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.

<u>Geometry and Measurement</u>:
1. By the end of Grade 5, students should 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 analyse 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.

<u>Usage of Calculators</u>: 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

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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 muti-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. ALEGEBRA
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., ½ * 2 = 1)
- ❑   2. _____ Use the commutative, associative and identity properties and zero property of multiplication to demonstrate that expressions in different forms can be equivalent

E.   Fractions/Decimals/Percents
The student will:
- ❑   1. _____ Find the least common multiple and the greatest common factor
- ❑   2. _____ Find the least common denominator for two or more fractions
- ❑   3. _____ Add and subtract fractions with like and unlike denominators
- ❑   4. _____ Add and subtract mixed numbers with like and unlike denominators
- ❑   5. _____ Change terminating decimals to fractions and fractions to decimals
- ❑   6. _____ Add and subtract decimals
- ❑   7. _____ Round numbers less than 1 to tenths, hundredths and thousandths
- ❑   8. _____ Multiply and divide decimals (with both whole numbers and decimals in the divisor)

The student will:
- ❑   1. _____ Multiply fractions and mixed numbers
- ❑   2. _____ Identify and use reciprocal numbers
- ❑   3. _____ Divide fractions and mixed numbers
- ❑   4. _____ Round decimals and fractions
- ❑   5. _____ Convert between fractions, decimals and percent

II. MEASUREMENT

The student will:
- ❑   1. _____ Continue to measure with accuracy to the nearest $1/16^{th}$ inch and millimeter
- ❑   2. _____ Continue to convert customary units of measure
- ❑   3. _____ Convert metric units of measurement using multiplication and division

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

The student will:
- ❑   1. _____ Identify properties of supplementary and complementary angles
- ❑   2. _____ Define properties of triangles as a figure whose interior angles add up to 180 degrees
- ❑   3. _____ Define basic transformations to include translation, reflection and rotation
- ❑   4. _____ Use 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 $1/16^{th}$ inch and millimeter
- 2. _____ Continue to convert customary units of measure
- 3. _____ Continue to convert metric units of measurement using multiplication and division
- 4. _____ Continue to convert between customary and metric units of measure

III. GEOMETRY

Students will use formulas appropriately.

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

IV. STATISTICS, PROBABILITY AND DATA ANALYSIS

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

❑   1. _____ Continue to choose the most appropriate way to display, interpret and make predictions with a variety of data, using measures of central tendency when appropriate

❑   2. _____ Continue to recognize and be able to give examples of how the display of data sets can be manipulated to be misleading

❑   3. _____ Apply and analyze probabilities of multiple events (dependent and independent) using a variety of methods such as organized lists, tree diagrams and area models; record results as fractions, decimals and percents

❑   4. _____ Construct and analyze a scatter plot; draw a trend line through the data to make predictions, define and accurately use the terms positive correlation, negative correlation and no correlation

❑   5. _____ Continue to identify and describe permutations or combinations using the Counting Principle or a tree diagram

V. ALGEBRA

Students will use formulas appropriately. The student will:

❑   1. _____ Continue to solve problems about similar objects by using the scale factors and proportions that relate corresponding lengths

❑   2. _____ Continue to use and understand proportional relationships to solve a variety of problems

❑   3. _____ Continue to solve and graph linear multi-step equations with one or two variables

❑   4. _____ Continue to use the properties of equality to express an equation in a new way, and then demonstrate that the solutions obtained for the new equation also serve the original equation

❑   5. _____ Continue to use linear graphing to represent and solve problems, using slope-intercept form

❑   6. _____ Continue to write, evaluate and simplify an algebraic expression for a given situation using any number of variables

❑   7. _____ Write, solve and graph solutions of two-step inequalities with a single variable

❑   8. _____ Introduce solving two variable inequalities and graphing solutions on a coordinate plane

❑   9._____ Continue to recognize connections between any two representations (tables, graphs, words and equations of a given relationship, especially functions); determine whether a relation is a function

❑   10._____ Write a function rule for arithmetic sequences

❑   11. _____ Identify domain and range of a relation; identify independent and dependent variable in a relation

