motion in opposite directions
    - round trip problems
  - area / perimeter / angle measures
  - problems that do not have a solution

### III. POLYNOMIALS

The student will:

1. \_\_\_\_\_ Use appropriate algebraic vocabulary:
- monomial, binomial, trinomial, polynomial
  - degree of a variable in a monomial
  - degree of a monomial
  - degree of a constant term
  - degree of a polynomial
2. \_\_\_\_\_ Write a polynomial in ascending / descending order of a specified variable
3. \_\_\_\_\_ Add and subtract polynomials
4. \_\_\_\_\_ Multiply monomials using the rules of exponents to include:
- Raising a power to a given power
  - Raising a product to a given power
5. \_\_\_\_\_ Find products in the following ways:
- multiply a polynomial by a monomial
  - multiply two binomials (using FOIL or similar method)
  - multiply a polynomial by a binomial
6. \_\_\_\_\_ Solve problems using direct and indirect variation
7. \_\_\_\_\_ Divide polynomials using long division and synthetic division
8. \_\_\_\_\_ Use the remainder and factor theorems to find factors of polynomials
9. \_\_\_\_\_ Find rational roots of a polynomial

### IV. FACTORING POLYNOMIALS

The student will:

1. \_\_\_\_\_ Find quotients and factors as follows:
- find the GCF of several integers
  - simplify quotients of monomials
  - divide polynomials by monomials
  - find the monomial factor (GCF) of a polynomial
2. \_\_\_\_\_ Factor the following types of polynomials:
- difference of two perfect squares
  - perfect square trinomials
  - factoring by grouping terms
  - apply factoring patterns for  $x^2 + bx + c$ , where  $c$  is positive / negative
  - apply factoring patterns for  $ax^2 + bx + c$ , where  $c$  is positive / negative

- 3. \_\_\_\_\_ Use factoring in solving polynomial equations
- 4. \_\_\_\_\_ Solve application problems by writing and factoring quadratic equations
- 5. \_\_\_\_\_ Solve polynomial equations and polynomial functions; identify roots, zeros, and multiples of each
- 6. \_\_\_\_\_ Solve real life applications involving polynomials
- 7. \_\_\_\_\_ Solve polynomial inequalities

#### V. RATIONAL EXPRESSIONS AND EQUATIONS

The student will:

- 1. \_\_\_\_\_ Simplify rational expressions
- 2. \_\_\_\_\_ Multiply rational expressions
- 3. \_\_\_\_\_ Divide rational expressions
- 4. \_\_\_\_\_ Add and subtract rational expressions with like denominators
- 5. \_\_\_\_\_ Add and subtract rational expressions with unlike denominators
- 6. \_\_\_\_\_ Graph rational functions
- 7. \_\_\_\_\_ Simplify complex fractions
- 8. \_\_\_\_\_ Evaluate exponential expressions containing negative and zero exponents
- 9. \_\_\_\_\_ Find the domain and range of rational functions
- 10. \_\_\_\_\_ Solve equations and inequalities having fractional coefficients
- 11. \_\_\_\_\_ Solve fractional equations
- 12. \_\_\_\_\_ Solve real-life equations and identify those which have no solution

#### VI. INTRODUCTION TO FUNCTIONS

The student will:

- 1. \_\_\_\_\_ Use appropriate algebraic vocabulary:
  - relation
  - function
  - domain
  - range
- 2. \_\_\_\_\_ Understand what a function is and define a function by using tables and graphs
- 3. \_\_\_\_\_ Identify the domain and range of a function
- 4. \_\_\_\_\_ Use the vertical line test to determine if a graph is a function
- 5. \_\_\_\_\_ Find the value of the function given the domain
- 6. \_\_\_\_\_ Graph a linear function on a coordinate plane
- 

#### VII. LINEAR EQUATIONS

The student will:

- 1. \_\_\_\_\_ Use appropriate algebraic vocabulary:
  - linear equation
  - slope
  - $x$  and  $y$  intercepts
  - slope-intercept form of an equation
  - standard/general form of an equation
- 2. \_\_\_\_\_ Identify a linear equation
- 3. \_\_\_\_\_ Differentiate between linear equations written in standard / general form and those written in slope-intercept form

- 4. \_\_\_\_\_ Transform linear equations from one form to another
- 5. \_\_\_\_\_ Understand and use the slope-intercept method of graphing a linear equation
- 6. \_\_\_\_\_ Understand and use the  $x$  and  $y$  intercept method of graphing a linear equation
- 7. \_\_\_\_\_ Determine the slope of a line when given the graph of the line
- 8. \_\_\_\_\_ Determine the slope of a line algebraically using the slope formula when given two points
- 9. \_\_\_\_\_ Determine the equation of a line when given
  - the slope and the  $y$ -intercept
  - the slope and one point on the line
  - two points on the line
- 10. \_\_\_\_\_ Determine the midpoint of a line segment
- 11. \_\_\_\_\_ Determine the distance between two points

### VIII. SYSTEMS OF LINEAR EQUATIONS IN 2-SPACE & 3-SPACE

The student will:

- 1. \_\_\_\_\_ Solve systems of linear equations in two variables by using:
  - graphs
  - linear combinations
  - substitution method
- 2. \_\_\_\_\_ Understand that solution sets of systems of linear equations can result in:
  - a single ordered pair (intersecting lines)
  - the empty set (parallel lines)
  - infinitely many ordered pairs (coincident lines)
- 3. \_\_\_\_\_ Graph linear equations in two variable on a coordinate plane using:
  - $x$ - and  $y$ -intercepts
  - slope and  $y$ -intercept
  - coordinate points
- 4. \_\_\_\_\_ Solve for the slope of a line and the equation of a line using:
  - slope formula
  - slope-intercept form
- 5. \_\_\_\_\_ Solve real-life application problems using systems of linear equations:
  - wind and water current problems
  - other types of applicable problems

### IX. INEQUALITIES

The student will:

- 1. \_\_\_\_\_ Solve and graph inequalities in one variable on a number line
- 2. \_\_\_\_\_ Solve and graph combined inequalities involving both “and” / “or” situations
- 3. \_\_\_\_\_ Solve and graph absolute value equations
- 4. \_\_\_\_\_ Solve and graph absolute value inequalities involving both “and” / “or” situations
- 5. \_\_\_\_\_ Solve and graph linear inequalities in two variables
- 6. \_\_\_\_\_ Solve and graph systems of linear & quadratic inequalities by graphing

**X. RATIONAL AND IRRATIONAL NUMBERS**

The student will:

- 1. \_\_\_\_\_ Express rational numbers as decimals or fractions
- 2. \_\_\_\_\_ Find square roots of numbers that have rational square roots
- 3. \_\_\_\_\_ Simplify radicals
- 4. \_\_\_\_\_ Work with problems containing radical expressions in the following way:
  - simplify products and quotients of radicals
  - simplify sums and differences of radicals
  - multiply binomials containing square-root radicals
  - rationalize binomial denominators
  - solve radical equations

**XI. COMPLEX NUMBERS**

The student will:

- 1. \_\_\_\_\_ Identify the real and imaginary components of complex numbers
- 2. \_\_\_\_\_ Simplify square roots of negative numbers
- 3. \_\_\_\_\_ Add, subtract, multiply, and divide complex numbers

**XII. QUADRATIC FUNCTIONS**

The student will:

- 1. \_\_\_\_\_ Solve quadratic equations by completing the square
- 2. \_\_\_\_\_ Solve quadratic equations by using the quadratic formula
- 3. \_\_\_\_\_ Find the determinant to determine the nature of its roots
- 4. \_\_\_\_\_ Graph quadratic equations and their transformations
- 5. \_\_\_\_\_ Solve systems of quadratic equations

**XIII. CONIC SECTIONS**

The student will:

- 1. \_\_\_\_\_ Find the distance between any two points
- 2. \_\_\_\_\_ Find the midpoint of a line segment joining any two points
- 3. \_\_\_\_\_ Write the standard form of the equation of a circle, graph a circle, and find the center and radius of a circle
- 4. \_\_\_\_\_ Write the standard form of the equation of a parabola, graph a parabola, and find the vertex, directrix, focus, axis of symmetry, and latus rectum
- 5. \_\_\_\_\_ Write the standard form of the equation of a hyperbola, graph a hyperbola, and find the center, vertices, equations of the asymptotes, and foci
- 6. \_\_\_\_\_ Write the standard form of the equation of an ellipse, graph an ellipse, and find the center, vertices, co-vertices, and foci

**XIV. LINEAR ALGEBRA (MATRICES)**

The student will:

