

**PRESCHOOL - PRE-KINDERGARTEN**

(Page 1 of 2)

**I. NUMBERS AND OPERATIONS****A. Number Sense***The student will:*

1. count orally from 1 to 10
2. touch and count objects from 1 to 5
3. recognize numerals from 1 to 5 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

**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 up to 5

**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)

*(Continued on page 53)*

**PRESCHOOL - PRE-KINDERGARTEN**

(Page 2 of 2)

**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, etc.)
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 - No objectives****V. ALGEBRA***The student will:*

1. recognize and duplicate simple sequential patterns (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)

**KINDERGARTEN**

(Page 1 of 2)

**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, fives, tens
2. count backwards from 10
3. demonstrate one-to-one correspondence for numbers to 10
4. recognize the number of objects in a small group without counting
5. create a group of a given number of objects
6. read / write numbers 0 to 30
7. identify ordinal numbers from first to tenth
8. use language such as more than, less than, equal to compare small quantities

**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 - No objectives****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 measure determine longer and shorter (using a shoe, a hand, etc.)
3. order several objects according to length

**KINDERGARTEN**

(Page 2 of 2)

**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. identify coins (penny, nickel, dime, quarter)

**III. GEOMETRY***The student will:*

1. identify the difference between two- and three-dimensional shapes
2. demonstrate common language of spatial sense and show examples: inside, between, about, below, behind, near to, left, right, etc.

**IV. STATISTICS, PROBABILITY AND DATA ANALYSIS***The student will:*

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

**V. ALGEBRA***The student will:*

1. sort objects and pictures by attributes
2. describe sorting rules

**1<sup>ST</sup> GRADE**

(Page 1 of 3)

**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. 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. read and write numbers 0 to 100
2. count by 2s 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
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 10)
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 the property.

**E. Fractions/Decimals/Percents - No objectives**

**1<sup>ST</sup> GRADE**

(Page 2 of 3)

**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 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 units
2. compare and order weights using non-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, and dimes

**D. 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
3. describe characteristics of two- and three-dimensional geometric shapes to include squares, rectangles, triangles and circles

*(Continued on page 58)*

**1<sup>ST</sup> GRADE**

(Page 3 of 3)

**IV. STATISTICS, PROBABILITY, DATA ANALYSIS***The student will:*

1. use data collected to describe parts to whole
2. construct and interpret picture 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

**2<sup>ND</sup> GRADE**

(Page 1 of 3)

**I. NUMBERS AND OPERATIONS**

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

**A. Number Sense**

*The student will:*

1. count in units and multiples of hundreds, tens, and ones (skip counting)
2. demonstrate understanding of place value up to and including the thousands place using expanded form
3. create equivalent representations of given numbers (such as 35 represented by 35 ones, 3 tens and 5 ones, or 2 tens and 15 ones)
4. count, read, and write numbers to 1,000
5. use a number line to round numbers to the nearest tens and hundreds
6. identify numbers as odd or even
7. compare and order numbers up to one thousand

**B. Addition and Subtraction**

*The student will:*

1. demonstrate addition and subtraction facts with fluency and automaticity (sums 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” (Focal Points, p. 14).
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.,  $12+15 = 15+12$ ;  $25+(50+19) = (25+50)+19$ )

*(Continued on page 60)*

**2<sup>ND</sup> GRADE**

(Page 2 of 3)

**E. Fractions/Decimals/Percents***The student will:*

1. represent familiar fractions such as  $\frac{1}{2}$ ,  $\frac{1}{3}$  and  $\frac{1}{4}$
2. represent familiar fractions geometrically as part of a whole

**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 the 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), dollars coins and dollar bills

**E. Capacity***The student will:*

1. identify and compare measure of capacity using cups, pints, quarts and gallons

**2<sup>ND</sup> GRADE**

(Page 3 of 3)

**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

**3<sup>RD</sup> GRADE**

(Page 1 of 3)

**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. The use of a “Guessing Jar” containing an unknown number of objects is one way to do this. Students should continue to determine the reasonableness of answers.

**A. Number Sense**

*The student will:*

1. recognize, read, count, and write numbers up to and including 100,000
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. 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 digits numbers

**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 0-10
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, commutative, and distributive properties for 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

*(Continued on page 63)*

**3<sup>RD</sup> GRADE**

(Page 2 of 3)

3. identify and write proper and improper fractions without simplification
4. use models and number lines to identify equivalent fractions
5. compare and order simple fractions with common numerators, uncommon denominators, and benchmark fractions using models

**II. MEASUREMENT**

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

**A. Linear measurement**

*The student will:*

1. measure length to the nearest half unit

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

*The student will:*

1. count up to ten dollars
2. make change to one dollar by counting up
3. round amounts to the nearest dollar; the nearest ten dollars
4. recognize that dollars and cents are decimals, and that money may be represented as fractions of dollars (i.e.,  $\frac{1}{4}$  of a dollar is a quarter)
5. write money appropriately as decimals OR with the 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 to 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. 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)