❑   12. _____ Solve literal linear equations for a given variable

Algebra I Sequence

Grade 6, Grade 7 (Pre-Algebra), Grade 8 (Alegbra 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., ½ * 2 = 1)
- ❑   2. _____ Use the commutative, associative and identity properties and zero property of multiplication to demonstrate that expressions in different forms can be equivalent

E.   Fractions/Decimals/Percents
The student will:
- ❑   1. _____ Multiply fractions and mixed numbers
- ❑   2. _____ Identify and use reciprocal numbers
- ❑   3. _____ Divide fractions and mixed numbers
- ❑   4. _____ Round decimals and fractions
- ❑   5. _____ Convert between fractions, decimals and percent
- ❑   6. _____ Calculate the percent of a number
- ❑

II. MEASUREMENT

The student will:
- ❑   1. _____ Continue to measure with accuracy to the nearest $1/16^{th}$ inch and millimeter
- ❑   2. _____ Continue to convert customary units of measure
- ❑   3. _____ Convert metric units of measurement using multiplication and division

III. GEOMETRY
Goal: Students will identify, define and calculate area, perimeter, volume and surface area of two-dimensional and three-dimensional figures using the proper formulas and tools, in real-world and mathematical problems. Students will use formulas appropriately.
The student will:
- ❑   1. _____ Identify properties of supplementary and complementary angles
- ❑   2. _____ Define properties of triangles as a figure whose interior angles add up to 180 degrees
- ❑   3. _____ Define basic transformations to include translation, reflection and rotation
- ❑   4. _____ Use tessellations to rotate and reflect geometric figures
- ❑   5. _____ Use geometric tools (protractor, straight edge) to draw and measure angles, triangles, squares and rectangles
- ❑   6. _____ Define similar and congruent figures and their corresponding line segments and angles
- ❑   7. _____ Identify properties of vertical, adjacent and straight angle
- ❑   8. _____ Calculate the area of squares, triangles, rectangles, parallelograms and circles and explain why the formulas are valid (with manipulatives and concrete examples)
- ❑   9. _____ Find volume and surface area of rectangular and triangular prisms
- ❑   10. _____ Solve area and volume problems where the area or volume is given, but one length is missing
- ❑   11. _____ Understand and graph in the coordinate plane in all quadrants
- ❑   12. _____ Identify properties of quadrilaterals

IV. STATISTICS, PROBABILITY AND DATA ANALYSIS
Goal: Represent probabilities using whole numbers, fractions, decimals and percents.
The student will:
- 1. _____ Construct, interpret and analyze bar graphs, line graphs, pictographs, histograms and circle graphs using fractions, decimals and percents
- 2. _____ Calculate probabilities of dependent and independent events and make Predictions using real-world and mathematical problems with fractions, decimals and percents
- 3. _____ Theoretical and experimental probability
- 4. _____ Measures of central tendency: mean, median, mode and range

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

(7th Grade – Pre-Algebra)

I. NUMBERS AND OPERATIONS

A. Number Sense
The student will:
- ❑ 1. _____ Identify squares of numbers from 1-20
- ❑ 2. _____ Define a square root as the inverse operation to squaring a number
- ❑ 3. _____ Find the square roots using tables, estimation and calculators
- ❑ 4. _____ Apply order of operations to simplify expressions

B. Addition and Subtraction – No objectives
Students should continue to practice skills..

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

D. Properties – No objectives
Students should continue to practice skills.

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

II. MEASUREMENT

The student will:
- ❑   1. _____ Continue to measure with accuracy to the nearest $1/16^{th}$ inch and millimeter
- ❑   2. _____ Continue to convert customary units of measure
- ❑   3. _____ Continue to convert metric units of measurement using multiplication and division
- ❑   4. _____ Convert between customary and metric units of measure

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

IV. STATISTICS, PROBABILITY AND DATA ANALYSIS

Students will use formulas appropriately. The student will:

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

V. ALGEBRA

Students will use formulas appropriately. The student will:

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

I.　EXPRESSIONS AND EQUATIONS

The student will:

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

II.　REAL NUMBERS

The student will:

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

III.　LINEAR FUNCTIONS

The student will:

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

IV.　　PROPORTIONAL REASONING

The student will:
- ❑　1. _____ Solve problems using ratio and proportion
- ❑　2. _____ Use proportions and similar triangles to reduce and enlarge figures
- ❑　3. _____ Solve percent problems using ratio and proportion
- ❑　4. _____ Solve direct, inverse and joint variation problems
- ❑　5. _____ Solve percent problems using ratio and proportion

V.　　RELATIONS AND FUNCTIONS

The student will:
- ❑　1. _____ Compare and contrast concepts of relations and functions
- ❑　2. _____ ^Determine the domain and range using graphs, ordered pairs and symbolic expressions
- ❑　3. _____ Define a function through the use of tables and graphs

VI.　　LINEAR FUNCTIONS

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

VII.　　LINEAR INEQUALITIES

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

VIII.   SYSTEMS OF EQUATIONS/INEQUALITIES

The student will:

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

IX.   POLYNOMIALS

The student will:

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

X.   FACTORING

The student will:

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

XI.   QUADRATIC FUNCTIONS

The student will:

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

XII. OTHER NONLINEAR FUNCTIONS

The student will: (Using an *xy* table)
- ❑ 1. _____ Plot cubic functions
- ❑ 2. _____ Plot exponential functions
- ❑ 3. _____ Plot the square root functions
- ❑ 4. _____ Plot the rectangular hyperbolic (a.k.a. the reciprocal) functions
- ❑ 5. _____ Graph absolute value functions

XIII. RATIONAL EXPRESSIONS AND EQUATIONS

The student will:
- ❑ 1. _____ Simplify rational expressions
- ❑ 2. _____ Multiply and divide rational expressions
- ❑ 3. _____ Add and subtract rational expressions with like denominators using variables
- ❑ 4. _____ Add and subtract rational expressions with unlike denominators using variables
- ❑ 5. _____ Simplify mixed expressions and complex fractions
- ❑ 6. _____ Solve rational equations
- ❑ 7. _____ Simplify expressions using negative exponents

XIV. RADICAL EXPRESSIONS AND EQUATIONS

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

XV. ALGEBRAIC LOGIC

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

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

Technology and Graphic Calculators

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

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

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

I.   REVIEW OF BASIC ALGEBRAIC CONCEPTS

The student will:

❑   1. _____ Identify, distinguish among, compare, order, and use various subsets of the real number system:
- natural numbers
- whole numbers
- integers
- rational numbers
- irrational numbers
- real numbers

❑   2. _____ Understand basic algebraic properties and use them efficiently to simplify algebraic expressions:
- reflexive, symmetric, and transitive properties
- associative properties
- commutative properties
- closure properties
- identity properties
- property of reciprocals
- property of opposites
- property of opposites of a sum
- multiplicative and additive properties of equalities and inequalities

❑   3. _____ Apply the order of operations to simplify and evaluate expressions with and without variables and grouping symbols involving:
- fractions
- decimals
- negatives
- absolute value
- exponents

II.   SOLVING EQUATIONS AND PROBLEMS

The student will:

❑   1. _____ Use appropriate algebraic vocabulary:
- equation
- solve
- like (similar) terms
- combine like terms
- replacement set
- solution set

❑   2. _____ Translate verbal statements into algebraic expressions/equations and vice versa

❑   3. _____ Solve equations in one variable by applying real number properties

❑   4. _____ Solve multiple variable equations for a specific variable (literal equations)

❑   5. _____ Solve equations and problems with variables on both sides

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

III.   POLYNOMIALS
The student will:
❑   1. _____ Use appropriate algebraic vocabulary:
- monomial, binomial, trinomial, polynomial
- degree of a variable in a monomial
- degree of a monomial
- degree of a constant term
- degree of a polynomial

❑   2. _____ Write a polynomial 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 a ellipse, graph an ellipse, and find the center, vertices, co-vertices, and foci

XIV.   LINEAR ALGEBRA (MATRICES)

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

XV.   LOGARITHMIC AND EXPONENTIAL FUNCTIONS

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

XVI.   SEQUENCES & SERIES

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

XVII.   PROBABILTY

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 know
- ❑   7. _____ Solve right triangle problems by using the sine, cosine and tangent ratios