- 1. \_\_\_\_\_ Identify & Describe Matrices
- 2. \_\_\_\_\_ Add, Subtract, Multiple, Transpose Matrices
- 3. \_\_\_\_\_ Use Row-Reduction (Gaussian elimination) to solve a system via the Graphing Calculator
- 4. \_\_\_\_\_ Evaluate inverses & determinants
- 5. \_\_\_\_\_ Apply Cramer's method

**XV. LOGARITHMIC AND EXPONENTIAL FUNCTIONS**

The student will:

- 1. \_\_\_\_\_ Change exponential expressions to logarithmic expressions
- 2. \_\_\_\_\_ Change logarithmic expressions to exponential expressions
- 3. \_\_\_\_\_ Evaluate, determine the domain, and graph logarithmic functions
- 4. \_\_\_\_\_ Solve problems using direct and indirect variation
- 5. \_\_\_\_\_ Solve logarithmic equations using properties of logarithms
- 6. \_\_\_\_\_ Solve logarithmic and exponential equations using a graphing utility

**XVI. SEQUENCES & SERIES**

The student will:

- 1. \_\_\_\_\_ Define, construct, & explain Recursive formulas
- 2. \_\_\_\_\_ Arithmetic Sequences & Series
- 3. \_\_\_\_\_ Geometric Sequences & Series
- 4. \_\_\_\_\_ Geometric & Arithmetic Means
- 5. \_\_\_\_\_ Sigma notation: application & expansion
- 6. \_\_\_\_\_ Address a variety of Sequence & Series applications

**XVII. PROBABILITY**

The student will:

- 1. \_\_\_\_\_ Counting Principle
- 2. \_\_\_\_\_ Permutation & Combinations
- 3. \_\_\_\_\_ Factorial notation & Application
- 4. \_\_\_\_\_ Discrete probability
- 5. \_\_\_\_\_ Draw and interpret Venn Diagrams

**XVIII. TRIGONOMETRIC FUNCTIONS**

The student will:

- 1. \_\_\_\_\_ Find degree and radian measures of a angle
- 2. \_\_\_\_\_ Find sine, cosine, tangent, and reciprocal functions of an acute triangle
- 3. \_\_\_\_\_ Find trigonometric functions of general angles

**I. LANGUAGE OF GEOMETRY**

The student will:

- 1. \_\_\_\_\_ Use and draw representations of the undefined terms: point, line and plane
- 2. \_\_\_\_\_ Use postulates and theorems relating points, lines and planes
- 3. \_\_\_\_\_ Use the terms collinear, coplanar, equidistant and intersection
- 4. \_\_\_\_\_ Use symbols for lines, segments, rays and distances
- 5. \_\_\_\_\_ Find the length of a segment on a number line
- 6. \_\_\_\_\_ Use the Ruler Postulate and the Segment Addition Postulate
- 7. \_\_\_\_\_ Apply the definition and theorems about perpendicular lines
- 8. \_\_\_\_\_ Use postulates and theorems relating points, lines and planes

**II. ANGLES**

The student will:

- 1. \_\_\_\_\_ Name angles and find their measures
- 2. \_\_\_\_\_ State and use the Angle Addition Postulate
- 3. \_\_\_\_\_ Apply the definitions of complementary and supplementary angles
- 4. \_\_\_\_\_ State and apply the theorems about angles supplementary to, or complementary to, congruent lines
- 5. \_\_\_\_\_ State and use the vertical angles theorem
- 6. \_\_\_\_\_ Apply the formula to find the sum of the angles of a polygon
- 7. \_\_\_\_\_ Apply the formula to find the angle measurement in regular polygons
- 8. \_\_\_\_\_ Apply the formula to find the sum of the exterior angles of a polygon

**III. LOGICAL REASONING**

The student will:

- 1. \_\_\_\_\_ Recognize the hypothesis and the conclusion of an if-then statement
- 2. \_\_\_\_\_ State the converse of an if-then statement and develop proof by counterexample
- 3. \_\_\_\_\_ Understand the meaning of a biconditional statement (*if and only if*)
- 4. \_\_\_\_\_ State the contrapositive and inverse of an if-then statement
- 5. \_\_\_\_\_ Understand the relationship between logically equivalent statements
- 6. \_\_\_\_\_ Draw correct conclusions from given statements
- 7. \_\_\_\_\_ Understand and create truth tables
- 8. \_\_\_\_\_ Plan proofs and write them in two-column form
- 9. \_\_\_\_\_ Use properties from algebra and properties of congruence in proofs
- 10. \_\_\_\_\_ Write indirect proofs in paragraph form

**IV. PARALLEL LINES AND PLANES**

The student will:

- 1. \_\_\_\_\_ Distinguish between intersecting lines, parallel lines and skew lines
- 2. \_\_\_\_\_ State and apply the theorem about the intersection of two parallel lines by a third plane
- 3. \_\_\_\_\_ Identify the angles formed when two lines are cut by a transversal
- 4. \_\_\_\_\_ Apply the postulates and theorems about parallel lines
- 5. \_\_\_\_\_ Apply the theorems about a parallel and a perpendicular to a given line through a point outside the line

**V. TRIANGLES**

The student will:

- 1. \_\_\_\_\_ Use the Triangle Sum Theorem
- 2. \_\_\_\_\_ Understand properties and their proofs for triangles to include scalene, isosceles and equilateral
- 3. \_\_\_\_\_ Apply the theorems and corollaries about isosceles triangles
- 4. \_\_\_\_\_ Understand the conjectures for the exterior angles of triangles
- 5. \_\_\_\_\_ Apply the properties and theorems associated with the median, the altitude, the perpendicular bisector and the angle bisector

**VI. CONGRUENT TRIANGLES**

The student will:

- 1. \_\_\_\_\_ Identify corresponding parts of congruent figures
- 2. \_\_\_\_\_ Prove two triangles congruent by using the SSS, SAS and ASA Postulates
- 3. \_\_\_\_\_ Use the AAS theorem to prove two triangles congruent
- 4. \_\_\_\_\_ Use the HL, LL, HA and LA theorems to prove two right triangles congruent
- 5. \_\_\_\_\_ Prove that two overlapping triangles are congruent
- 6. \_\_\_\_\_ Prove two triangles congruent by first proving two other triangles congruent
- 

**VII. QUADRILATERALS**

The student will:

- 1. \_\_\_\_\_ Apply the definition of a parallelogram and the theorems about properties of a parallelogram
- 2. \_\_\_\_\_ Prove that certain quadrilaterals are parallelograms
- 3. \_\_\_\_\_ Apply the definitions and identify the special properties of a rectangle, a rhombus and a square
- 4. \_\_\_\_\_ Determine when a parallelogram is a rectangle, rhombus or square
- 5. \_\_\_\_\_ Apply the definitions and identify the properties of a trapezoid, isosceles trapezoid and kite

**VII. INEQUALITIES**

The student will:

- 1. \_\_\_\_\_ Apply properties of inequality to positive numbers, lengths of segments and measures of angles
- 2. \_\_\_\_\_ State and use the Exterior Angle Inequality Theorem
- 3. \_\_\_\_\_ State and apply the Triangle Inequality Theorem
- 4. \_\_\_\_\_ State and apply the theorem relating unequal sides and unequal angles of a triangle

**VIII. SIMILARITY**

The student will:

- 1. \_\_\_\_\_ State and apply the properties of similar polygons
- 2. \_\_\_\_\_ Use the AA Similarity Postulate to prove triangles similar
- 3. \_\_\_\_\_ Use the SAS and SSS Similarity Theorems to prove triangles similar
- 4. \_\_\_\_\_ Use scale drawings as an application of similarity
- 5. \_\_\_\_\_ Solve application problems using the similarity properties
- 6. \_\_\_\_\_ Apply the Mid-Segment Theorem
- 7. \_\_\_\_\_ Apply the Triangle Proportionality Theorem and its corollary
- 8. \_\_\_\_\_ Apply the Triangle Angle-Bisector Theorem

**IX. RIGHT TRIANGLES**

The student will:

- 1. \_\_\_\_\_ Simplify radical expressions
- 2. \_\_\_\_\_ Determine the geometric mean between two numbers
- 3. \_\_\_\_\_ State and apply the relationships that exist when the altitude is drawn to the hypotenuse of a right triangle
- 4. \_\_\_\_\_ State and apply the Pythagorean Theorem to find the lengths of segments, the midpoints of segments, the distance between a point and a line
- 5. \_\_\_\_\_ State and apply the converse of the Pythagorean Theorem and related theorems about obtuse and acute angles
- 6. \_\_\_\_\_ Determine the lengths of two sides of a  $45^\circ$ - $45^\circ$ - $90^\circ$  or a  $30^\circ$ - $60^\circ$ - $90^\circ$  triangle when the length of the third side is know
- 7. \_\_\_\_\_ Solve right triangle problems by using the sine, cosine and tangent ratios

