

EAST HELENA SCHOOL DISTRICT #9

MATHEMATICS

CURRICULUM

GUIDE

May, 2009

INTRODUCTIONS and DEFINITIONS

Benchmarks – Expectations that define what a student’s knowledge, skills and abilities along a developmental continuum in each content area. The continuum is focused at three points: the end of grade 4, grade 8 and grade 12

Cognitive Guided Instruction (CGI) – A research-based approach to teaching mathematics where teachers utilize what they know about children’s understanding of mathematics to make decisions about what each child knows and how instruction should be structured to enable that child to learn.

Content Standards - General statements that indicate what all students should know, understand and be able to do in a specific content area.

Correlation to Standards – Comparison of learner goals to those recommended at state and national levels.

Focal points/focus skills – Areas of instructional emphasis which are central to mathematics. They are specific areas that will help learn content that gives them a foundation for increasing their understanding as they encounter richer, more challenging mathematics.

Philosophy – The general principles and beliefs of a field of study.

Rigor(ous) – In the 2009 Montana Mathematics Content Standards, rigor is a process where students:

- Approach mathematics with a disposition to accept challenge and apply effort;
- Engage in mathematical work that promotes deep knowledge of content, analytical reasoning, and use of appropriate tools: and
- Emerge fluent in the language of mathematics, proficient with tools of mathematics, and empowered as mathematical thinkers

Textbook Evaluation – Comparison of the **focus skills**/focal points to various textbook programs to determine the best match.

Mathematics Education Philosophy

The East Helena Public School System is committed to providing a mathematics program that is organized to serve as an important resource for all students throughout their lives. Our curriculum is based on both state and national standards stemming from Curriculum Focal Points designed by the National Council of Teachers of Mathematics. Mathematics is a dynamic, growing, changing discipline whose priorities for basic mathematics skills include more than computation. Mathematics gives students the resources necessary to solve problems, to reason inductively and deductively and to apply numerical and spatial concepts necessary to function according to their needs in an ever-changing society.

Each student shall have the opportunity to develop a positive attitude toward mathematics. We are dedicated to providing our children with a rigorous foundation in mathematics that will prepare them for further study in math as well as its application to the world.

Special Focus Areas

Student Goals

Students will have the opportunity to interact in solving mathematics problems that relate to real-life situations. They will learn to value mathematics, gain confidence, become problem solvers, and communicate and reason mathematically. Students will be challenged to find their own solutions and explain and justify their reasoning. Algebraic thinking will be emphasized along with fluency of basic facts.

Teacher Goals

Teachers will offer many types of instructional strategies focusing on inquiry-based learning opportunities through cognitive guided instruction (CGI). Teachers will provide a varied instruction to reach a wide variety of learning styles and developmental levels. Manipulatives will be used to develop and reinforce various concepts. Teachers will help students to persevere through problem solving and to think for themselves. Teachers will recognize the differences among students and provide a positive learning environment for all. Teachers will help each child reach their fullest potential through differentiated instruction.

Technology

Students will have the opportunity to develop skills and demonstrate an understanding of the basic operations of technologies, use a variety of technologies, and apply technological abilities to construct new personal understanding (Montana Technology Content Standards 1-6).

Indian Education for All

Teachers will make every effort to provide opportunities to connect cultures to the classroom. In doing so, teachers will provide authentic connections to Montana's Native American history.

<p>Pursuant to Article X Sect 1 (2) of the Constitution of the state of Montana and statues 20-1-501 and 20-9-309 2(c) MCA, the implementation of these standards must incorporate the distinct and unique cultural heritage of Montana American Indians.</p>

Curriculum Focal Points and Connections for Kindergarten

The set of four curriculum focal points and related connections for mathematics in kindergarten follow. These topics are the recommended content emphases for this grade level. It is essential that these focal points be addressed through hands-on, inquiry-based experiences in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

Number and Operations: To develop an understanding of whole numbers, including concepts of correspondence, counting, cardinality, and comparison, the student will:

- develop an understanding of the meanings of whole numbers;
- understand number words refer to quantity;
- order sets by the number of objects in them;
- recognize the number of objects in small groups without counting and by counting;
- understand that the last word that they state in counting tells “how many”;
- use one-to-one correspondence in counting objects to 10 and beyond;
- demonstrate counting backwards;
- create and count to determine number amounts and compare quantities “more than” and “less than” (equal groups, more, fewer);
- compare and order sets or numerals by using both cardinal and ordinal meanings;
- use meanings of numbers to create strategies for solving problems and responding to practical situations or mathematical situations;
- represent, compare, and order whole numbers and joining and separating sets;
- use numbers, including written numerals, to represent quantities and to solve quantitative problems;
- choose, combine, and apply effective strategies for answering quantitative questions.