**3<sup>RD</sup> GRADE**

(Page 3 of 3)

**III. GEOMETRY***The students will:*

1. describe characteristics of two-dimensional shapes (rhombus, irregular figures) and three-dimensional geometric 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 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

**IV. 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

**V. ALGEBRA***The student will:*

1. predict the next number in a pattern
2. name the previous number in a pattern

**4<sup>TH</sup> GRADE**

(Page 1 of 3)

**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. The use of a “Guessing Jar” containing an unknown number of objects is one way to do this. 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 – No objectives**

Students should continue to practice skills.

**C. Multiplication and Division**

*The student will:*

1. multiply by two digit numbers and three digit numbers
2. demonstrate automaticity and fluency with multiplication and division facts (11 - 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, commutative and distributive 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

*(Continued on page 66)*

**4<sup>TH</sup> GRADE**

(Page 2 of 3)

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 and decimals
11. write decimals as equivalent fractions to the thousandths place

**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. measure length to the nearest  $\frac{1}{4}$ , and  $\frac{1}{8}$  of an inch or to 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)

**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. identify equilateral, isosceles, scalene and right triangles
3. measure volume of rectangular prisms using cubes
4. measure surface area with tiles
5. derive the formula for area of a rectangle
6. classify two-dimensional figures - i.e., squares – as subsets of rectangles, and rectangles as subsets of parallelograms

**4<sup>TH</sup> GRADE**

(Page 3 of 3)

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

Students continue to use the skills and tools from Grade 3.

*The student will:*

1. apply place value to use stem/leaf plots
2. model situations using experiments to determine probability and predict results
3. represent probability as a fraction

**V. ALGEBRA**

*The student will:*

1. find the missing number in a pattern
2. identify missing operational signs in equations

**5<sup>TH</sup> GRADE**

(Page 1 of 3)

**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. The use of a “Guessing Jar” containing an unknown number of objects is one way to do this. 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, commutative and distributive 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 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)

**5<sup>TH</sup> GRADE**

(Page 2 of 3)

**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

**E. Capacity**

*The student will:*

1. convert measures within the same system using multiplication and division (How many cups are in three pints? How many milliliters are in 10 liters?)

**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

**5<sup>TH</sup> GRADE**

(Page 3 of 3)

**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

**6<sup>TH</sup> GRADE**

(Page 1 of 2)

**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. identify the components of the real number system (i.e., natural, whole, integers, rational, and irrational)
4. read, write and plot real numbers on a number line
5. 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.

**B. Addition and Subtraction***The student will:*

1. add and subtract integers

**C. Multiplication and Division***The student will:*

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

**D. Properties***The student will:*

1. identify and use the inverse property of multiplication (i.e.,  $\frac{1}{2} * 2 = 1$ )
2. use the commutative, associative and distributive properties 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. convert between fractions, decimals and percent
5. calculate the percent of a number

**6<sup>TH</sup> GRADE**

(Page 2 of 2)

**II. MEASUREMENT – NO OBJECTIVES****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.

*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 slide, flip and rotate
4. use tessellations to rotate and reflect geometric figures
5. use geometric tools (compass, protractor, straight edge) to construct and measure angles, triangles, squares, rectangles, and circles
6. define similar and congruent figures and their corresponding angles
7. identify properties of vertical, adjacent, and straight angles
8. calculate the area of squares, triangles, rectangles, and parallelograms, and explain why the formulas are valid
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

**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 and circle graphs using fractions, decimals, and percents
2. calculate probabilities and make predictions using real-world and mathematical problems with fractions, decimals, and percents

**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. solve simple one-step equations
7. construct and analyze tables and use equations to describe simple relationships (such as  $3x = y$ )
8. use sequences and patterns to find an equation
9. write and solve proportions

**7<sup>TH</sup> GRADE**

(Page 1 of 2)

**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

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

Students should continue to practice skills

**C. Multiplication and Division***The student will:*

1. solve multiplication and division problems using positive and negative numbers
2. use scientific notation to multiply and divide large and small numbers (recognize and use positive and negative exponents)

**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 – No objectives****III. GEOMETRY***The student will:*

1. identify and construct basic elements of geometric figures using geometric tools (compass, protractor, straight edge) - altitudes, midpoints, diagonals, perpendicular bisectors, central angles, radii, diameters, and chords
2. calculate area and circumference of circles
3. compute the perimeter of regular and irregular figures
4. compute the area of selected complex figures

*(Continued on page 74)*

**7<sup>TH</sup> GRADE**

(Page 2 of 2)