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

XI.   CONSTRUCTIONS

The student will:

❑   1. _____ Show proof of geometric theorems using construction tools (straight edge and compass)

XII.   AREAS OF PLANE FIGURES

The student will:

❑   1. _____ Use the formulas for the areas of rectangles, parallelograms, triangles, rhombuses, trapezoids and regular polygons

❑   2. _____ Apply the relationships between scale factors, perimeters and areas of similar figures

❑   3. _____ Use areas to solve problems involving geometric probability

XIII.   AREA AND VOLUME OF SOLIDS

The student will:

❑   1. _____ Apply the formulas for the surface area of prisms, cylinders, pyramids, cones and spheres

❑   2. _____ Apply the formulas for volume of prisms, cylinders, pyramids, cones and spheres

❑   3. _____ Recognize the properties of similar solids

XIV.   COORDINATE GEOMETRY

The student will:

❑   1. _____ Apply the distance and midpoint formula

❑   2. _____ Understand the basic properties of vectors

❑   3. _____ Given a polygon, choose a convenient placement of coordinate axes and assign appropriate coordinates

❑   4. _____ Prove statements by using coordinate geometry methods

XV.   TRANSFORMATIONS

The student will:

❑   1. _____ Recognize and use terms: *image, preimage, mapping, one-to-one mapping, transformation, isometry* and *congruence mapping*

❑   2. _____ Recognize and use terms *identity* and *inverse* in relation to mappings

❑   3. _____ Locate images of figures by reflection, translation and glide reflection, rotation, dilation/reduction, composites of mapping

❑   4. _____ Describe the symmetry of figures and solids

❑   5. _____ Recognize tessellations

I.   ALGEBRA CONCEPTS
The student will:
- ❑   1. _____ Recognize monomials and polynomials, and add, subtract, multiply and divide polynomials
- ❑   2. _____ Review methods for factoring polynomials
- ❑   3. _____ Review how to reduce, multiply, divide, add and subtract rational expressions
- ❑   4. _____ Simplify complex fractions
- ❑   5. _____ Solve rational equations and inequalities
- ❑   6. _____ Review evaluating square roots and rational exponents

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

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

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

V. COMPLEX NUMBERS
The student will:
- ❑ 1. _____ Identify the real and imaginary components of complex numbers
- ❑ 2. _____ Simplify square roots of negative numbers
- ❑ 3. _____ Add, subtract, multiply and divide complex numbers

VI. LOGARITHMIC FUNCTIONS
The student will:
- ❑ 1. _____ Change exponential expressions to logarithmic expressions
- ❑ 2. _____ Change logarithmic expressions to exponential expressions
- ❑ 3. _____ Evaluate, determine the domain and graph logarithmic functions
- ❑ 4. _____ Solve problems using direct, indirect and joint variation
- ❑ 5. _____ Solve logarithmic equations using properties of logarithms
- ❑ 6. _____ Solve logarithmic and exponential equations using a graphing utility

VII. CONICS
The student will:
- ❑ 1. _____ Identify conic sections: (refer to section C)
- ❑ 2. _____ Discuss and graph conics (refer to section C)
- ❑ 3. _____ Recognize and analyze conic sections equations given in general form
- ❑ 4. _____ Graph and interpret systems of conic sections (include inequalities)

VIII. LINEAR ALGEBRA (MATRICES)

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

IX. SEQUAENCES & 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. PROBABILTY

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*-intercept, turns, symmetry, end behavior, etc.)
- ❑   3. _____ Develop a connection between factors, zeroes, *x*-intercepts, and solutions to $f(x) = 0$
- ❑   4. _____ Review transformations and combinations of functions
- ❑   5. _____ Apply horizontal line test to determine if a function is invertible
- ❑   6. _____ Find inverse functions
- ❑   7. _____ Determine equations from graphs
- ❑   8. _____ Develop rules for graphing functions