Geometry: To identify shapes and describe spatial relationships, the student will:

- develop spatial reasoning by working from two perspectives on space as they examine the shapes of objects and inspect their relative positions;
- find shapes in their environments and describe them in their own words;
- build pictures and designs by combining two-and three-dimensional shapes;
- solve problems as deciding which piece will fit into a space in a puzzle;
- discuss the relative positions of objects with specific vocabulary;
- interpret the physical world with geometric ideas and describe it with corresponding vocabulary;
- identify, name, and describe a variety of shapes presented in a variety of ways;
- use basic shapes and spatial reasoning to model objects in their environment and construct more complex shapes;
- understand, discuss, and create simple navigational directions;
- identify, name, and describe squares, triangles, circles, rectangles, regular hexagons, and isosceles trapezoids, spheres, cubes, cone, and cylinders.

Measurement and Data Analysis: To identify measurable attributes and compare and order objects by using these attributes, the student will:

- identify objects as “the same” or “different” and then “more” or “less” based on attributes that they can measure;
- identify measurable attributes such as length and weight;
- solve problems by making direct comparisons of objects on the basis of specific attributes;
- learn the foundation of data analysis by using objects’ attributes that they have identified in relation to geometry and measurement;
- describe, sort, and compare geometric figures;
- use measurable attributes to solve problems by comparing and ordering objects;
- identify various measures in daily life through calendar activities (e.g., days of week, months, money, tallies, weather, skip counting);
- create and interpret graphs.

Algebra: To develop algebraic thinking and reasoning, the student will:

- recognize and duplicate simple sequential patterns;
- sort objects and use one or more attributes to solve problems;
- identify, duplicate, and extend simple number patterns and sequential and growing patterns;

create rules that describe relationships of patterns. **Curriculum Focal Points and**

Connections for Grade 1

The set of four curriculum focal points and related connections for mathematics in Grade 1 follow. These topics are the recommended content emphases for this grade level. It is essential that these focal points be addressed through hands-on, inquiry based experiences in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

Number and Operations: To develop understandings of addition and subtraction and strategies for basic addition facts and related subtraction facts, the student will:

- compare and order numbers (at least to 100) to develop an understanding of and solve problems involving relative sizes of these numbers;
- identify the number of tens and ones in whole numbers between 10 and 100, especially recognizing the numbers 11-19 as 1 group of ten and a specific number of ones;
- represent whole numbers on a number line to demonstrate an understanding of the sequential order of the counting numbers;
- use a variety of models to develop an understanding of various addition and subtraction strategies to solve arithmetic problems: including discrete objects, length-based models (lengths of connecting cubes), and number lines, to model “part-whole”, “adding to”, “subtracting from” and “comparing” situations;
- demonstrate the connections between counting and the operations of addition and subtraction (adding two is the same as “counting on” two);
- compare a variety of solution strategies to relate addition and subtraction as inverse operations (fact families);
- use mathematical reasoning to solve two-digit addition and subtraction problems (both routine and non-routine).

Algebra: To develop algebraic thinking and reasoning, the student will:

- investigate and use number patterns and properties in numbers and operations, such as odd and even;
- identify, describe and use properties of addition to solve problems involving basic facts (Commutative, Associative, and Zero Identity Properties).

Measurement and Data Analysis: To develop and strengthen number sense, the student will:

- solve problems involving measurement and data;
- measure by laying multiple copies of a unit end to end;
- count the units by using groups of tens and ones to demonstrate understanding of number lines and number relationships;
- represent measurements and discrete data in pictures/*pictographs*;
- create a bar graph using collected data and a tally chart;
- estimate, measure, and compute lengths as they solve problems involving data, space, and movement through space (including calendar, daily schedules, probability, and telling time to the hour and half hour);
- identify and compare values of coins and trade (How can I use the fewest coins?).