5. compute the volumes and surface areas of regular pyramids and cylinders using a variety of methods
6. calculate the interior angles of various regular polygons
7. use deductive reasoning to determine the measure of an angles 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

**IV. STATISTICS, PROBABILITY AND DATA ANALYSIS***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. use mean, median, mode and range to draw conclusions about data and to make predictions
3. recognize and be able to give examples of how the display of data sets can be manipulated to tell different stories
4. 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 a fractions, decimals and percents
5. recognize probability of multiple events as either multiplication or addition problems
6. continue to use probabilities and to make predictions using real-world and mathematical problems with fractions, decimals, and percents
7. organize and interpret in a scatter plot; draw a trend line through the data to make predictions
8. define and accurately use the terms positive correlation, negative correlation, and no correlation

**V. ALGEBRA***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 equations with one variable using inverse operations
5. use linear 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

## ALGEBRA I

(Page 1 of 5)

“Algebraic thinking begins with the very young, expands and deepens and matures throughout the years, and continues to serve adults long after the end of formal schooling. To achieve that outcome requires an algebra curriculum that is coherent and developmental, that is anchored by important mathematical concepts, and that is well articulated and coordinated across the grades.”

(*Navigating through Algebra in Grades 6-8*. Susan Friel, Sid Rachlin, and Dot Doyle, NCTM, 2001)

Algebra deals with relationships among quantities demonstrated in the abstract. Students understand the manipulation and interpretation of symbols and how using symbols and equations in mathematical relationships can assist them in other branches of mathematics, other school subjects, and life issues.

Students will use algebraic methods to explore, model, and describe patterns and functions involving numbers, shapes, data, graphs, etc. Students are exposed to and use the logical reasoning skills and processes in the development of the algebraic skills and concepts. They will use models, manipulatives, and diagrams to explain answers.

Successful completion of this course is a prerequisite for Geometry and for Algebra II. Prepared students will take this course in 8th grade. Those who require additional preparation will take a pre-algebra course that reinforces the 7th grade objectives. 8th graders who have completed this course may be required to pass high school placement tests to determine appropriate placement in a freshman math class at the high school of their choice.

### I. PROPERTIES OF EXPRESSIONS AND EQUATIONS

*The student will:*

1. identify variables and simplify expressions
2. identify patterns and sequences
3. evaluate expressions
4. use order of operations to simplify expressions with variables
5. define and use the identity and equality properties
6. define and use the commutative and associative property with variables
7. define and use the distributive properties
8. define and use absolute value

### II. NUMBERS

*The student will:*

1. identify integers on a number line
2. use opposites, reciprocals, powers, and roots to solve problems
3. add, subtract, multiply, and divide rational numbers
4. estimate square roots
5. compare the location of square roots within the real number set
6. add, subtract, multiply, and divide integers using variables

**ALGEBRA I**

(Page 2 of 5)

**III. LINEAR EQUATIONS***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 using formulas of known geometric figures
4. solve equations using formulas for:
  - rate
  - work
  - age
  - percent
  - 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. use direct and inverse variations to solve problems
4. use slope ratio to investigate the  $\Delta y/\Delta x$  ratio
5. solve percent problems using ratio and proportion

**V. RELATIONS AND FUNCTIONS***The student will:*

1. contrast and compare concepts of relations and functions
2. determine the domain and range using graphs, ordered pairs, and symbolic expressions
3. write equations from patterns

**IV. LINEAR FUNCTIONS***The student will:*

1. verify that a given point lies on a line
2. define slope
3. write linear equations in point-slope, slope-intercept, and standard form
4. identify and graph vertical and horizontal lines to include the concept of zero and undefined slope
5. graph parallel and perpendicular lines and identify their slope relations
6. write and graph lines from a table of values
7. use the general properties of the parent graph to include the horizontal shift, vertical shift and stretch factors to graph linear functions

*(Continued on page 77)*

**ALGEBRA I**

(Page 3 of 5)

**VII. SOLVING LINEAR INEQUALITIES***The student will:*

1. solve inequalities using addition and subtraction rules
2. solve inequalities using the multiplication and division rules
3. solve multi-step inequalities
4. solve compound inequalities
5. solve open sentences, equations, and inequalities involving absolute value
6. graph linear inequalities to include 1 and 2 variables

**VIII. SYSTEMS OF EQUATIONS***The student will:*

1. graph systems of equations
2. solve system equations using the substitution method
3. solve system equations using elimination method using addition and subtraction
4. solve system equations using elimination method using multiplication
5. graph systems of inequalities
6. solve linear systems with 1 or 2 variables algebraically, to include inequalities

**IX. POLYNOMIALS***The student will:*

1. identify properties of polynomials
2. add and subtract polynomials
3. multiply and factor polynomials