III.   POLYNOMIAL FUNCTIONS

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

IV.   RATIONAL FUNCTIONS
The student will:
- ❑   1. _____ Solve inequalities (linear, absolute value, polynomial, and rational)
- ❑   2. _____ Graph inequalities (linear, absolute value, polynomial, and rational)
- ❑   3. _____ Graph rational functions
- ❑   4. _____ Identify vertical, horizontal, and slant asymptotes
- ❑   5. _____ Identify the range, domain, and intercepts
- ❑   6. _____ Analyze rational functions
- ❑   7. _____ Introduce limits
- ❑   8. _____ Perform partial fraction decomposition
- ❑   9. _____ Identify end behavior

V.   EXPONENTIAL AND LOGARITHMIC FUNCTIONS
The student will:
- ❑   1. _____ Graph exponential and logarithmic functions
- ❑   2. _____ Analyze exponential and logarithmic functions
- ❑   3. _____ Evaluate logarithms, exponentials, and radicals
- ❑   4. _____ Evaluate, determine the domain, and graph logarithmic functions
- ❑   5. _____ Use laws of exponents / logarithms
- ❑   6. _____ Use patterns for exponents and logarithms
- ❑   7. _____ Use zeros of equations applying exponents, radicals, and logarithms to estimate
- ❑   8. _____ Perform composition and inversion of functions
- ❑   9. _____ Solve exponential growth and decay problems
- ❑   10. _____ Create and use normal distribution graphs

VI.   TRIGONOMETRY
The student will:
- ❑   1. _____ Define degree and radian measure
- ❑   2. _____ Convert between degree and radian measure
- ❑   3. _____ Define trig functions using the unit circle, right triangles, and trig functions of any angle
- ❑   4. _____ Calculate arc length and sector area of circles
- ❑   5. _____ Evaluate angular/linear velocity
- ❑   6. _____ Know trigonometric function values for all integral multiples of $\frac{\pi}{6}$ and $\frac{\pi}{4}$
- ❑   7. _____ Use $30° - 60° - 90°$ 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 PROBABILTY
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:
  $$\int_a^b f'(x)dx = f(b) - f(a).$$
- ❑   3. _____ Understand and use the basic properties of definite integrals, including additivity and linearity

B.   Applications of Integrals

The student will:

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

C.   Fundamental Theorem of Calculus

The student will:

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

D.   Techniques of Antidifferentiation

The student will:

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

E.   Applications of Antidifferentiation

The student will:

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

F.   Numerical Approximations to Definite Integrals

The student will:

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

I. SUMMARIZING DATA WITH FREQUENCY TABLES

The student will:

❑ 1. _____ Organize or normalize data into a frequency table or relative distribution table

❑ 2. _____ Construct a joint frequency contingency table from two categorical variables

❑ 3. _____ Construct a frequency polygon and a frequency curve from a frequency (or relative frequency) distribution

❑ 4. _____ Construct an objective given a relative cumulative frequency distribution

❑

II. PICTURES OF DATA

The student will:

❑ 1. _____ Develop methods of displaying numerical data in a organized form

❑ 2. _____ Construct a histogram from a frequency distribution

❑ 3. _____ Distinguish between a histogram and a stem-and-leaf diagram

❑ 4. _____ Construct a bar graph from given data

❑ 5. _____ Construct a circle graph from given data

❑ 6. _____ Identify distortions (illustrations) in graphs or picture charts

❑ 7. _____ Plot points on a scattergram when given a bivariate distribution

❑ 8. _____ Construct a Normal curve for data and standardized data

❑ 9. _____ Construct a box and whisker plot

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

III. MEASURES OF CENTER

The student will:

❑ 1. _____ Compute the mean, median, and mode for a set of numbers

❑ 2. _____ Describe common characteristics of the mean, median, and mode

❑ 3. _____ Compute harmonic and geometric means for a set of data

❑ 4. _____ Locate the relative positions of the mean, median, and mode on a skewed frequency distribution

❑ 5. _____ Describe how measures of dispersion differ from measures of central tendency

❑ 6. _____ Determine an appropriate measure of central tendency for data scaled on nominal, ordinal, interval, and ratio levels

❑ 7. _____ Explain why the mean is influenced by extreme values in a distribution while the median is relatively unaffected by extreme values