Geometry: To develop and strengthen spatial reasoning, the student will:

- compose and decompose plane and solid figures (e.g. combining two congruent isosceles triangles to create a rhombus);
- demonstrate an understanding of part-whole relationships as well as the properties of the original and composite shapes;
- recognize two- and three-dimensional figures when viewed from different perspectives and orientations;
- describe, compare and contrast geometric attributes and properties of various shapes;
- recognize and create shapes with congruence or symmetry;
- sort and classify shapes by their attributes including size, shape, and color using various graphic organizers (i.e., Venn diagram).

Curriculum Focal Points and Connections for Grade 2

The set of four curriculum focal points and related connections for mathematics in Grade 2 follow. These topics are the recommended content emphases for this grade level. It is essential that these focal points be addressed through hands-on, inquiry-based experiences in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

Number and Operations: To develop an understanding of the base-ten numeration system and place value concepts, the student will:

- write, compare, and order whole numbers to at least 1,000;
- understand and apply base-ten numeration including ideas of counting in units and multiples of hundreds, tens, and ones;
- compose and decompose numbers less than 1000 in terms of place value while recognizing that place-value notation is shorthand for the sums of multiples of powers of 10 (e.g., 853 as 8 hundreds + 5 tens + 3 ones);
- use place value and properties of operations to create equivalent representations of given numbers (such as 35 represented by 35 ones, 3 tens and 5 ones, or 2 tens and 15 ones);
- add and subtract to solve a variety of routine and nonroutine problems, including applications involving measurement, geometry, and data problems;
- solve problems involving multiplicative situations, developing initial understandings of multiplication as repeated addition or skip counting.

Number and Operations and Algebra: To develop quick recall of basic addition facts and related subtraction facts and fluency with multidigit addition and subtraction, the student will:

- apply, with fluency, sums to at least 20 and related subtraction facts (inverse operations).
- solve addition and subtraction problems by applying various computational strategies (e.g. taking away, subtracting), models (e.g. combining or separating sets, using number lines, hundreds charts), and strategies (e.g., commutative, associative, and zero identity properties, fact families, adding ten to a number, doubles, and understanding that $9 + 6 = 10 + 5$);
- select and apply efficient and appropriate methods to estimate sums and differences of multidigit whole numbers, or calculate mentally.

Measurement and Data Analysis: To develop an understanding of linear measurement and facilitate the measuring of lengths, the student will:

- develop and apply concepts of partitioning (the mental activity of slicing the length of an object into equalized units) and transitivity (e.g., if object A is longer than object B and object B is longer than object C, then object A is longer than object C);
- understand and demonstrate that linear measure is a repetition of units and use rulers and other measurement tools with that understanding;
- understand the need for equal-length units, the use of standard units of measure (centimeter and inch), and the inverse relationship between the size of a unit and the number of units used in a particular measurement [(i.e., Children recognize that the smaller the unit, the more iterations (repetitions) they need to cover a given length)];
- estimate, measure, and compute lengths as they solve problems involving data, space, and movement through space (including calendar, probability, and telling time to at least the nearest 5 minutes using analog and digital clocks);
- identify coins and determine the value of mixed collections of coins to \$1.00;
- demonstrate an understanding of time and use of time relationships (e.g., how many minutes in an hour, days in a week, and months in a year);
- create, read and interpret basic graphs/charts from collected data.

Geometry: To develop and extend spatial reasoning, the student will:

- compose and decompose two-dimensional shapes (e.g., combine two triangles to create a rhombus or rectangle);
- identify three-dimensional shapes (e.g. cones, cylinders, rectangular prisms);
- investigate and develop a general understanding of area;
- connect geometric models of plane and solid figures to real-world situations.