**X. FACTORING***The student will:*

1. factor polynomials using the greatest common factor
2. factor trinomials with a leading coefficient of one
3. factor trinomials with a leading coefficient other than one
4. factor differences of squares
5. factor perfect squares
6. simplify rational expressions by factoring and reducing

**ALGEBRA I**

(Page 4 of 5)

**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 functions
3. solve quadratic equations by graphing
4. solve equations by factoring, including the zero-product property
5. solve quadratic equations by using the quadratic formula
6. solve quadratic equations by completing the square

**XII. OTHER NONLINEAR FUNCTIONS***Using an xy table, the student will:*

1. plot cubic functions
2. plot exponential functions
3. plot the square root function
4. plot the hyperbolic function
5. graph absolute value

**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

**XIV. RADICAL EXPRESSIONS AND EQUATIONS***The student will:*

1. simplify radical expressions
2. add, subtract, multiply, and divide radical expressions
3. develop the Pythagorean Theorem
4. apply the Pythagorean Theorem to find the length of the sides of a right triangle
5. apply the Pythagorean Theorem to find the distance between two points

*(Continued on page 79)*

**ALGEBRA I**

(Page 5 of 5)

6. solve radical equations
7. apply the quadratic formula to solve problems
8. graph quadratic functions showing that the real roots are the x-intercepts, and determine whether a function will intersect in 0, 1, or 2 points

**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

**HIGH SCHOOL: GEOMETRY**

(Page 1 of 4)

Geometry is a complete college preparatory course of plane and solid geometry. It is recommended that there be a strand of algebra review woven throughout the course to help students maintain their understanding of algebra and the use of their algebraic skills. The exploration of various proof methods is recommended. Such methods are two and three column proofs, flowcharts, and paragraph formats. Constructions for the sake of visualization is encouraged which may include construction tools, paper folding, and the Geometry Sketchpad investigations.

**I. LANGUAGE OF GEOMETRY**

1. Undefined terms: points, lines, and planes
2. Defined terms: angle, bisector, midpoint, etc.

**II. LOGICAL REASONING**

1. Conditional and bi-conditional statements
2. Written justification for logical arguments
3. Patterning and mathematical modeling
4. Inductive and deductive reasoning
5. Indirect proofs
6. Converses and proof by counterexample
7. Proof by contradiction
8. Truth tables

**III. LINES AND SEGMENTS**

1. Properties associated with transversal lines
2. Properties of parallel and perpendicular lines
3. Properties associated with perpendicular bisectors

**IV. GRAPHS**

1. Graphs and equations of linear functions
2. Equations of both parallel and perpendicular lines
3. Equations of both vertical and horizontal lines
4. Plane regions formed by linear equations
5. Graphs and equations of quadratic functions

**V. PLANE FIGURES**

1. Concept development of area and perimeter and their units of measure
2. Properties and their proofs for quadrilaterals to include parallelograms, rectangles, squares, rhombuses, trapezoids and kites

*(Continued on page 81)*

**HIGH SCHOOL: GEOMETRY**

(Page 2 of 4)

3. Properties and their proofs for triangles to include scalene, isosceles, equilateral, right triangles
4. Triangle inequality property
5. Properties and their proofs for polygons to include regular and irregular polygons
6. Properties associated with medians and altitudes
7. Relationships between the base and height in triangles and quadrilaterals
8. Concept development for perimeter formulas for all polygonal regions
9. Concept development for area formulas for all polygonal regions
10. Area of polygons using figure dissection and sub-problems

**VI. ANGLES**

1. Properties and relationships of all angles
2. Conjectures for angle relationships formed by parallel lines
3. Converse for angle relationships formed by parallel lines
4. Conjecture for vertical angles
5. Conjectures for the exterior angles of triangles
6. Conjectures for the measure of the angles of a triangle
7. Conjectures for the isosceles triangle theorem
8. Formula development to find the sum of the angles of a polygon
9. Formula development to find the angle measurement in regular polygons
10. Formula development to find the sum of the exterior angles of a polygon

**VII. SIMILARITY**

1. Conjecture development for an intuitive understanding of similarity
2. Scale drawings as an application of similarity
3. Conjectures for the basic ratio of similarity for plane figures
4. AA similarity theorem
5. Application problems using the similarity properties
6. Mid-segment theorem
7. Formula development of ratios for perimeter, area and volume using similar figures or solids
8. Application problems using ratios for length, area, and volume

**VII. CONGRUENCY**

1. Concept development of congruence
2. Concept development for corresponding parts of two congruent figures
3. Fundamental congruence postulates for triangles: SSS, SAS, ASA, AAS

*(Continued on page 82)*

**HIGH SCHOOL: GEOMETRY**

(Page 3 of 4)

