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
A. Number Sense
The student will:
   - 1. __________ Count orally from 1 to 20
   - 2. __________ Touch and count objects 1 to 10
   - 3. __________ Recognize numerals from 1 to 10 in random order
   - 4. __________ Recognize the difference between numbers and letters
   - 5. __________ Equate “zero” to quantity of nothing
   - 6. __________ Print some numerals 1 to 10
   - 7. __________ Demonstrate 1 to 1 correspondence

B. Addition and Subtraction
The student will:
   - 1. __________ Guess the amount of objects before counting
   - 2. __________ Use concrete objects to perform addition and subtraction with sums and differences
   - 3. __________ Compare equal to, less than, greater than

C. Multiplication and Division – No objectives

D. Properties – No objectives

E. Fractions/Decimals/Percents – No objectives

II. MEASUREMENT
A. Linear Measurement
The student will:
   - 1. __________ Guess the relative length of objects (i.e., longer, shorter or the same) before measuring

B. Weight
The student will:
   - 1. __________ Identify common objects as heavy or light to demonstrate understanding of the terms
C. Temperature – No objectives

D. Time/Money
The student will:
  1. __________ Recognize a clock and a calendar as measures of time
  2. __________ Identify time (i.e., night-day; morning-afternoon; today-tomorrow-yesterday; day-week-month)

E. Capacity
The student will:
  1. __________ Identify quantity and volume (i.e., full-empty; more than-less than)
  2. __________ Experiment with and manipulate dry and liquid substances

III. GEOMETRY
The student will:
  1. __________ Identify the location of an object (i.e., top-bottom; over-under; outside-inside)
  2. __________ Identify basic shapes (i.e., circle, square, triangle, diamond, heart, oval, rectangle)
  3. __________ Match shapes
  4. __________ Sort objects by size and by weight
  5. __________ Draw simple shapes without a pattern (i.e., circle, square, triangle)

IV. STATISTICS, PROBABILITY AND DATA ANALYSIS
The student will:
  1. __________ Recognize and create pictographs, simple bar graphs and make graphs with concrete objects

V. ALGEBRA
The student will:
  1. __________ Recognize and duplicate simple sequential patterns using manipulatives (i.e., red block, blue block, red block or ABAB)
  2. __________ Identify an object that does not belong in a specific group
  3. __________ Separate objects to form new groups (i.e., groups of animals such as baby animals and adult animals or farm animals and zoo animals)

VOCABULARY - Long, longer, short, shorter, tall, taller, small, medium, large, more, less, big, little, heavier, lighter, near, far
A “major goal for K-8 mathematics education should be proficiency with fractions (including decimals, percents and negative fractions), for such proficiency is foundational for algebra. Proficiency with whole numbers is a necessary precursor for the study of fractions as are aspects of measurement and geometry. These three areas - whole numbers, fractions and particular aspects of geometry and measurements are the Critical Foundations of Algebra”.

It is expected that teachers will use technology when appropriate and available.

It is the intention that teachers are held accountable for the objectives in this curriculum and not necessarily for the contents of an entire or particular textbook.

**Benchmarks for Critical Foundations**
The following benchmarks should be mastered by most students prior to the years given. If they are not met by the indicated grade, intervention is most likely required.

**Fluency With Whole Numbers:**
1. By the end of Grade 2, students should be proficient with the addition and subtraction of whole numbers.
2. By the end of Grade 4, students should be proficient with multiplication and division of whole numbers.

**Fluency with Fractions:**
1. By the end of Grade 4, students should be able to identify and represent fractions and decimals, and compare them on a number line or with other common representations of fractions and decimals.
2. By the end of Grade 5, students should be proficient with comparing fractions and decimals and common percents, and with the addition and subtraction of fractions and decimals.
3. By the end of Grade 6, students should be proficient with multiplication and division of fractions and decimals.
4. By the end of Grade 6, students should be proficient with all operations involving positive and negative integers.
5. By the end of Grade 7, students should be proficient with all operations involving positive and negative fractions.
6. By the end of Grade 7, students should be able to solve problems involving percent, ratio, and rate and extend this work to proportionality.
Geometry and Measurement:
1. By the end of Grade 5, students should be able to solve problems involving perimeter and area of triangles and all quadrilaterals having at least one pair of parallel sides (ex: trapezoids).
2. By the end of grade 5: students should be able to convert customary units of measure.
3. By the end of Grade 6, students should be able to analyze the properties of two-dimensional shapes and solve problems involving perimeter and area, and analyze the properties of three-dimensional shapes and solve problems involving surface area and volume.
4. By the end of grade 6: students should be able to convert metric units of measure.
5. By the end of Grade 7, students should be familiar with the relationship between similar triangles and the concept of the slope of a line.
6. By the end of grade 7: students should be able to convert between customary and metric units of measure.

Usage of Calculators: Calculators should be discouraged in grades k-5. Calculators should be used judiciously in grades 6-8 when the skill focuses on process rather than computation. When used, proper use of calculators must be taught.
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 ¼ and ½
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
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
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)
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
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., ¼ 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
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
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 1/4 and 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.
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

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 9th 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 8th grade. It provides students with a solid pre-algebra program before they enter the Algebra I high school course.