**X. CIRCLES**

The student will:

- 1. \_\_\_\_\_ Understand basic conjectures and proofs of properties of a circle to include investigations of  $\pi$
- 2. \_\_\_\_\_ Develop the concept of the diameter-chord relationships in circles
- 3. \_\_\_\_\_ Apply the formulas for the circumferences and areas of circles
- 4. \_\_\_\_\_ Develop relationships between the area and central angles in circles
- 5. \_\_\_\_\_ Use the formulas for arc length and the areas of sectors of a circle
- 6. \_\_\_\_\_ Understand angle and arc length relationships in circles
- 7. \_\_\_\_\_ Apply the proofs for theorems of angles, chords, secants and tangent segments
- 8. \_\_\_\_\_ Apply the general equation of the circle using its locus of points

**XI. CONSTRUCTIONS**

The student will:

- 1. \_\_\_\_\_ Show proof of geometric theorems using construction tools (straight edge and compass)

**XII. AREAS OF PLANE FIGURES**

The student will:

- 1. \_\_\_\_\_ Use the formulas for the areas of rectangles, parallelograms, triangles, rhombuses, trapezoids and regular polygons
- 2. \_\_\_\_\_ Apply the relationships between scale factors, perimeters and areas of similar figures
- 3. \_\_\_\_\_ Use areas to solve problems involving geometric probability

**XIII. AREA AND VOLUME OF SOLIDS**

The student will:

- 1. \_\_\_\_\_ Apply the formulas for the surface area of prisms, cylinders, pyramids, cones and spheres
- 2. \_\_\_\_\_ Apply the formulas for volume of prisms, cylinders, pyramids, cones and spheres
- 3. \_\_\_\_\_ Recognize the properties of similar solids

**XIV. COORDINATE GEOMETRY**

The student will:

- 1. \_\_\_\_\_ Apply the distance and midpoint formula
- 2. \_\_\_\_\_ Understand the basic properties of vectors
- 3. \_\_\_\_\_ Given a polygon, choose a convenient placement of coordinate axes and assign appropriate coordinates
- 4. \_\_\_\_\_ Prove statements by using coordinate geometry methods

**XV. TRANSFORMATIONS**

The student will:

- 1. \_\_\_\_\_ Recognize and use terms: *image, preimage, mapping, one-to-one mapping, transformation, isometry* and *congruence mapping*
- 2. \_\_\_\_\_ Recognize and use terms *identity* and *inverse* in relation to mappings
- 3. \_\_\_\_\_ Locate images of figures by reflection, translation and glide reflection, rotation, dilation/reduction, composites of mapping
- 4. \_\_\_\_\_ Describe the symmetry of figures and solids
- 5. \_\_\_\_\_ Recognize tessellations

**I. ALGEBRA CONCEPTS**

The student will:

- 1. \_\_\_\_\_ Recognize monomials and polynomials, and add, subtract, multiply and divide polynomials
- 2. \_\_\_\_\_ Review methods for factoring polynomials
- 3. \_\_\_\_\_ Review how to reduce, multiply, divide, add and subtract rational expressions
- 4. \_\_\_\_\_ Simplify complex fractions
- 5. \_\_\_\_\_ Solve rational equations and inequalities
- 6. \_\_\_\_\_ Review evaluating square roots and rational exponents

**II. POLYNOMIALS**

The student will:

- 1. \_\_\_\_\_ Solve quadratic equations by factoring, completing the square and the quadratic formula
- 2. \_\_\_\_\_ Solve problems involving quadratic equations
- 3. \_\_\_\_\_ Solve systems of polynomial function: conics and lines
- 4. \_\_\_\_\_ Find all zeros of a polynomial function
- 5. \_\_\_\_\_ Know the factoring of a sum and/or difference of cubes
- 6. \_\_\_\_\_ Factor a polynomial using the rational roots theorem and long division or synthetic division

**III. GRAPHING**

The student will:

- 1. \_\_\_\_\_ Locate  $x$ - and  $y$ -intercepts
- 2. \_\_\_\_\_ Locate discontinuities: point, infinite & jump
- 3. \_\_\_\_\_ Locate all horizontal and vertical asymptotes
- 4. \_\_\_\_\_ Write the equation of a line in slope-intercept form, point slope form or general form
- 5. \_\_\_\_\_ Write the standard form of the equation of a circle, graph a circle and find the center and radius of a circle
- 6. \_\_\_\_\_ Write the standard form of the equation of a parabola, graph a parabola, and find the vertex, directrix, focus, axis of symmetry and latus rectum
- 7. \_\_\_\_\_ Write the standard form of the equation of a hyperbola, graph a hyperbola, and find the center, vertices, equations of the asymptotes and foci
- 8. \_\_\_\_\_ Write the standard form of the equation of an ellipse, graph an ellipse, and find the center, vertices, co-vertices and foci
- 9. \_\_\_\_\_ Draw and interpret scatter diagrams
- 10. \_\_\_\_\_ Distinguish between linear and nonlinear relations
- 11. \_\_\_\_\_ Use a calculator to find the line of best fit
- 12. \_\_\_\_\_ Identify the graph of a function
- 13. \_\_\_\_\_ Graph the following functions:
  - rational
  - polynomial
  - root
  - exponential
  - logarithmic

**IV. FUNCTIONS**

The student will:

- 1. \_\_\_\_\_ Study linear, rational, root, polynomial, exponential and logarithmic functions
- 2. \_\_\_\_\_ Identify the domain and range of a relation
- 3. \_\_\_\_\_ Model relations using diagrams, graphs and set notation
- 4. \_\_\_\_\_ Identify the range, domain and intercepts given the graph of a function
- 5. \_\_\_\_\_ Find the value of a function given the domain
- 6. \_\_\_\_\_ Graph linear functions on a coordinate plane
- 7. \_\_\_\_\_ Graph the following types of functions:
  - piecewise
  - constant
  - identity
  - quadratic
  - cube root and square root
  - reciprocal
  - absolute value

**V. COMPLEX NUMBERS**

The student will:

- 1. \_\_\_\_\_ Identify the real and imaginary components of complex numbers
- 2. \_\_\_\_\_ Simplify square roots of negative numbers
- 3. \_\_\_\_\_ Add, subtract, multiply and divide complex numbers

**VI. LOGARITHMIC FUNCTIONS**

The student will:

- 1. \_\_\_\_\_ Change exponential expressions to logarithmic expressions
- 2. \_\_\_\_\_ Change logarithmic expressions to exponential expressions
- 3. \_\_\_\_\_ Evaluate, determine the domain and graph logarithmic functions
- 4. \_\_\_\_\_ Solve problems using direct, indirect and joint variation
- 5. \_\_\_\_\_ Solve logarithmic equations using properties of logarithms
- 6. \_\_\_\_\_ Solve logarithmic and exponential equations using a graphing utility

**VII. CONICS**

The student will:

- 1. \_\_\_\_\_ Identify conic sections: (refer to section C)
- 2. \_\_\_\_\_ Discuss and graph conics (refer to section C)
- 3. \_\_\_\_\_ Recognize and analyze conic sections equations given in general form
- 4. \_\_\_\_\_ Graph and interpret systems of conic sections (include inequalities)

**VIII. LINEAR ALGEBRA (MATRICES)**

The student will:

- 1. \_\_\_\_\_ Identify & describe matrices
- 2. \_\_\_\_\_ Add, subtract, multiple, transpose matrices
- 3. \_\_\_\_\_ Use Row-Reduction to solve a system via the Graphing Calculator
- 4. \_\_\_\_\_ Evaluate inverses & determinants
- 5. \_\_\_\_\_ Apply Cramer's method

**IX. SEQUENCES & SERIES**

The student will:

- 1. \_\_\_\_\_ Define, construct & explain Recursive formulas
- 2. \_\_\_\_\_ Arithmetic sequences & series
- 3. \_\_\_\_\_ Geometric sequences & series
- 4. \_\_\_\_\_ Geometric & arithmetic means
- 5. \_\_\_\_\_ Sigma notation: application & expansion
- 6. \_\_\_\_\_ Address a variety of sequence & series applications

**X. PROBABILITY**

The student will:

- 1. \_\_\_\_\_ Counting principle
- 2. \_\_\_\_\_ Permutation & combinations
- 3. \_\_\_\_\_ Factorial notation & application
- 4. \_\_\_\_\_ Discrete probability
- 5. \_\_\_\_\_ Draw and interpret Venn Diagrams