4. Fundamental congruence postulates for right triangles: HL, LL, HA, LA
5. Proofs using congruent triangles

**IX. CIRCLES**

1. Basic properties of a circle to include investigations of  $\pi$
2. Conjectures and proofs of the properties of the circle
3. Area and circumference of circles
4. Concept development of the diameter-chord relationships in circles
5. Relationships between the area and central angles in circles
6. Area of sectors and sector segments
7. Angle and arc length relationships in circles
8. Concept development and proofs for the theorems of angles, chords, secants, and tangent segments
9. Concept development of the equation of the circle using its locus of points

**X. PYTHAGOREAN THEOREM**

1. Concept development of the Pythagorean Theorem and its converse
2. Pythagorean Theorem application to find the lengths of segments
3. Pythagorean Theorem application to find the midpoints of segments
4. Pythagorean Theorem application to find the distance between a point and a line
5. Pythagorean Theorem application to find the length of a segment
6. Concept development and use of the properties of special right triangles
7. Radical expressions and simplification review

**XI. TRIGONOMETRY**

1. Exploration of the sine, cosine, and tangent values using a calculator
2. Concept development for the sine, cosine and tangent ratio for right triangles
3. Concept development of the relationship between the tangent and slope ratios
4. Application problems using trigonometric ratios
5. Concept development of the relationships between the sides of special right triangles
6. Concept development and use of the Law of Sines as proportionality

**XII. SOLID FIGURES**

1. Isometric and orthogonal drawings of three-dimensional figures
2. Mats to build isometric figures
3. Surface area of polyhedrons and spheres

*(Continued on page 83)*

**HIGH SCHOOL: GEOMETRY**

(Page 4 of 4)

4. Construction of various polyhedrons and concept development of volume
5. Concept development of the formulas for the volume of prisms, cylinders, pyramids, cones and spheres
6. Concept development of the formulas for the surface area of prisms, cylinders, pyramids, cones and spheres
7. Application problems

**XIII. TRANSFORMATIONAL GEOMETRY**

1. Coordinate geometry
2. Explorations of line symmetry and reflections
3. Explorations of translations, rotations and dilations
4. Exploration of tessellations

**XIV. GEOMETRIC PROBABILITY**

1. Concept development of geometric probabilities
2. Applications of geometric probability

**XV. CONSTRUCTIONS**

1. Proof of geometric theorems using the construction tools

**HIGH SCHOOL: ALGEBRA II**

(Page 1 of 3)

This is an Advanced Algebra course designed for students who have satisfactorily completed both the college-preparatory Algebra I and Geometry courses. Topics to be covered are listed below.

**I. LINEAR FUNCTIONS**

1. Properties of linear functions
2. Graphs of linear functions to include the vertical and horizontal shifts, and stretch factors
3. Slope-intercept form
4. Point-slope form
5. Applications of the linear function
6. Solving linear equations

**II. EXPONENTIAL FUNCTIONS**

1. Properties of exponential functions
2. Graphs of the exponential function to include the vertical and horizontal shifts, and stretch factors
3. Effects of negative and rational exponents to the exponential function
4. The properties of the number  $e$
5. Applications of the exponential function to growth and decay

**III. LOGARITHMIC FUNCTIONS**

1. Properties of inverse functions
2. Connections between the exponential and logarithmic functions
3. Properties and graphs of logarithmic functions to include the vertical and horizontal shifts, and stretch factors
4. Solving logarithmic equations
5. Application of the logarithmic functions

**IV. QUADRATIC FUNCTIONS**

1. Properties of quadratic functions
2. Graphs of quadratic functions to include the vertical and horizontal shifts, and stretch factors
3. Properties of quadratic functions in standard and intercept form
4. Completing of the square process
5. Proof and use of the quadratic formula
6. Factoring the quadratics in their enhanced form

**HIGH SCHOOL: ALGEBRA II**

(Page 2 of 3)

**V. SYSTEM OF EQUATIONS**

1. Solving systems of equations using the graphing method and algebraic method
2. Solving linear systems using matrices
3. Properties and graphs of inequalities
4. Solving equations using absolute value
5. Solving systems of inequalities
6. Linear programming

**VI. RADICAL FUNCTIONS**

1. Properties of the square root function
2. Graphs of the square root function to include vertical and horizontal shifts, and stretch factors
3. Properties of radical functions
4. Graphs of radical functions to include vertical and horizontal shifts, and stretch factors
5. Solving radical equation
6. Properties of complex numbers

**VII. POLYNOMIAL FUNCTIONS**

1. Properties of polynomials
2. Multiplying and dividing polynomials
3. Graphs of polynomials to include vertical and horizontal shifts, and stretch factors
4. Finding zeros of polynomial functions
5. Solving cubic equations

**VIII. RATIONAL FUNCTIONS**

1. Inverse variation
2. Properties of rational functions
3. Graphs of rational functions to include vertical and horizontal shifts, and stretch factors
4. Solving rational equations