Curriculum Focal Points and Connections for Grade 3

The set of four curriculum focal points and related connections for mathematics in Grade 3 follow. These topics are the recommended content emphases for this grade level. It is essential that these focal points be addressed through hands-on, inquiry-based experiences in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

Number and Operations: To develop an understanding of fractions and fraction equivalence, and extend place value concepts, the student will:

- identify and use fractions to represent parts of a whole, parts of a set, or points or distances on a number line (e.g., halves, thirds, fourths, tenths);
- recognize and demonstrate that the size of a fractional part is relative to the size of the whole;
- use fractions to represent numbers that are equal to, less than, or greater than 1;
- solve problems that involve comparing and ordering fractions by using models, benchmarks (0, $\frac{1}{2}$, 1), or common numerators or denominators;
- use and apply models, including the number line, to identify equivalent fractions;
- develop and apply their understanding of place value of numbers up to 10,000 in various contexts;
- apply this understanding to the task of representing numbers in different equivalent forms (expanded notation);
- develop their understanding of numbers and demonstrate fluency using computational estimation, mental computation, and paper-and-pencil computations.

Number and Operations and Algebra: To develop an understanding of multiplication and division strategies for basic multiplication facts and related division facts, the student will:

- represent and apply the concept of multiplication as repeated addition;
- apply models, analyze patterns, and create representations of multiplication (equal-sized groups, arrays, area models and equal “jumps” on number lines);
- represent and apply the concept of division as repeated subtraction by forming equal groups;

- apply models and representations of division (repeated subtractions, partitioning and sharing);
- apply the concept of multiplication and division as inverse operations to develop fluency;
- use and apply properties of addition and multiplication (commutative, associative, distributive, and identity) to multiply whole numbers;
- write and evaluate numerical expressions;
- write and solve equations using tables, graphs and models.

Geometry and Measurement: To describe and analyze properties of two-dimensional shapes, including perimeters, the student will:

- describe, analyze, compare and classify two-dimensional shapes by their sides and angles, and connect these attributes to definitions of shapes;
- describe and create transformations of polygons (slides, flips, turns/translation, reflection, rotation);
- use attributes and properties of two-dimensional shapes to solve problems including applications involving parallel and perpendicular lines, congruence, and symmetry.
- create and analyze various two-dimensional shapes (right, obtuse and acute angles within two dimensional shapes; classify triangles by sides and angles; quadrilaterals; classify pentagons, hexagons and octagons by sides or angles);
- demonstrate an understanding of perimeter as a measurable attribute and select appropriate units, strategies, and tools to solve problems involving perimeter;
- represent money amounts to \$5.00 in dollars and cents, and apply to situations involving purchasing ability and making change.

Data Analysis and Probability: To analyze data and make logical decisions and predictions based on that data, the student will:

- construct and analyze frequency tables, bar graphs, picture graphs/pictographs, and line plots and use them to solve problems using addition, subtraction, multiplication and division of whole numbers;
- determine the likeliness of an event occurring and make predictions based on the determination.

Curriculum Focal Points and Connections for Grade 4

The set of four curriculum focal points and related connections for mathematics in Grade 4 follow. These topics are the recommended content emphases for this grade level. It is essential that these focal points be addressed through hands-on, inquiry-based experiences in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

Number and Operations: To develop an understanding of decimals, including the connections between fractions, decimals and place value, the student will:

- demonstrate and apply understanding of place value and ways of representing numbers to 100,000 in various contexts (word form, standard form, expanded form);
- use estimation in determining the relative sizes of amounts or distances (comparing units);
- apply the base-ten system to read, write and represent decimal numbers (to the hundredths) between 0 and 1, between 1 and 2, and so on;
- relate fractions to reading and writing decimals that are greater than or less than 1;
- identify equivalent decimals, compare and order decimals, and estimate decimal or fractional amounts in problem solving;
- use models to connect and compare equivalent fractions and decimals;
- use models of fractions and multiplication and division facts to demonstrate understanding techniques to generate equivalent fractions and simplifying fractions;
- represent money amounts to \$10.00 in dollars and cents, and apply to situations involving purchasing ability and making change.

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Number and Operations and Algebra: To develop quick recall of multiplication facts and related division facts and fluency with whole number multiplication, the student will:

- apply with fluency the basic multiplication facts and related division facts (through 12 x 12);
- apply and use properties of operations (associative, commutative, and identity);
- apply their understanding of models for multiplication (i.e., equal-sized groups, arrays, area models, equal intervals on the number line), place value, and properties of operations (in particular, the distributive property) as they develop, discuss, and use efficient, accurate and generalizable methods to multiply multidigit whole numbers
- select and apply appropriate methods to estimate or mentally calculate products;
- develop fluency using the standard algorithm for multiplying whole numbers;
- identify, describe, and extend numeric patterns involving all operations and nonnumeric growing or repeating patterns;
- develop understandings of strategies for single digit divisor and multidigit dividend division by using models that represent division as the inverse of multiplication, as partitioning, or as successive subtraction.