**XI. TRIGONOMETRY**

The student will:

- 1. \_\_\_\_\_ Identify the following:
  - period
  - amplitude
  - phase shift
  - vertical shift
- 2. \_\_\_\_\_ Master sine, cosine and tangent values corresponding to the unit circle at angles of:  $0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \pi$  ( $0^\circ, 30^\circ, 45^\circ, 60^\circ, 90^\circ, 180^\circ$ ) and multiples of the same
- 3. \_\_\_\_\_ Define and use circular trigonometric functions
- 4. \_\_\_\_\_ Define and use trigonometric function of right triangle
- 5. \_\_\_\_\_ Compute the values of trigonometric functions of angles
- 6. \_\_\_\_\_ Graph trigonometric functions and their transformations
- 7. \_\_\_\_\_ Graph sinusoidal functions and find an equation for a sinusoidal graph
- 8. \_\_\_\_\_ Find an angle using a calculator and an inverse trigonometric function
- 9. \_\_\_\_\_ Prove trigonometric identities
- 10. \_\_\_\_\_ Use Law of Sines and Law of Cosines to solve triangle and applied problems

**I. ALGEBRA CONCEPTS**

The student will:

- 1. \_\_\_\_\_ Review process for factoring polynomials
- 2. \_\_\_\_\_ Review how to find domain and range
- 3. \_\_\_\_\_ Review how to solve linear inequalities
- 4. \_\_\_\_\_ Write solutions in set and interval notation
- 5. \_\_\_\_\_ Check solutions through equations
- 6. \_\_\_\_\_ Use patterns for exponents
- 7. \_\_\_\_\_ Emphasize the importance of using the correct unit of measurement
- 8. \_\_\_\_\_ Evaluate / use area and volume
- 9. \_\_\_\_\_ Solve rate problems
- 10. \_\_\_\_\_ Create deductive proofs
- 11. \_\_\_\_\_ Use inductive reasoning
- 12. \_\_\_\_\_ Analyze general / standard forms for equations

**II. FUNCTIONS AND THEIR GRAPHS**

The student will:

- 1. \_\_\_\_\_ Graph polynomial functions, trig functions, exponential functions, logarithmic functions, conic sections, rational functions, and special functions
- 2. \_\_\_\_\_ Graph polynomials after algebraically analyzing all aspects ( $x$ - and  $y$ -intercept, turns, symmetry, end behavior, etc.)
- 3. \_\_\_\_\_ Develop a connection between factors, zeroes,  $x$ -intercepts, and solutions to  $f(x) = 0$
- 4. \_\_\_\_\_ Review transformations and combinations of functions
- 5. \_\_\_\_\_ Apply horizontal line test to determine if a function is invertible
- 6. \_\_\_\_\_ Find inverse functions
- 7. \_\_\_\_\_ Determine equations from graphs
- 8. \_\_\_\_\_ Develop rules for graphing functions

**III. POLYNOMIAL FUNCTIONS**

The student will:

- 1. \_\_\_\_\_ Analyze polynomial functions of a higher degree using the rational roots theorem, synthetic division and Descartes' rule of signs to find the zeroes of the functions
- 2. \_\_\_\_\_ Graph composite and inverse functions
- 3. \_\_\_\_\_ Use synthetic and long division
- 4. \_\_\_\_\_ Review complex numbers and how to find complex zeroes of a polynomial function
- 5. \_\_\_\_\_ Apply Pascal's Triangle to find binomial coefficients
- 6. \_\_\_\_\_ Analyze polynomial functions and root functions
- 7. \_\_\_\_\_ Perform arithmetic operations, composition, and find the inverse of functions

**IV. RATIONAL FUNCTIONS**

The student will:

- 1. \_\_\_\_\_ Solve inequalities (linear, absolute value, polynomial, and rational)
- 2. \_\_\_\_\_ Graph inequalities (linear, absolute value, polynomial, and rational)
- 3. \_\_\_\_\_ Graph rational functions
- 4. \_\_\_\_\_ Identify vertical, horizontal, and slant asymptotes
- 5. \_\_\_\_\_ Identify the range, domain, and intercepts
- 6. \_\_\_\_\_ Analyze rational functions
- 7. \_\_\_\_\_ Introduce limits
- 8. \_\_\_\_\_ Perform partial fraction decomposition
- 9. \_\_\_\_\_ Identify end behavior

**V. EXPONENTIAL AND LOGARITHMIC FUNCTIONS**

The student will:

- 1. \_\_\_\_\_ Graph exponential and logarithmic functions
- 2. \_\_\_\_\_ Analyze exponential and logarithmic functions
- 3. \_\_\_\_\_ Evaluate logarithms, exponentials, and radicals
- 4. \_\_\_\_\_ Evaluate, determine the domain, and graph logarithmic functions
- 5. \_\_\_\_\_ Use laws of exponents / logarithms
- 6. \_\_\_\_\_ Use patterns for exponents and logarithms
- 7. \_\_\_\_\_ Use zeros of equations applying exponents, radicals, and logarithms to estimate
- 8. \_\_\_\_\_ Perform composition and inversion of functions
- 9. \_\_\_\_\_ Solve exponential growth and decay problems
- 10. \_\_\_\_\_ Create and use normal distribution graphs

**VI. TRIGONOMETRY**

The student will:

- 1. \_\_\_\_\_ Define degree and radian measure
- 2. \_\_\_\_\_ Convert between degree and radian measure
- 3. \_\_\_\_\_ Define trig functions using the unit circle, right triangles, and trig functions of any angle
- 4. \_\_\_\_\_ Calculate arc length and sector area of circles
- 5. \_\_\_\_\_ Evaluate angular/linear velocity
- 6. \_\_\_\_\_ Know trigonometric function values for all integral multiples of  $\frac{\pi}{6}$  and  $\frac{\pi}{4}$
- 7. \_\_\_\_\_ Use  $30^\circ - 60^\circ - 90^\circ$  and  $45^\circ - 45^\circ - 90^\circ$  triangles to derive those values
- 8. \_\_\_\_\_ Prove trig identities
- 9. \_\_\_\_\_ Graph sine, cosine, tangent, secant, cosecant and other cotangent functions
- 10. \_\_\_\_\_ Define and graph inverse trig functions
- 11. \_\_\_\_\_ Perform compositions of functions
- 12. \_\_\_\_\_ Solve trig equations
- 13. \_\_\_\_\_ Manipulate fundamental identities, sum and difference formulas, multiple angle formulas, and product and sum formulas

**VI. (Trigonometry Continued)**

- 14. \_\_\_\_\_ Use approximate decimals for trigonometric values
- 15. \_\_\_\_\_ Use law of sines and law of cosines
- 16. \_\_\_\_\_ Solve problems involving bearings and/or directions
- 17. \_\_\_\_\_ Apply Heron's Formula
- 18. \_\_\_\_\_ Solve simple harmonic motion problems

**VII. VECTORS**

The student will:

- 1. \_\_\_\_\_ Calculate vector magnitude
- 2. \_\_\_\_\_ Use vectors and rotations
- 3. \_\_\_\_\_ Add, subtract, and find a scalar product and the magnitude of a vector
- 4. \_\_\_\_\_ Find a vector from its direction and magnitude
- 5. \_\_\_\_\_ Evaluate Dot Product and Cross Product
- 6. \_\_\_\_\_ Apply Dot Product and Cross Product to various real-world applications

**VIII. POLAR COORDINATES AND COMPLEX NUMBERS**

The student will:

- 1. \_\_\_\_\_ Define Properties of Complex numbers
- 2. \_\_\_\_\_ Describe the relationship between polar and complex numbers; convert complex numbers to polar form and vice versa
- 3. \_\_\_\_\_ Compute powers and roots of complex numbers
- 4. \_\_\_\_\_ Compute products and quotients of complex numbers in polar form
- 5. \_\_\_\_\_ Convert rectangular coordinates to polar coordinates and vice versa
- 6. \_\_\_\_\_ Graph polar curves
- 7. \_\_\_\_\_ Solve equations in polar coordinates

**IX. STATISTICS AND PROBABILITY**

The student will:

- 1. \_\_\_\_\_ Introduce and evaluate factorials
- 2. \_\_\_\_\_ Use theories of combination and permutation
- 3. \_\_\_\_\_ Use normal distribution graphs

**X. ANALYTICAL GEOMETRY**

The student will:

- 1. \_\_\_\_\_ Graph conic sections
- 2. \_\_\_\_\_ Analyze conic sections
- 3. \_\_\_\_\_ Solve conic section problems
- 4. \_\_\_\_\_ Write the standard form of the equation of a circle, graph a circle, and find the center and radius of a circle
- 5. \_\_\_\_\_ Analyze properties and graphs of functions defined parametrically
- 6. \_\_\_\_\_ Convert functions defined parametrically to rectangular coordinates by eliminating the parameter
- 7. \_\_\_\_\_ Use parametrically defined functions to model motion

**XI. LINEAR ALGEBRA**

The student will:

- 1. \_\_\_\_\_ Perform matrix arithmetic (sums, differences, scalar multiplication, matrix multiplication)
- 2. \_\_\_\_\_ Calculate determinants using minors and co-factors and the Rule of Sarrus
- 3. \_\_\_\_\_ Solve systems of equations using both matrix algebra (inverse matrices) and Cramer's Rule

**XII. MATHEMATICAL INDUCTION**

The student will:

- 1. \_\_\_\_\_ Define recursive and explicit formulas
- 2. \_\_\_\_\_ Review sequences and series
- 3. \_\_\_\_\_ Construct mathematical induction proofs

**XIII. LIMITS OF FUNCTIONS (INCLUDING ONE-SIDED LIMITS)**

The student will:

- 1. \_\_\_\_\_ Develop an intuitive understanding of the limiting process
- 2. \_\_\_\_\_ Calculate limits using algebra
- 3. \_\_\_\_\_ Estimate limits from graphs or tables of data
- 4. \_\_\_\_\_ Develop an understanding of asymptotes in terms of graphical behavior
- 5. \_\_\_\_\_ Describe asymptotic behavior in terms of limits involving infinity
- 6. \_\_\_\_\_ Develop an intuitive understanding of continuity (The function values can be made as close as desired by taking sufficiently close values of the domain)
- 7. \_\_\_\_\_ Develop an understanding of continuity in terms of limits

**XIV. DERIVATIVES**

The student will:

- 1. \_\_\_\_\_ Define average rate of change of a function on an interval
- 2. \_\_\_\_\_ Interpret an instantaneous rate of change as the limiting case of an average rate of change
- 3. \_\_\_\_\_ Interpret a derivative as an instantaneous rate of change
- 4. \_\_\_\_\_ Present a derivative graphically, numerically and analytically
- 5. \_\_\_\_\_ Interpret a derivative as an instantaneous rate of change
- 6. \_\_\_\_\_ Define a derivative as the limit of the difference quotient

**\*Adapted from the AP Calculus (AB) topic outline. Additional topics should include those topics from the AP Calculus (BC) outline, available at [collegeboard.org](http://collegeboard.org)**

## I. FUNCTIONS, GRAPHS AND LIMITS

### A. Analysis of Graphs

The student will:

- 1. \_\_\_\_\_ Use technology to produce graphs of functions
- 2. \_\_\_\_\_ Understand the interplay between the geometric and analytic information
- 3. \_\_\_\_\_ Use calculus both to predict and to explain the observed local and global behavior of a function

### B. Limits of Functions (including one-sided limits)

The student will:

- 1. \_\_\_\_\_ Develop an intuitive understanding of the limiting process
- 2. \_\_\_\_\_ Calculate limits using algebra
- 3. \_\_\_\_\_ Estimate limits from graphs or tables of data

### C. Asymptotic and Unbounded Behavior

The student will:

- 1. \_\_\_\_\_ Develop an understanding of asymptotes in terms of graphical behavior
- 2. \_\_\_\_\_ Describe asymptotic behavior in terms of limits involving infinity
- 3. \_\_\_\_\_ Compare relative magnitudes of functions and their rates of change to include contrasting exponential growth, polynomial growth, and logarithmic growth

### D. Continuity as a Property of Functions

The student will:

- 1. \_\_\_\_\_ Develop an intuitive understanding of continuity (The function values can be made as close as desired by taking sufficiently close values of the domain)
- 2. \_\_\_\_\_ Develop an understanding of continuity in terms of limits
- 3. \_\_\_\_\_ Develop a geometric understanding of graphs of continuous functions including the Intermediate Value Theorem and Extreme Value Theorem

## II. DERIVATIVES

### A. Concept of the Derivative

The student will:

- 1. \_\_\_\_\_ Present a derivative graphically, numerically, and analytically
- 2. \_\_\_\_\_ Interpret a derivative as an instantaneous rate of change
- 3. \_\_\_\_\_ Define a derivative as the limit of the difference quotient
- 4. \_\_\_\_\_ Determine the relationship between differentiability and continuity

**B. Derivative at a Point**

The student will:

- 1. \_\_\_\_\_ Provide examples of the slope of a curve at a point, including points at which there are vertical tangents and points at which there are no tangents
- 2. \_\_\_\_\_ Provide examples of a tangent line to a curve at a point and local linear approximation
- 3. \_\_\_\_\_ Describe instantaneous rate of change as the limit of average rate of change
- 4. \_\_\_\_\_ Approximate rate of change from graphs and tables of values

**C. Derivative as a Function**

The student will:

- 1. \_\_\_\_\_ Understand the corresponding characteristics of graphs of  $f$  and  $f'$
- 2. \_\_\_\_\_ Understand the relationship between the increasing and decreasing behavior of  $f$  and the sign of  $f'$
- 3. \_\_\_\_\_ Understand the Mean Value Theorem and its geometric consequences
- 4. \_\_\_\_\_ Solve equations involving derivatives
- 5. \_\_\_\_\_ Translate verbal descriptions into equations involving derivatives and vice versa

**D. Second Derivatives**

The student will:

- 1. \_\_\_\_\_ Understand the corresponding characteristics of the graphs of  $f$ ,  $f'$ , and  $f''$
- 2. \_\_\_\_\_ Understand the relationship between the concavity of  $f$  and the sign of  $f''$
- 3. \_\_\_\_\_ Describe points of inflection as places where concavity changes

**E. Applications of Derivatives**

The student will:

- 1. \_\_\_\_\_ Analyze curves, including the notions of monotonicity and concavity
- 2. \_\_\_\_\_ Understand optimization, both absolute (global) and relative (local) extrema
- 3. \_\_\_\_\_ Model rates of change, including related rates problems
- 4. \_\_\_\_\_ Use implicit differentiation to find the derivative of an inverse function
- 5. \_\_\_\_\_ Interpret the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration
- 6. \_\_\_\_\_ Understand the geometric interpretation of differential equations via slope fields and the relationship between slope fields and solution curves for differential

**F. Computation of Derivatives**

The student will:

- 1. \_\_\_\_\_ Demonstrate knowledge of the derivatives of basic functions:
  - power functions
  - exponential functions
  - logarithmic functions
  - trigonometric functions
  - inverse trigonometric functions
- 2. \_\_\_\_\_ Understand and use the basic rules for the derivative of sums, products, and quotients of functions
- 3. \_\_\_\_\_ Understand chain rule and implicit differentiation

**II. INTEGRALS****A. Interpretations and Properties of Definite Integrals**

The student will:

- 1. \_\_\_\_\_ Interpret a definite integral as a limit of Riemann sums
- 2. \_\_\_\_\_ Interpret a definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval:  

$$\int_a^b f'(x)dx = f(b) - f(a).$$
- 3. \_\_\_\_\_ Understand and use the basic properties of definite integrals, including additivity and linearity

**B. Applications of Integrals**

The student will:

- 1. \_\_\_\_\_ Use appropriate integrals in a variety of applications to model physical, biological, or economic situations
- 2. \_\_\_\_\_ Use the integral of a rate of change to give accumulated change
- 3. \_\_\_\_\_ Use the method of setting up an approximating Riemann sum and representing its limit as a definite integral
- 4. \_\_\_\_\_ Specific applications should include:
  - finding the area of a region
  - finding the volume of a solid with known cross sections
  - finding the average value of a function
  - finding the distance traveled by a particle along a line

**C. Fundamental Theorem of Calculus**

The student will:

- 1. \_\_\_\_\_ Use the Fundamental Theorem to evaluate definite integrals
- 2. \_\_\_\_\_ Use the Fundamental Theorem to represent a particular antiderivative and the analytical and graphical analysis of functions so defined

**D. Techniques of Antidifferentiation**

The student will:

- 1. \_\_\_\_\_ Use antiderivatives following directly from derivatives of basic functions
- 2. \_\_\_\_\_ Use antiderivatives by substituting variables (including change of limits for definite integrals)

**E. Applications of Antidifferentiation**

The student will:

- 1. \_\_\_\_\_ Find specific antiderivatives using initial conditions, including applications to motion along a line
- 2. \_\_\_\_\_ Solve separable differential equations and use them in modeling.  
In particular, study the equation  $y' = ky$  and exponential growth