**IX. SERIES AND SEQUENCES**

1. Properties of arithmetic sequences
2. Properties of geometric sequences
3. Recursion formulas
4. Sums of arithmetic and geometric series
5. Infinite geometric series

*(Continued on page 86)*

**HIGH SCHOOL: ALGEBRA II**

(Page 3 of 3)

**X. CONIC SECTIONS**

1. Distance and midpoint formulas
2. Slopes of parallel and perpendicular lines
3. Properties of the parabola, circle, ellipse and hyperbola
4. Graphs of the parabola, circle, ellipse and hyperbola
5. Identification of second degree equations

**XI. TRIANGLE TRIGONOMETRY**

1. Right triangle trigonometry
2. Sine, cosine, and tangent ratios
3. Angles of rotation
4. Area of a triangle
5. Law of sines
6. Law of cosines

**XII. TRIGONOMETRIC FUNCTIONS**

1. Unit circle properties of the sine and cosine
2. Radian measure
3. Amplitude, period, and phase shifts
4. Tangent function
5. Graphs of the sine, cosine and tangent functions to include the vertical and horizontal shifts, and stretch factors

**HIGH SCHOOL: PROBABILITY AND STATISTICS**

(Page 1 of 2)

This course shows students how statistics is used to picture and describe the world. With this knowledge, students will be able to make informed decisions about their world as contributing members of society. This course should be offered as an elective upper division course. Topics to be covered are listed below.

**I. INTRODUCTION TO STATISTICAL MEASURES**

1. Methods of data classification
2. Design experiments

**II. DESCRIPTIVE STATISTICS**

1. Frequency distributions and their graphs
2. Measures of central tendency
3. Measures of variation
4. Measures of position

**III. PROBABILITY**

1. Basic concepts of probability
2. Conditional probability and the multiplication rule
3. Addition rule
4. Counting principles

**IV. DISCRETE PROBABILITY DISTRIBUTIONS**

1. Probability distributions
2. Binomial distributions
3. Discrete probability distributions to include Poisson distributions

**V. NORMAL PROBABILITY DISTRIBUTIONS**

1. Normal distributions
2. Standard normal distribution
3. Central limit theorem
4. Normal approximations to binomial distributions

**VI. CONFIDENCE INTERVALS**

1. Confidence intervals for the mean for large samples
2. Confidence intervals for the mean for small samples
3. Confidence intervals for population proportions
4. Confidence intervals for variance and standard deviation

**HIGH SCHOOL: PROBABILITY AND STATISTICS**

(Page 2 of 2)

**VII. HYPOTHESIS TESTING WITH ONE SAMPLE**

1. Definition of hypothesis testing
2. Hypothesis testing for the mean for  $n > \text{or} = 30$
3. Hypothesis testing for the mean for  $n < 30$
4. Hypothesis testing for proportions
5. Hypothesis testing for the variance and standard deviation

**VIII. HYPOTHESIS TESTING WITH TWO SAMPLES**

1. Testing the difference between two means – large independent samples
2. Testing the difference between two means – small independent samples
3. Testing the difference between two means – dependent samples
4. Testing the difference between two proportions

**IX. CORRELATION AND REGRESSION**

1. Definition of correlation
2. Definition of linear regression
3. Measures of regression and prediction intervals
4. Multiple regression

**X. CHI-SQUARE TESTS AND THE F-DISTRIBUTION**

1. 'Goodness of Fit' concept
2. Independence
3. Comparing two variances
4. Analysis of variance

**XI. NONPARAMETRIC TESTS**

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

**HIGH SCHOOL: PRECALCULUS**

(Page 1 of 4)

This course combines algebraic, geometric, and trigonometric ideas and techniques that are needed to prepare students for calculus. It introduces students to the concept of limit. This course is frequently taught in conjunction with an in-depth study of trigonometry or with linear algebra or statistics if the trigonometric concepts were taught completely in the Algebra II course. The topics to be addressed are listed below.

**I. FUNCTION ANALYSIS**

1. Properties of relations and functions
2. Properties and graphs of piecewise functions
3. Continuity
4. Functional properties of parallel and perpendicular lines
5. Properties of odd and even functions
6. Properties of increasing and decreasing functions
7. Properties of domain, range, maxima, minima, and end-behavior
8. Properties of limits to include at a point and at infinity

**II. FUNCTIONS, EQUATIONS AND INEQUALITIES**

1. Equation solving techniques to include systems of equations
2. Properties of composite functions to include the domain and range
3. Properties of inverse functions to include the domain and range
4. Approximate solutions to equations
5. Inequality equation solving techniques
6. Graphs of inequalities to include the vertical and horizontal shifts, and stretch factors
7. Absolute value equation solving techniques
8. Graphs of absolute value equations to include the vertical and horizontal shifts, and stretch factors
9. Linear programming