Geometry and Measurement: To describe and analyze properties of two-dimensional shapes including area using appropriate units of measure, the student will:

- demonstrate and apply their understanding of properties of two-dimensional shapes as they find the areas of polygons.
- recognize area as an attribute of two-dimensional shapes;
- understanding that a square that is 1 unit on a side is the standard unit for measuring area;
- calculate area by finding the total number of same-sized units of area that cover the shape without gaps or overlaps;
- use and understand the standard algorithm for finding area ($A = l \times w$);
- select appropriate units, strategies (e.g., decomposing shapes), and tools for solving problems that involve estimating or measuring area;
- find the area of complex shapes that can be subdivided into rectangles

- solve problems involving perimeters and areas of rectangles and squares;
- demonstrate that rectangles with the same area can have different perimeters and that rectangles with the same perimeter can have different areas;
- apply and extend transformations, including those that produce line and rotational symmetry;
- use transformations to design and analyze simple tessellations to deepen their understanding of two-dimensional space
- measure and classify angles as part of their understanding of two-dimensional shapes.

Data Analysis and Probability: To develop and extend an understanding of data analysis through the use of graphs and symbols; the student will:

- solve problems by creating frequency tables, bar graphs, picture graphs/pictographs, and line plots;
- apply understanding of place value to develop and use stem-and-leaf plots;
- compare groups of objects to determine greater than, less than or equal to, using symbols and words;
- investigate the likeliness and unlikeliness of various events occurring;
- make valid predictions based on accumulated data.

Curriculum Focal Points and Connections for Grade 5

The set of five curriculum focal points and related connections for mathematics in Grade 5 follow. These topics are the recommended content emphases for this grade level. It is essential that these focal points be addressed through hands-on, inquiry-based experiences in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

Number and Operation: To develop and extend number sense through the relationships among numbers and number systems, the student will:

- extend their understanding of place value to numbers through millions and millionths in various contexts;
- apply what they know about multiplication of whole numbers to larger numbers;
- explore contexts that they can describe with negative numbers (e.g., situations of owing money or measuring elevations above and below sea level).

Number and Operations and Algebra: To develop an understanding of and fluency with division of whole numbers, the student will:

- apply their understanding of models for division, place value, properties, and the relationship of division to multiplication;
- apply concepts of place value using the properties of operations to solve problems;
- investigate, develop, communicate, and use efficient, accurate, and generalizable procedures to find quotients involving multidigit dividends;
- select and apply appropriate methods of estimation in division (e.g., benchmarks, overestimate, underestimate, round) depending on the context and numbers involved;
- develop fluency with efficient procedures, including the standard algorithm, for dividing whole numbers, understand why the procedures work (on the basis of place value and properties of operations), and use them to solve problems;
- determine the most appropriate form of the quotient and interpret the remainder in a problem situation appropriately.

Algebra: To develop and extend algebraic reasoning, the student will:

- use patterns, models, and relationships as contexts for writing and solving simple equations and inequalities;
- create graphs of simple equations and write equations from those graphs;
- explore and use prime and composite numbers;
- discover concepts related to the addition and subtraction of fractions as they use factors and multiples, including applications of common factors and common multiples;
- develop an understanding of the order of operations and use it for all operations.

Number and Operations and **Data Analysis:** To develop an understanding of and fluency with addition and subtraction of fractions and decimals, the student will:

- use fraction models to represent addition and subtraction of fractions with unlike denominators;
- apply their understandings of fractions and fraction models to represent the addition and subtraction of fractions with unlike denominators;
- use decimal models, place value, and number properties to add and subtract decimals (to at least the ten-thousandths);
- select and use appropriate strategies to estimate sums and differences of fractions and decimals;
- apply understandings of models, place value, and properties to add and subtract fractions and decimals fluently;
- solve problems that involve the addition and subtraction of fractions and decimals, including problems including measurement;
- apply their understanding of whole numbers, fractions, and decimals as they construct and analyze double-bar and line graphs; and use ordered pairs on coordinate grids;
- use ordered pairs on coordinate grids.