**F. Numerical Approximations to Definite Integrals**

The student will:

- 1. \_\_\_\_\_ Use Riemann sums (using left, right, and midpoint evaluation points) and trapezoidal sums to approximate definite integrals of functions represented algebraically, graphically, and by tables of values

**I. SUMMARIZING DATA WITH FREQUENCY TABLES**

The student will:

- 1. \_\_\_\_\_ Organize or normalize data into a frequency table or relative distribution table
- 2. \_\_\_\_\_ Construct a joint frequency contingency table from two categorical variables
- 3. \_\_\_\_\_ Construct a frequency polygon and a frequency curve from a frequency (or relative frequency) distribution
- 4. \_\_\_\_\_ Construct an objective given a relative cumulative frequency distribution
- 

**II. PICTURES OF DATA**

The student will:

- 1. \_\_\_\_\_ Develop methods of displaying numerical data in a organized form
- 2. \_\_\_\_\_ Construct a histogram from a frequency distribution
- 3. \_\_\_\_\_ Distinguish between a histogram and a stem-and-leaf diagram
- 4. \_\_\_\_\_ Construct a bar graph from given data
- 5. \_\_\_\_\_ Construct a circle graph from given data
- 6. \_\_\_\_\_ Identify distortions (illustrations) in graphs or picture charts
- 7. \_\_\_\_\_ Plot points on a scattergram when given a bivariate distribution
- 8. \_\_\_\_\_ Construct a Normal curve for data and standardized data
- 9. \_\_\_\_\_ Construct a box and whisker plot

\*Graphing with Technology: Graphing Calculator, Microsoft Excel, CAS, etc.

**III. MEASURES OF CENTER**

The student will:

- 1. \_\_\_\_\_ Compute the mean, median, and mode for a set of numbers
- 2. \_\_\_\_\_ Describe common characteristics of the mean, median, and mode
- 3. \_\_\_\_\_ Compute harmonic and geometric means for a set of data
- 4. \_\_\_\_\_ Locate the relative positions of the mean, median, and mode on a skewed frequency distribution
- 5. \_\_\_\_\_ Describe how measures of dispersion differ from measures of central tendency
- 6. \_\_\_\_\_ Determine an appropriate measure of central tendency for data scaled on nominal, ordinal, interval, and ratio levels
- 7. \_\_\_\_\_ Explain why the mean is influenced by extreme values in a distribution while the median is relatively unaffected by extreme values

**IV. MEASURE OF VARIATION**

The student will:

- 1. \_\_\_\_\_ Calculate the standard deviation
- 2. \_\_\_\_\_ Interpret the variance
- 3. \_\_\_\_\_ Interpret the mean deviation
- 4. \_\_\_\_\_ Distinguish among definitions of the range of a set of data
- 5. \_\_\_\_\_ Interpret the standard deviation from a given value of the variance for a variable
- 6. \_\_\_\_\_ Understand and use the 5-number summary including:
  - the minimum value
  - the first quartile
  - the median, or second quartile
  - the third quartile
  - the maximum value
- 7. \_\_\_\_\_ Compute the sum of the squares of the deviation scores
- 8. \_\_\_\_\_ Distinguish between “real” and “apparent” class intervals
- 9. \_\_\_\_\_ Interpret the meaning of an individual standard score relative to the distribution of concern
- 10. \_\_\_\_\_ Describe characteristics of the normal curve
- 11. \_\_\_\_\_ Interpret the meaning of  $r$  and  $R^2$

\*All interpretations should be written within the context of the problem.

**V. MEASURES OF POSITION**

The student will:

- 1. \_\_\_\_\_ Describe Z-score and T-score numerical distributions in terms of the mean and standard deviation
- 2. \_\_\_\_\_ Transfer raw scores into corresponding standard Z-scores
- 3. \_\_\_\_\_ Convert a set of Z-scores into a distribution of standard scores with any given mean and standard deviation
- 4. \_\_\_\_\_ Given a set of Z-scores, use characteristics of the normal curve to convert the Z-scores into percentile equivalents
- 5. \_\_\_\_\_ Given a percentile score, use the characteristics of the normal curve to transform the percentile to a standard Z-score
- 6. \_\_\_\_\_ Convert a set of Z-scores into a distribution of T-scores

**VI. HYPOTHESIS TESTING**

The student will:

- 1. \_\_\_\_\_ Define Hypothesis testing: null versus alternative
- 2. \_\_\_\_\_ Hypothesis testing for one proportion
- 3. \_\_\_\_\_ Hypothesis testing for two proportions
- 4. \_\_\_\_\_ Hypothesis testing for the mean  $n \geq 30$  and  $n < 30$
- 5. \_\_\_\_\_ Hypothesis testing for the difference between two means
- 6. \_\_\_\_\_ Hypothesis testing for the slope of a regression line
- 7. \_\_\_\_\_ Hypothesis testing for the association between two categorical variables
- 8. \_\_\_\_\_ Discuss and research Ethical research practices
- 9. \_\_\_\_\_ Discuss and explain Type I and Type II Error
- 

**VII. CONFIDENCE INTERVALS**

The student will:

- 1. \_\_\_\_\_ Define confidence intervals
- 2. \_\_\_\_\_ Confidence intervals for one proportion
- 3. \_\_\_\_\_ Confidence intervals for two proportions
- 4. \_\_\_\_\_ Confidence intervals for the mean  $n \geq 30$  and  $n < 30$
- 5. \_\_\_\_\_ Confidence intervals for the difference between two means
- 6. \_\_\_\_\_ Confidence intervals for the slope of a regression line
- 

**VIII. CORRELATION AND REGRESSION**

The student will:

- 1. \_\_\_\_\_ Define correlation
- 2. \_\_\_\_\_ Define linear regression
- 3. \_\_\_\_\_ Compare & contrast a regression line vs. a least-square regression line
- 4. \_\_\_\_\_ Measures of regression and prediction intervals
- 5. \_\_\_\_\_ Explain  $r$  and  $R^2$
- 6. \_\_\_\_\_ Calculate the slope of a regression line using statistical formulas

**IX. CHI-SQUARE TEST & F-DISTRIBUTION**

The student will:

- 1. \_\_\_\_\_ Define “Goodness-of-Fit”
- 2. \_\_\_\_\_ Define and assess independence
- 3. \_\_\_\_\_ Compare two variances
- 4. \_\_\_\_\_ Define when to use an ANOVA
- 5. \_\_\_\_\_ Properly run and interpret an ANOVA

**X. GENERAL CONCEPTS/DISTRIBUTIONS NAMES**

The student will:

- 1. \_\_\_\_\_ Be able to write a research based paper within the context of the study
- 2. \_\_\_\_\_ Use a process such as S.P.D.C.: State, Plan, Do, Conclude to report findings
- 3. \_\_\_\_\_ Use calculator/computer to manipulate various statistical data
- 4. \_\_\_\_\_ Normal Distribution
- 5. \_\_\_\_\_ F-Distribution
- 6. \_\_\_\_\_ ANOVA analysis
- 7. \_\_\_\_\_ Binomial distribution
- 8. \_\_\_\_\_  $t$  Distribution

**XI. NON-PARAMETRIC TEST (\*Time permitting)**

The student will:

- 1. \_\_\_\_\_ Sign test
- 2. \_\_\_\_\_ Wilcoxon tests
- 3. \_\_\_\_\_ Kruskal-Wallis test
- 4. \_\_\_\_\_ Rank correlation

**Sample Lesson**  
**Kindergarten****Making Patterns**

**Objective:** The student will identify, create, copy, and extend patterns using objects and pictures.

**Materials:**

- chalk and chalkboard
- triangle and square blocks (or any 2 shapes)
- paper
- crayons

**Procedure:**

1. Draw a pattern on the chalkboard using triangles and squares.
2. Have children describe the pattern using the names of the shapes.
3. Have students name the shape(s) that would come next to continue the pattern.
4. Repeat with another pattern.
5. Have children create their own patterns using the triangles and squares.
6. Draw and color the pattern on paper.
7. Repeat the activity using different shapes.
8. As an extension, students exchange papers and have a partner extend the pattern.

**Assessment:**

- Teacher observations
- Pattern papers

**Resource:** [mathforum.org](http://mathforum.org)

Sample Lesson  
Grade 1

## Odd and Even Numbers

**Objectives:**

- To represent even and odd numbers concretely as pairs and left over ones.
- To identify even and odd numbers to 50.