Non-Algebra Sequence

6th 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., $\frac{1}{2} \times 2 = 1$)
- 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)

II. MEASUREMENT
The student will:
- 1. ________ Continue to measure with accuracy to the nearest $\frac{1}{16}$ 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
7th 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 1/16th 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)
8th 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 1/16th 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
Mathematics Curriculum  
Diocese of Richmond

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

6th 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., \( \frac{1}{2} \times 2 = 1 \))
- 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 1/16th 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
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\textsuperscript{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
5. _______ 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:
     o motion in the same direction
     o motion in opposite directions
     o 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 is 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, Multiply, 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°-45°-90° or a 30°-60°-90° triangle when the length of the third side is known
- 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, multiply, 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°, 30°, 45°, 60°, 90°, 180°) 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-intercepts, 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° – 60° – 90° and 45° – 45° – 90° 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

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:
  \[ \int f'(x) \, dx = f(b) - f(a) \]
- 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. SUMMARYING 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 an 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 ≥ 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 ≥ 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 R²
- 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. _______ Binominal 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
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.
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
Objectives:
- Practice estimating, counting, and sorting.
- Write and solve math problems.

Materials:
- Pencils and paper
- Small bags of M and M’s candy (one for every two students)
- Internet access

Procedure:
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:
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 number (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 ships 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
A website with something for everyone—lesson plan ideas, online games and links, all ages and levels.

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

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

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 homeschoois, offering lesson plans and lesson ideas that develop critical thinking and inquiry skills.

www.mathforum.org/teachers/elm/
Just about anything you need to teach math at any age level.

www.eding.k12.mn.us/creekvalley.com
Assortment

www.aaamath.com/
Assortment

www.guernsey.net/~sgibbs/roman.html
Roman Numeral conversions
Mathematics Curriculum
Diocese of Richmond

http://illuminations.nctm.org/LessonDetail.aspx?ID=L406
Geometric shapes

www.sesameworkshop.org/sesamestreet/games/flash.php?contentId=110740
Sorting PreK- 1 or 2

www.teachrkids.com/
Assortment

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.
Tessellations

cemc2.math.uwaterloo.ca/mathfrog/english/kidz/order.shtml
Order of operations

school.discoveryeducation.com/searchresults.cfm?N=0&Nty=1&Ntk=all&blnPublic=1&Ntt=math
Assortment

www.stccs.org/education/components/docmgr/default.php?sectiondetailid=324&catfilter=44
Addition, subtraction, multiplication and division practice worksheets

www.math-drills.com
Practice math skills

A+ Math.com
Practice math skills

Dude's Dilemma.com
Practice math skills

Math Skills Builder.com
Practice math skills

Spacey Math.com
Practice math skills

Rainforest Math.com
Practice math skills
www.harcourtschool.com/menus/math_advantage.html
Concept Definitions across grade levels

www.mathgoodies.com/lessons/vol1/perimeter.html
Geometry website

www.iit.edu/~smile/ma9517.html
Introduction to volume

www.sdcoe.k12.ca.us/score/actbank/sjournal.htm
Journaling

www.nhusd.k12.ca.us/ALVE/ace/MATH/Math_Puzzles.html
Math Puzzles

aaamath.com/
Measurement

library.thinkquest.org/3804/
Metric Matters

www.dositey.com/math34.htm
Math worksheets for 4th grade

www.homeschoolmath.net/worksheets/grade_4.php
More math worksheets for 4th grade

www.berghuis.co.nz/abiator/maths/mcindex.html
Place value and problem solving

jc-schools.net/terranova-res.htm
Terra Nova practice skills

www.blountk12.org/LearningLinks/terranova.htm
Terra Nova information and practice

www.thelearningpage.org/fun_sites/CappsG_TerraNova.htm
Terra Nova math practice

www.iit.edu/~smile/ma9315.html
What’s my area- a lesson plan for teachers

www.harcourtschool.com/menus/math_advantage.html
Concept Definitions across grade levels
<table>
<thead>
<tr>
<th>Website</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://www.mathgoodies.com/lessons/vol1/perimeter.html">www.mathgoodies.com/lessons/vol1/perimeter.html</a></td>
<td>Geometry website</td>
</tr>
<tr>
<td><a href="http://www.lessonplanspage.com/Math45.htm">www.lessonplanspage.com/Math45.htm</a></td>
<td>Great math lessons (various skills)</td>
</tr>
<tr>
<td><a href="http://www.iit.edu/~smile/ma9517.html">www.iit.edu/~smile/ma9517.html</a></td>
<td>Introduction to volume</td>
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<tr>
<td><a href="http://www.learningplanet.com/">www.learningplanet.com/</a></td>
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<td><a href="http://www.scholastic.com/">www.scholastic.com/</a></td>
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<td><a href="http://www.sheppardsoftware.com/web_games.htm">www.sheppardsoftware.com/web_games.htm</a></td>
<td>State Games</td>
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<td><a href="http://www.ecokids.ca/pub/index.cfm">www.ecokids.ca/pub/index.cfm</a></td>
<td>Eco Kids</td>
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<td>yucky.discovery.com/noflash/fun_n_games/category_icky.html</td>
<td>Discovery Kids Yucky Lab Activities</td>
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<td><a href="http://www.brainpop.com/">www.brainpop.com/</a></td>
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<td><a href="http://www.funbrain.com/">www.funbrain.com/</a></td>
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<td><a href="http://www.learningplanet.com/act/mayhem/">www.learningplanet.com/act/mayhem/</a></td>
<td>Math Mayhem</td>
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<tr>
<td>nces.ed.gov/nceskids/index.asp</td>
<td>National Center for Education Statistics</td>
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www.coolmath4kids.com/
Cool Math 4 Kids

nces.ed.gov/nceskids/createagraph/
Create a graph

Multiplication Tables Practice

www.coolmath-games.com/lemonade/
Lemonade Stand

www.eduplace.com/math/brain/
Brain Teasers

www.khanacademy.org

http://education.jlab.org/solquiz/
Good practice problems

http://alex.state.al.us/lesson_view.php?id=24049
Box and Whiskers

http://nces.ed.gov/nceskids/help/user_guide/graph/howto.asp
Graphing Tutorial

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
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