Geometry and Measurement and Algebra: To describe three-dimensional shapes and analyzing their properties, including volume and surface area, the student will:

- **relate two-dimensional shapes to three-dimensional shapes and analyze properties of polyhedral solids, describing them by the number of edges, faces, or vertices as well as the types of faces;**
- **recognize volume as an attribute of three-dimensional space;**
- **understand that a cube that is 1 unit on an edge is the standard unit for measuring volume;**
- **select appropriate units, strategies, and tools for solving problems that involve estimating or measuring volume;**
- **decompose three-dimensional shapes and find surface areas and volumes of prisms;**
- **find and justify relationships among the formulas for the areas of different polygons as they work with surface area;**
- **measure necessary attributes of shapes to use area formulas to solve problems**
- **connect their work with solids and volume to their earlier work with capacity and weight or mass;**
- **solve problems that require attention to both approximation and precision of measurement.**

Curriculum Focal Points and Connections for Grade 6

The set of four curriculum focal points and related connections for mathematics in Grade 6 follow. These topics are the recommended content emphases for this grade level. It is essential that these focal points be addressed through hands-on, inquiry-based experiences in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

Number and Operations: To develop an understanding of and fluency with multiplication and division of fractions and decimals, and to connect ratio, rate and percent, the student will:

- select and use appropriate strategies to estimate fraction and decimal products and quotients;
- investigate, use, and analyze a variety of strategies, including models for solving problems with multiplication and division of fractions;
- use and apply common procedures to multiply and divide fractions and decimals fluently;
- multiply and divide fractions and decimals to solve problems, including multistep problems and problems involving measurement.
- convert among decimals, fractions, and percents and use within estimations, computations, and applications;
- use multiplication and division to solve ratio and rate problems;
- solve a variety of problems involving percents (e.g., taxes, tips, and discounts);
- evaluate numbers with exponents and square roots;
- add, subtract, multiply and divide negative and positive integers;
- read, write, order, and compare rational numbers;
- identify and represent decimals, fractions, mixed numbers, and integers on a number line;
- apply concepts of primes, multiples, factors, divisors, composites, exponents, prime factorization, common factors, and common multiples within a specific context.

Algebra: To write, interpret, and use mathematical expressions and equations, the student will:

- simplify and evaluate expressions using order of operations with whole numbers;
- develop the meaning and uses of variables;
- write mathematical expressions and equations that correspond to given situations;
- determine that the solutions of an equation are the values of the variables that make the equation true;
- solve simple one-step equations by using number sense, properties of operations, and the idea of maintaining equality on both sides of an equation involving addition, subtraction, multiplication, and division;
- construct and analyze tables, and use equations to describe simple relationships shown in a table
- write an equation for a function and use the equation to find a missing value;
- represent linear functions using ordered pairs and graphs;
- use order of operations to solve equations which may include exponents and parentheses;
- use translations, reflections, and rotations to change the positions of figures on a coordinate plane
- use commutative and associative properties in mental arithmetic;
- use formulas to solve numerical and geometric problems;
- create rules for simple numerical and geometric patterns;
- demonstrate and analyze simple numerical and geometric relationships using concrete models;

Measurement and Geometry: To strengthen and expand their spatial reasoning, the student will:

- find areas, perimeters, and volumes from lengths, and find lengths from areas, perimeters, and volumes;
- find circumference and areas of circles;
- solve a variety of problems involving measures of sides and angles of triangles;

- use appropriate tools and units to measure length, width, and capacity;
- develop, use, and analyze perimeter and area formulas for rectangles, triangles, circles, prisms, and pyramids;
- investigate and identify properties of parallel, perpendicular, and skew lines

Probability and Statistics: To develop skills to evaluate information and make informed decisions, the student will:

- collect and analyze data to make predictions;
- organize and display data using bar graphs, line plots, stem and leaf plots, and circle graphs;
- determine whether games of chance are fair or unfair;
- determine the likelihood of events based on the probability scale;
- estimate probabilities based on desired outcomes out of total;
- investigate and understand the meaning of probability and represent probabilities as ratios, decimals, and percents;
- determine simple probabilities, both experimental and theoretical.