**Materials:**

- Unifix Cubes
- Odd and Even mats, 1 for each student and 1 transparency
- Number cards 1-50
- Missing Mittens by Stuart J. Murphy

**Procedure:**

1. Advise students that today they will learn to identify odd and even numbers.
2. Ask children what comes in pairs.
3. Lead children to see that *pair* means two. (mittens, gloves, shoes, earrings, shoe laces)
4. Read children Missing Mittens by Stuart J. Murphy
5. As you read, ask children if they can predict what will come next in the story, where they think the missing mittens are, and what they notice about the number of mittens.
6. Pass out odd/even mats and unifix cubes.
7. Ask students to put 4 unifix cubes in front of them and make pairs.
8. Ask,
  - Were you able to make pairs?
  - Were there any left over?
9. Model making pairs using the overhead.
10. Explain that since there are pairs with none left over, 4 is an **even** number.
11. Then ask students to pull out 7 unifix cubes and make pairs.
12. Model on overhead and explain that since one cube is left over after making pairs, 7 is an **odd** number.
13. Continue with all the numbers to 10.
14. Write on the board in two separate columns: odd                      even
15. Place the number cards 1-10 on the board and ask volunteers to come to the board and place the number under the correct heading.
16. When all the cards are in place, ask students if they see a pattern in the odd and even numbers.
17. Lead students to recognize that even numbers end with digits 0, 2, 4, 6, 8 and odd numbers end with digits 1, 3, 5, 7, and 9.

18. Remind students that a number is even if no cubes are left over and odd if one cube is left over.
19. Repeat step #15 with larger numbers.

**Assessment:**

1. Ask students to explain how they know a number is even or odd.
2. Call out numbers to students and have them model on their place value mats.
3. Walk around and observe who can make pairs to identify even and odd numbers.
4. In a copybook or on a separate piece of paper, write a series of numbers. For example: 11, 14, 16, 17, 20, 22, 33, 39, 45, 18, 50
5. In their copybook or on the paper, have children fold the paper in half and set up 2 columns, odd and even, and write the numbers under the correct heading.
6. Collect and check.

**Internet site for odd and even numbers practice or center:**

[www.softschools.com/math/games/odd\\_even\\_number\\_game.jsp](http://www.softschools.com/math/games/odd_even_number_game.jsp)

Sample Lesson  
Grade 2

## Estimating, Counting, and Sorting

**Objectives:**

- Practice estimating, counting, and sorting.
- Write and solve math problems.
- Explore and appreciate the literature book, “The M & M’s Brand Chocolate Candies Counting Book” by Barbara Barbieri McGrath.

**Materials:**

- The children’s book “The M and M’s Brand Chocolate Candies Counting Book.”
- Pencils and paper
- Small bags of M and M’s candy (one for every two students)
- Internet access

**Procedure:**

1. Read “The M & M Brand Chocolate Candies Counting Book” to the children.
2. Discuss the concepts of estimation, simple addition, subtraction, forming sets, and color recognition mentioned in the book.
3. Distribute one small bag of M & M’s to each pair of children.
4. Have each group estimate “how many” M & M’s are in the bag and write their findings down on their paper.
5. The children will now open their bag, and take a real count of “how many” M & M’s there are in the bag.
6. The students will talk with their partner to see if how close they were to their estimate.
7. Have the students count how many of each color there are in the bag of M & M’s, and record their findings.
8. Discuss as a class:
  - Did all the bags have the same number of M & M’s?
  - Did all the bags have the same number of each color?
9. Send some children to the board to write addition and subtraction sentences, using the numbers recorded from the different colors of M & M’s.
10. The students can continue to practice these concepts at this website: [www.visualmathlearning.com](http://www.visualmathlearning.com). Click “Practice Exercises” and do the various games such as “Switcharoo Circle.”

**Assessment:**

- The teacher will observe the oral responses of the children.
- As one student from each group writes a number sentence at the board, students from the other groups can check to see if it is correct.

Sample Lesson  
Grade 3

## Multiplication Facts

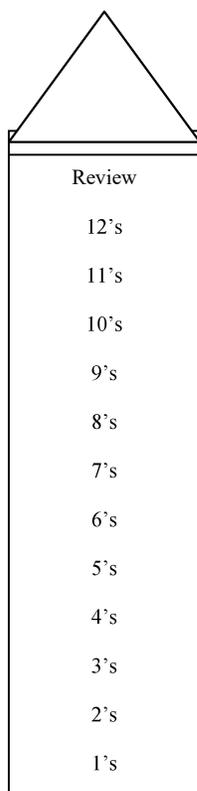
**Objective:** The students will practice and master multiplication facts.

**Procedure:**

1. Create a rocket ship, separating into 12 segments. One segment each for the 1's, 2's, 3's, 4's, 5's, 6's, 7's, 8's, 9's, 10's, 11's, 12's, and review. (ex. see rocket below)
2. Create an astronaut for each student. (you can find several in your clipart)
3. Make copies of 25 problems for each level. This website <http://www.math-drills.com> has worksheets of 100 problems for each level. You can cut the worksheets into 4 parts, creating 4 small sheets of 25 problems each.
4. Separate levels into files or envelopes.
5. Each day the students take a sheet depending on their level.
6. Students have 1 minute to finish 25 problems.
7. If they score 100%, they move up to the next level.

**Assessment:** Scores on each level and reaching the review level of the rocket ship

Rocket example



Sample Lesson  
Grade 4

## Angles

**Objective:** The students will determine the number of degrees for each angle of each pattern block by using the right angle of the square as a reference.

**Introduction:** Have the students examine the pattern blocks and discuss the definition of the various shapes. Stress that the square has four right angles (90).

**Materials:**

- Pattern blocks
- Pencil and paper

**Procedure:**

1. Have the students work individually with his or her own set of pattern blocks.
2. Have the student make a chart to record their data: the shape, the number of angles and the degree of the angles.
3. Have the student write a brief description of how he/she determined the angle.
4. Have the students measure their angle to check their accuracy and then record the measurement on their chart.

**Assessment:** The students would turn in their data chart with their recorded data, Measurements, and the description of their strategy.

**Source:**

Teaching Children Mathematics. December, 1995. Vol 2. #4. Reston: VA. NCTM.

Sample Lesson  
Grade 5

## Ratios

**Objective:** Students will use a ratio to describe a relationship between two numbers.

**Materials:**

- Colored chips
- Pencil and paper

**Procedure:**

1. Review what students know about fractions. Give each student a handful of colored chips. Have each student write down the number of chips of each color. Have students write down the fraction of chips of each color. Discuss the role of the numerator (describes part) and the denominator (describes whole – or total number of chips).
2. Ask all girls to stand. Tally the number of girls on the board. Ask boys to stand. Tally the number of boys on the board. Represent the number of girls and boys as fractions of the whole group. Introduce the idea of ratio. (*What if we want to compare the number of girls to boys? Could we just say 11 to 13... Can we compare the number of boys to girls? Let's see what will happen if we have 13 to 11...*)
3. Have the students work individually with his/her own set of colored chips.
4. Have the student lineup chips on his/her desk, according to color. (One color should be lined up above the other color. A pencil may be used to separate the two colors and to represent the fraction bar.)
5. Discuss the definition of ratio (describes the relationship between two numbers). Compare ratios to fractions. (Similarities should include: they look alike, they can both be reduced. Differences should include: fractions tell part-to-whole relationship, while ratios tell part-to-part relationship, we read them differently when reading aloud, ratios cannot be represented as a mixed number.)
6. Have students read the ratio of colored chips on his/her desk aloud, reducing if possible. Have the students write down the ratio.
7. Have students change desks and write down the ratio on another desk. Repeat until students grasp concept.

**Assessment:** Students will be able to describe the ratio of boys to girls and girls to boys in the class (without reverting to a mixed number).

## Math Websites

[www.Math.about.com](http://www.Math.about.com)

A website with something for everyone—lesson plan ideas, online games and links, all ages and levels.

[www.AtoZteacherstuff.com](http://www.AtoZteacherstuff.com)

Teacher-created site designed to help teachers find online resources more quickly and easily. Find lesson plans, thematic units, teacher tips, discussion forums for teachers, downloadable teaching materials & eBooks, printable worksheets and blacklines, emergent reader books, themes, and more.

[www.teachers.net/](http://www.teachers.net/)

Lesson plans, links, webchats, and numerous other resources for the educator

[www.edhelper.com](http://www.edhelper.com)

Create worksheets and design lesson plans using their worksheets and other information—grade levels from Pre-K to high school

[www.visualmathlearning.com](http://www.visualmathlearning.com)

A variety of resources are available to help educators and trainers learn about visual learning and Inspiration<sup>®</sup>, Kidspiration<sup>®</sup> and the new InspireData<sup>™</sup>.