**III. INTEGERS AND POLYNOMIALS**

1. Factors of polynomial
2. Zeros of a polynomial
3. Quotient/ remainder theorem
4. Division of polynomials
5. Synthetic division
6. Remainder and factor theorems
7. Quadratic equations and inequalities

*(Continued on page 90)*

**HIGH SCHOOL: PRECALCULUS**

(Page 2 of 4)

**IV. RATIONAL NUMBERS AND FUNCTIONS**

1. Rational numbers and expressions
2. Irrational numbers
3. Reciprocals of the power function
4. Properties of rational functions
5. End behavior of rational functions
6. Graphs of rational functions
7. Solving rational equations

**V. EXPONENTIAL AND LOGARITHMIC FUNCTIONS**

1. Properties and use of rational exponents
2. Properties and graphs of exponential functions
3. Properties and graphs of logarithmic functions
4. Solving the exponential and logarithmic equations
5. The number  $e$
6. Properties and graphs of natural logarithmic functions
7. Applications

**VI. TRIGONOMETRIC FUNCTIONS**

1. Properties of the circular functions
2. Radian measure
3. Trigonometric functions of special angles
4. Right triangle trigonometry
5. Law of sines
6. Law of cosines
7. Ambiguous case
8. Parent graphs of  $\sin(x)$ ,  $\cos(x)$ ,  $\tan(x)$  and their reciprocals
9. Properties of trigonometric graphs to include the vertical shift, horizontal shift and stretch factor components
10. Properties of inverse trigonometric functions
11. Properties of inverse trigonometric graphs to include the vertical shift, horizontal shift and stretch factor components

**HIGH SCHOOL: PRECALCULUS**

(Page 3 of 4)

**VII. TRIGONOMETRIC IDENTITIES AND EQUATIONS**

1. Trigonometric identities
2. Proofs of identities
3. Sum/ difference formulas
4. Double-angle formulas
5. Half-angle formulas
6. Solving trigonometric equations
7. Solving trigonometric inequalities
8. Applications

**VIII. VECTORS AND PARAMETRIC EQUATIONS**

1. Geometric and algebraic vectors
2. Vectors in three-dimensional space
3. Perpendicular vectors
4. Dot product and the angle between vectors
5. Applications using vectors to include directional problems
6. Properties and graphs of parametric equations
7. Applications of parametric equations to model motion

**IX. POLAR COORDINATES AND COMPLEX NUMBERS**

1. Properties of complex numbers
2. Distinguish the characteristics and uses of vectors in representations of velocity and force
3. Polar coordinates
4. Conversions between the polar and rectangular systems
5. Polar equations and their graphs
6. Product and quotients of complex numbers in polar form
7. Powers of complex numbers
8. Roots of complex numbers

**X. CONICS**

1. Properties of the parabola, hyperbola, and ellipse
2. Graphs of the conics and their degenerates: the line and circle
3. Transformations of the conics
4. Solving quadratic systems to include inequality properties

*(Continued on page 92)*

**HIGH SCHOOL: PRECALCULUS**

(Page 4 of 4)

**XI. RECURSION AND MATHEMATICAL INDUCTION**

1. Recursion and explicit formulas
2. Arithmetic and geometric series
3. Principle of mathematical induction

**XII. AREA UNDER THE CURVE: INTEGRATION**

1. Area of rectangles
2. Summation and sigma notation
3. Graphical interpretation
4. Area of rectangles using the left and right endpoints
5. Application of distance as area
6. Definite integral of polynomial functions

**XIII. RATES OF CHANGE: DERIVATIVE**

1. Rates of change
2. Secants and tangents to the curve
3. Graphical interpretation of the derivative
4. Derivative at a point
5. Derivative of a function
6. Applications: velocity, acceleration, and critical points on a polynomial

**HIGH SCHOOL: CALCULUS**

(Page 1 of 5)

The calculus course taught in high school should be rigorous and taught at the same depth as an entry-level college or university calculus course. It is recommended that the syllabi presented by the College Board for Calculus AB and Calculus BC be considered when designing a Calculus class for high school students. Presented here is the topic outline for the Advanced Placement Calculus curriculum.