Curriculum Focal Points and Connections for Grade 7

The set of curriculum focal points and related connections for mathematics in Grade 7 follow. These topics are the recommended content emphases for this grade level. It is essential that these focal points be addressed through hands-on, inquiry based experiences in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

Number and Operations and Algebra and Geometry: To develop an understanding of and applying proportionality, including similarity, the student will:

- use ratio & proportionality to solve a wide variety of percent problems including taxes, tips, discounts, interests, & percent increase or decrease;
- use scale factors and proportional relationships to solve problems, including similarity and congruence;
- use scale factor to find corresponding lengths in two similar objects, the square of the scale factor for area, and the cube of scale factor for volume (changing dimensions);
- graph proportional relationships and identify the unit rate as the slope of the line (as in rate of change);
- use coordinate graphs, tables, and equations to distinguish proportional relationships from other relationships, including reverse proportionality;
- use proportionality with work in circumference, radius, and diameter of a circle and when they find the area of a sector of a circle, and in making scale drawings.

Numbers and Operations and Algebra: To develop an understanding of operations on all rational numbers and solving linear equations, the student will:

- apply addition, subtraction, multiplication, and division properties to all rational numbers, including negative integers;
- using properties of arithmetic and negative numbers, explain why the rules for addition, subtraction, multiplying, and dividing integers make sense;
- form and solve linear equations in one variable and use these equations to solve problems;
- choose procedures to undo one equation to create equivalent equations using solution sets;
- translate/write a phrase into algebraic expressions, equations, or inequalities;

- determine the slope of a line using x and y coordinates;
- graph inequalities and absolute value equations;
- simplify algebraic expressions and solve multi-step equations;
- translate among contextual, verbal, tabular, graphical, and algebraic representations of linear functions;
- use linear functions and equations to represent, analyze, and solve problems and to make predictions and inferences.

Number and Operations:

- use division to write fractions as decimals (both finite and infinite);
- use fractions to solve proportions and percents;
- use dimensional analysis to solve problems;
- use proportions & rate tables to change units of measurement within the same system;
- solve equations (in the form of $ax = b$) by dividing fractions (where a and b are fractions);
- use factoring methods to find the product of primes;
- use scientific and exponential notation to represent small/large numbers;
- extend understanding of number systems to include irrational numbers;
- simplify/evaluate expressions with variables using order of operations;
- compare/contrast the Real Number System;
- select an appropriate problem solving strategy to solve a variety of problems.
- choose the appropriate computation method for solving word problems involving rational numbers;
- evaluate expressions & those involving absolute values, exponents, and roots;

Measurement and Geometry and Algebra: To develop an understanding of and use formulas to determine areas of polygons and surface areas and volumes three-dimensional shapes, the student will:

- construct and model 2- and 3-dimensional figures;
- use models to explain the reasonableness of formulas and the circumference and area of circles;
- use different estimations of PI to calculate the area and circumference of circles;
- use and decompose models to explain the reasonableness of formulas for the surface areas of pyramids and cylinders, and volume of pyramids, cylinders, and cones;
- classify, identify and compare prisms and cylinders and their component parts: faces, edges, vertices, and bases;
- develop and use formulas to find areas of polygons and irregular figures(divide irregular figures into basic shapes);
- apply volume and surface area formulas in problem solving to determine volumes and surface areas of rectangular prisms and cylinders;
- solve a variety of problems involving surface areas, areas and circumferences of circles, and volumes of prisms and cylinders.

Measurement and Geometry:

- use ratio and proportions to determine the measures of similar figures;
- convert among different units of measurements to solve problems involving rates and unit rates;
- measure, draw, and classify angles;
- identify combinations of angles and determine their measures
- use models to show the sum of angles of any triangle is 180 degrees and apply this fact to find unknown angles;
- decompose polygons into triangles by diagonals and determine the sum of the measures of the angles of the polygons;
- identify, model, draw, and label complementary, supplementary, vertical, and adjacent angles;
- use the Pythagorean Theorem to find the missing side lengths of right triangles;
- use distance and midpoint formulas to solve problems;

- find and estimate square roots, solve equations by finding square roots;
- use properties of parallel lines, transversals, and angles to find missing sides and angles and to solve problems including similarity and congruence of triangles.