[www.brainpopjr.com](http://www.brainpopjr.com)

BrainPOP Jr. provides educational movies and homework help for K-3 students. Each animated movie has quizzes, games, vocabulary, and activities for kids. BrainPOP Jr. is a great resource for teachers and homeschools, offering lesson plans and lesson ideas that develop critical thinking and inquiry skills.

[www.mathforum.org/teachers/elem/](http://www.mathforum.org/teachers/elem/)

Just about anything you need to teach math at any age level.

[www.eding.k12.mn.us/creekvalley.com](http://www.eding.k12.mn.us/creekvalley.com)

Assortment

[www.aaamath.com/](http://www.aaamath.com/)

Assortment

[www.guernsey.net/~sgibbs/roman.html](http://www.guernsey.net/~sgibbs/roman.html)

Roman Numeral conversions

<http://illuminations.nctm.org/LessonDetail.aspx?ID=L406>

Geometric shapes

[www.sesameworkshop.org/sesamestreet/games/flash.php?contentId=110740](http://www.sesameworkshop.org/sesamestreet/games/flash.php?contentId=110740)

Sorting PreK- 1 or 2

[www.teachrkids.com/](http://www.teachrkids.com/)

Assortment

[www.geocities.com/EnchantedForest/Tower/1217/math1.html](http://www.geocities.com/EnchantedForest/Tower/1217/math1.html)

Assortment

[www.shodor.org/interactivate/activities/tessellate/?version=1.6.0\\_05&browser=MSIE&vendor=Sun\\_Microsystems\\_Inc.](http://www.shodor.org/interactivate/activities/tessellate/?version=1.6.0_05&browser=MSIE&vendor=Sun_Microsystems_Inc.)

Tessellations

[cemc2.math.uwaterloo.ca/mathfrog/english/kidz/order.shtml](http://cemc2.math.uwaterloo.ca/mathfrog/english/kidz/order.shtml)

Order of operations

[school.discoveryeducation.com/searchresults.cfm?N=0&Nty=1&Ntk=all&bInPublic=1&Ntt=math](http://school.discoveryeducation.com/searchresults.cfm?N=0&Nty=1&Ntk=all&bInPublic=1&Ntt=math)

Assortment

[www.stccs.org/education/components/docmgr/default.php?sectiondetailid=324&catfilter=44](http://www.stccs.org/education/components/docmgr/default.php?sectiondetailid=324&catfilter=44)

Addition, subtraction, multiplication and division practice worksheets

[www.math-drills.com](http://www.math-drills.com)

Practice math skills

[A+ Math.com](http://A+Math.com)

Practice math skills

[Dude's Dilemma.com](http://Dude's Dilemma.com)

Practice math skills

[Math Skills Builder.com](http://Math Skills Builder.com)

Practice math skills

[Spacey Math.com](http://Spacey Math.com)

Practice math skills

[Rainforest Math.com](http://Rainforest Math.com)

Practice math skills

[www.harcourtschool.com/menus/math\\_advantage.html](http://www.harcourtschool.com/menus/math_advantage.html)

Concept Definitions across grade levels

[www.mathgoodies.com/lessons/vol1/perimeter.html](http://www.mathgoodies.com/lessons/vol1/perimeter.html)

Geometry website

[www.iit.edu/~smile/ma9517.html](http://www.iit.edu/~smile/ma9517.html)

Introduction to volume

[www.sdcoe.k12.ca.us/score/actbank/sjournal.htm](http://www.sdcoe.k12.ca.us/score/actbank/sjournal.htm)

Journaling

[www.nhusd.k12.ca.us/ALVE/ace/MATH/Math\\_Puzzles.html](http://www.nhusd.k12.ca.us/ALVE/ace/MATH/Math_Puzzles.html)

Math Puzzles

[aaamath.com/](http://aaamath.com/)

Measurement

[library.thinkquest.org/3804/](http://library.thinkquest.org/3804/)

Metric Matters

[www.dositey.com/math34.htm](http://www.dositey.com/math34.htm)

Math worksheets for 4th grade

[www.homeschoolmath.net/worksheets/grade\\_4.php](http://www.homeschoolmath.net/worksheets/grade_4.php)

More math worksheets for 4th grade

[www.berghuis.co.nz/abiator/maths/mcindex.html](http://www.berghuis.co.nz/abiator/maths/mcindex.html)

Place value and problem solving

[jc-schools.net/terranova-res.htm](http://jc-schools.net/terranova-res.htm)

Terra Nova practice skills

[www.blountk12.org/LearningLinks/terranova.htm](http://www.blountk12.org/LearningLinks/terranova.htm)

Terra Nova information and practice

[www.thelearningpage.org/fun\\_sites/CappsG\\_TerraNova.htm](http://www.thelearningpage.org/fun_sites/CappsG_TerraNova.htm)

Terra Nova math practice

[www.iit.edu/~smile/ma9315.html](http://www.iit.edu/~smile/ma9315.html)

What's my area- a lesson plan for teachers

[www.harcourtschool.com/menus/math\\_advantage.html](http://www.harcourtschool.com/menus/math_advantage.html)

Concept Definitions across grade levels

[www.mathgoodies.com/lessons/vol1/perimeter.html](http://www.mathgoodies.com/lessons/vol1/perimeter.html)

Geometry website

[www.lessonplanspage.com/Math45.htm](http://www.lessonplanspage.com/Math45.htm)

Great math lessons (various skills)

[www.iit.edu/~smile/ma9517.html](http://www.iit.edu/~smile/ma9517.html)

Introduction to volume

[www.learningplanet.com/](http://www.learningplanet.com/)

Learning Planet

[www.scholastic.com/](http://www.scholastic.com/)

Scholastic

[www.sheppardsoftware.com/web\\_games.htm](http://www.sheppardsoftware.com/web_games.htm)

State Games

[www.ecokids.ca/pub/index.cfm](http://www.ecokids.ca/pub/index.cfm)

Eco Kids

[yucky.discovery.com/noflash/fun\\_n\\_games/category\\_icky.html](http://yucky.discovery.com/noflash/fun_n_games/category_icky.html)

Discovery Kids Yucky Lab Activities

[www.brainpop.com/](http://www.brainpop.com/)

Brain Pop

[www.funbrain.com/](http://www.funbrain.com/)

Funbrain.com

[www.learningplanet.com/act/mayhem/](http://www.learningplanet.com/act/mayhem/)

Math Mayhem

[www.visualfractions.com/](http://www.visualfractions.com/)

Visual Fractions – Online Visual Fraction Tutorial

[nces.ed.gov/nceskids/index.asp](http://nces.ed.gov/nceskids/index.asp)

National Center for Education Statistics

[www.coolmath4kids.com/](http://www.coolmath4kids.com/)

Cool Math 4 Kids

[nces.ed.gov/nceskids/createagraph/](http://nces.ed.gov/nceskids/createagraph/)

Create a graph

[www.multiplication.com/interactive/quickflash/flash/index.html](http://www.multiplication.com/interactive/quickflash/flash/index.html)

Multiplication Tables Practice

[www.coolmath-games.com/lemonade/](http://www.coolmath-games.com/lemonade/)

Lemonade Stand

[www.eduplace.com/math/brain/](http://www.eduplace.com/math/brain/)

Brain Teasers

[www.khanacademy.org](http://www.khanacademy.org)

<http://education.jlab.org/solquiz/>

Good practice problems

[http://alex.state.al.us/lesson\\_view.php?id=24049](http://alex.state.al.us/lesson_view.php?id=24049)

Box and Whiskers

[http://nces.ed.gov/nceskids/help/user\\_guide/graph/howto.asp](http://nces.ed.gov/nceskids/help/user_guide/graph/howto.asp)

Graphing Tutorial

<http://www.heimath.com/main/samples/us18/teacherstemplate.html>

Balancing Equations Flipbook

Pre-K

<http://www.prekinders.com/math-center/>

<http://softschools.com/grades/preschool>

<http://www.ixl.com/promo?partner=google&campaign=1208&adGroup=kindergarten+math&gclid=CPvhw--Cn74CFYw70god7zsA0Q>

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**Additional Resources for 4th Grade Teachers**

**Books**

4th Grade Math Practice (Scholastic) (Paperback)- by [Terry Cooper](#) (Editor)

[Math Strategies You Can Count On: Tools & Activities To Build Math Appreciation, Understanding & Skills](#) by Char Forsten

[Math Dictionary for Kids: The Essential Guide to Math Terms, Strategies, and Tables](#) by Theresa R. Fitzgerald