**ADVANCED PLACEMENT CALCULUS AB****FUNCTIONS, GRAPHS, AND LIMITS****Analysis of Graphs**

1. Using both geometric and analytic information, predict and explain the observed local and global behavior of functions

**Limits of functions**

1. Intuitive understanding of the limiting process
2. Calculate limits using algebra
3. Estimating limits from graphs and tables of data

**Asymptotic and unbounded behavior of functions**

1. Understand 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

**Continuity as a property of functions**

1. Intuitive understanding of continuity
2. Continuity in terms of limits
3. Geometric understanding graphs of continuous functions to include, Intermediate and Extreme Value Theorems

**DERIVATIVES****Concept of the derivative**

1. Derivatives presented graphically, numerically, and analytically
2. Derivatives interpreted as an instantaneous rate of change
3. Derivatives defined as the limit of the difference quotient
4. Relationship between differential ability and continuity

**Derivative at a point**

1. Slope of a curve at a point
2. Tangent line to a curve at a point of local linear approximation

*(Continued on page 94)*

**HIGH SCHOOL: CALCULUS**

(Page 2 of 5)

3. Instantaneous rate of change as the limit of average rate of change
4. Approximate rate of change from graph and tables of values

**Derivative as a function**

1. Corresponding characteristics of graphs of  $f$  and  $f'$
2. Relationship between the increasing and decreasing behavior of  $f$  and  $f'$
3. The Mean Value Theorem
4. Equations involving derivatives

**Second derivatives**

1. Corresponding characteristics of  $f$ ,  $f'$ , and  $f''$
2. Relationship between the concavity of the  $f$  and  $f''$
3. Points of inflection

**Applications of derivatives**

1. Analysis of curves
2. Optimization
3. Modeling rates of change to include related rates
4. Use of implicit differentiation to find the derivative of an inverse function
5. Interpretation of the derivative as a rate of change to include velocity, speed, and acceleration

**Computation of derivatives**

1. Derivatives of basic functions to include; power, exponential, logarithmic, trigonometric and inverse trigonometric functions
2. Derivatives of sums, products, and quotients
3. Chain rule and implicit differentiation

**INTEGRALS****Interpretations and properties of definite integrals**

1. Computation of Riemann sums to include left, right, and midpoint evaluation points
2. Definite integral as a limit of Riemann sums over equal subdivisions
3. Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval
4. Basic properties of definite integrals

**Applications of integrals**

1. Applications to model physical, biological, and economic situations
2. Area of a region

*(Continued on page 95)*

**HIGH SCHOOL: CALCULUS**

(Page 3 of 5)

3. Volume of a solid with known cross sections
4. Average value of a function
5. Distance traveled by a particle along a line

**Fundamental Theorem of Calculus**

1. Use of the Fundamental Theorem to evaluate definite integrals
2. Use of the Fundamental Theorem to represent a particular antiderivative, including the analytical and graphical analysis of the function

**Techniques of antidifferentiation**

1. Antiderivatives following directly from derivatives of basic functions
2. Antiderivatives by substitution of variables

**Applications of antidifferentiation**

1. Specific antiderivatives using initial condition, including applications to motion along a line
2. Solve separable differential equations using them in modeling

**Numerical approximations to definite integrals**

1. Reiman and trapezoidal sums

**ADVANCED PLACEMENT CALCULUS BC**

The topics for the BC course include the topics listed below as well as all of the above-mentioned topics from the AB curricular topics outline.

**FUNCTIONS, GRAPHS, AND LIMITS****Parametric, Polar, and Vector functions**

1. Analysis of planar curves to include those given in parametric, polar and vector form

**DERIVATIVES****Applications of derivatives**

1. Analysis of planar curves given in parametric, polar, and vector form to include velocity and acceleration vectors
2. Geometric interpretation of differential equations via slope fields
3. Numerical solutions of differential equations using Euler's method
4. L'Hopital's Rule to include determining limits and convergence of improper integrals and series

**Computation of derivatives**

1. Derivatives of parametric, polar and vector functions

*(Continued on page 96)*

**HIGH SCHOOL: CALCULUS**

(Page 4 of 5)

**INTEGRALS****Applications of integrals**

1. Area of a region bounded by polar curves
2. Length of a curve

**Fundamental Theorem of Calculus****Techniques of antidifferentiation**

1. Antiderivatives by substitution of variables, by parts, and simple partial fraction
2. Improper integrals

**Applications of antidifferentiation**

1. Solve logistic differential equations

**Numerical approximations to definite integrals****POLYNOMIAL APPROXIMATION AND SERIES****Concept of series**

1. Partial sums and convergence

**Series of Constants**

1. Decimal expansions
2. Geometric series
3. Harmonic series
4. Alternating series with error bound
5. Terms of series as areas of rectangles to include p-series
6. Test ratio test for convergence and divergence

**Taylor Series**

1. Taylor polynomial approximation
2. Maclaurin series
3. Formal manipulation of Taylor series
4. Functions defined by power series
5. Radius and interval of convergence of power series
6. Language error bound for Taylor polynomials

*(Continued on page 97)*

**HIGH SCHOOL: CALCULUS**

(Page 5 of 5)

Some electives at the high school level might include the following based on staff availability and student interest.

**Discrete /Finite Math**

**Consumer Math**

**Accounting**

**Mechanical Drawing**