Data Analysis:

- collect and analyze data to test a hypothesis;
- make predictions based on patterns in data;
- organize and display data using different graphic forms (histogram, box-and whisker plots, stem and leaf plots, circle graphs, and scatter plots);
- determine which graphic form is most appropriately used for a given situation;
- use measures of center and spread to summarize and compare data sets;
- use proportions to make estimates relating to a population on the basis of a sample;
- apply percentages to make and interpret circle graphs and histograms.

Probability:

- conduct experiments using experimental and theoretical probabilities to make approximate predictions and calculate probabilities;
- use organized lists and tree diagrams to determine theoretical probabilities;
- use the *Fundamental Counting Principle* to determine the number of ways that two or more separate tasks can occur;
- determine and reason whether experiments are fair or unfair.

Curriculum Focal Points and Connections for Grade 8

The set of four curriculum focal points and related connections for mathematics in grade 8 follow. These topics are the recommended content emphases for this grade level. It is essential that these focal points be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations.

Algebra: To analyze and represent linear functions and solve linear equations and systems of linear equations, the student will:

- translate among verbal, tabular, graphical, and algebraic representations;
- discover that all “slope triangles” are similar given the exploration of a line in a coordinate plane;
- discover the relationship between similar “slope triangles” formed by a line and the constant rate of change or slope of that line;
- demonstrate that the slope (m) of a line is a constant rate of change such that the output y is a function of the slope and input x ;
- write linear equations using graphical representations;
- recognize a proportion ($y/x = k$ or $y = kx$) as a linear equation of the form $y = mx + b$, understanding that the constant of proportionality (k) is the slope and the resulting graph is a line through the origin;
- connect arithmetic sequences, including those arising from patterns or problems, to linear functions whose inputs are counting numbers;
- use linear functions, linear equations, and systems to represent, analyze, and solve a variety of problems;
- solve systems of two linear equations and identify if the lines intersect, are parallel, or are the same line;
- use algebraic reasoning to solve algebraic equations and inequalities containing rational numbers and common irrational numbers;
- translate between the distributive property and factoring to simplify or solve algebraic equations and expressions;
- explore a selection of nonlinear functions whose rates of change contrast with the constant rate of change of linear functions.

Geometry and Measurement: To analyze two- and three-dimensional space and figures by using distance and angle, the student will:

- prove that particular configurations of lines give rise to similar triangles because of the congruent angles created when a transversal cuts parallel lines;
- apply this reasoning about similar triangles to solve a variety of problems, including those that ask them to find heights and distances;
- use facts about the angles that are created when a transversal cuts parallel lines to explain why the sum of the measures of the angles in a triangle is 180 degrees. Apply this fact about triangles to find unknown measures of angles;
- use two- and three- dimensional shapes to solve problems, including those with multiple steps;
- apply area formulas to irregular figures to analyze their area;
- apply 2-dimensional area formulas to determine the surface area of 3- dimensional figures;
- use volume formulas to analyze and solve related problems;
- explain why the Pythagorean Theorem is valid by using a variety of methods;
- apply the Pythagorean Theorem and utilize square roots to find distances between points in the Cartesian coordinate plane to measure lengths and analyze polygons and polyhedra.

Data Analysis: To analyze and summarize data sets, the student will:

- use previous knowledge of organizing and displaying data in order to pose and answer question to see numerical data as an aggregate;
- use descriptive statistics, including mean, median, and range to summarize and compare data sets, in addition to organizing and displaying data to pose and answer questions.;
- compare the information provided by the mean and the median and investigate the different effects that changes in data values have on these measures of center;
- make scatter plots to display bivariate data and informally estimate lines of best fit to make and test conjectures.

Number and Operations: To extend knowledge of the relationships among numbers and number systems, the student will:

- **use ratios and proportions to solve problems containing percents and probabilities;**
- **use percents to solve related problems including tax rates, simple interest, and percent increase and decrease;**
- **create and use experimental and theoretical probability to represent and solve related problems;**
- **use tree diagrams and factorial functions to analyze sampling techniques (combinations and permutations).**

2008-09 MATHEMATICS COMMITTEE

Kindergarten – FayeAnn Cummings

First Grade – Rhonda Burnett

Second Grade – Connie Ford

Third Grade – Patty Buckley

Fourth Grade – KD Jones

Fifth Grade – Judi Grimes

Sixth Grade – Kathy Dummer

Seventh Grade – Beth Walsh

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