IV.   MEASURE OF VARIATION

The student will:

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

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

V.   MEASURES OF POSITION

The student will:

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

VI.   HYPOTHESIS TESTING

The student will:

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

VII.   CONFIDENCE INTERVALS

The student will:

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

VIII.   CORRELATION AND REGRESSION

The student will:

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

IX.   CHI-SQUARE TEST & F-DISTRIBUTION

The student will:

- ❑   1. _____ Define "Goodness-of-Fit"
- ❑   2. _____ Define and assess independence
- ❑   3. _____ Compare two variances
- ❑   4. _____ Define when to use an ANOVA
- ❑   5. _____ Properly run and interpret an ANOVA

X.   GENERAL CONCEPTS/DISTRIBUTIONS NAMES

The student will:

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

XI.   NON-PARAMETRIC TEST (*Time permitting)

The student will:

- ❑   1. _____ Sign test
- ❑   2. _____ Wilcoxon tests
- ❑   3. _____ Kruskal-Wallis test
- ❑   4. _____ Rank correlation

Sample Lesson
Kindergarten

Making Patterns

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

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

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

Assessment:
- Teacher observations
- Pattern papers

Resource: mathforum.org

Sample Lesson
Grade 1

Odd and Even Numbers

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

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

Procedure:

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

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

Assessment:

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

Internet site for odd and even numbers practice or center:
www.softschools.com/math/games/odd_even_number_game.jsp

Sample Lesson
Grade 2

Estimating, Counting, and Sorting

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

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

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

Review

12's

11's

10's

9's

8's

7's

6's

5's

4's

3's

2's

1's
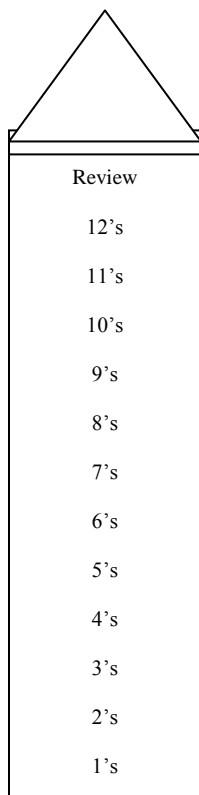
Sample Lesson
Grade 4

Angles

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

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

Materials:
- Pattern blocks
- Pencil and paper

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

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

Source:

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

Sample Lesson
Grade 5

Ratios

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

Materials:
- Colored chips
- Pencil and paper

Procedure:
1. Review what students know about fractions. Give each student a handful of colored chips. Have each student write down the number of chips of each color. Have students write down the fraction of chips of each color. Discuss the role of the 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 homeschools, offering lesson plans and lesson ideas that develop critical thinking and inquiry skills.

www.mathforum.org/teachers/elem/
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

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

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

www.lessonplanspage.com/Math45.htm
Great math lessons (various skills)

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

www.learningplanet.com/
Learning Planet

www.scholastic.com/
Scholastic

www.sheppardsoftware.com/web_games.htm
State Games

www.ecokids.ca/pub/index.cfm
Eco Kids

yucky.discovery.com/noflash/fun_n_games/category_icky.html
Discovery Kids Yucky Lab Activities

www.brainpop.com/
Brain Pop

www.funbrain.com/
Funbrain.com

www.learningplanet.com/act/mayhem/
Math Mayhem

www.visualfractions.com/
Visual Fractions – Online Visual Fraction Tutorial

nces.ed.gov/nceskids/index.asp
National Center for Education Statistics

www.coolmath4kids.com/
Cool Math 4 Kids

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

www.multiplication.com/interactive/quickflash/flash/index.html
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

http://www.heymath.com/main/samples/us18/teacherstemplate.html
Balancing Equations Flipbook

Pre-K
http://www.prekinders.com/math-center/

http://softschools.com/grades/preschool

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

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Additional Resources for 4th Grade Teachers

<u>Books</u>

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

Math Strategies You Can Count On: Tools & Activities To Build Math Appreciation, Understanding & Skills by Char Forsten

Math Dictionary for Kids: The Essential Guide to Math Terms, Strategies, and Tables by Theresa R. Fitzgerald