Mathematics Curriculum Standards 2018

Grades K-8

Catholic Schools Office
Diocese of Burlington
55 Joy Drive
South Burlington, VT

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Rationale for Learning Mathematics

The vision statement of the Catholic schools of the Diocese of Burlington challenges its schools to graduate students who are productive moral citizens and critical thinkers. The discipline of mathematics is key to the achievement of that vision. By its nature, mathematics promotes logical and abstract thinking. Significant moral decisions require the techniques of problem solving practiced in a strong mathematics curriculum. Mathematical processes and skills are necessary to solve problems and construct valid arguments in other disciplines. Mathematics serves both the natural and social sciences and stands as a logical foundation for the consideration of moral and ethical issues by Catholic Christian thinkers. This foundation is built on the students' abilities to observe, predict, analyze and problem solve. Modern technology requires varying forms of mathematical thought from all who use and create it. Most significant of all, the importance of mathematics instruction, learning and assessment lies in the universality of its problem-solving applications to every-day life.

Graduation Outcomes

Students will live according to Catholic values.

Students will use effective communication skills.

Students will read, think, and listen critically.

Students will demonstrate a global awareness.

Students will engage in lifelong learning.

Students will solve problems effectively.

Students will use technology wisely and well.

Introduction

These mathematics standards represent the completion of three years of research into current mathematics teaching practice, thoughtful consideration of teaching and assessment methods used in the diocese, and collaboration and consultation with teachers in developing content and student learning objectives.

Structure

The Standards for Mathematics Instruction in the Diocese of Burlington is divided by grade level. Within each grade level, with the exception of Algebra I, there are five strands:

- Number Theory, Estimation and Operations
- Algebra: Patterns and Functions
- Geometry
- Measurement
- Data Analysis, Statistics and Probability

Content, Student Objectives/Enabling Outcomes, Assessment

The overall goals listed at the beginning of each strand are restatements of the National Council of Teachers of Mathematics Learning Standards. The content areas included in each strand are listed in the first column in each table. Additional space is provided in this column for teachers to make notes about materials, relative ease or difficulty of the lesson, connections to other strands or other subject areas. In the second column, student objectives are bold-faced and numbered; enabling outcomes are bulleted after the student learning objectives. Each table contains a third column dedicated to assessment. Teachers use that column to record the kind of assessment used to measure objectives and outcomes and to make notes about extraordinary achievement or lack of achievement. Teachers should use a variety of assessment tools and methods.

The student objectives contained under each strand heading represent a minimum instructional plan for the year. It is essential that each mathematics teacher becomes familiar with the objectives for the preceding as well as the following grade, and a good overall picture of the sequence of instruction throughout the twelve grades. As schools use the standards document efficiently, each teacher should receive a record of what students covered the previous year. The notes in that document, along with report card and standardized testing data should inform instructional planning to meet the needs of each student.

Frequent mention of the NCTM Standards indicates that instruction should be modeled upon those standards, both in content and in style. Classrooms should incorporate a

learning environment which values problem solving in real life situations, and encourages the active participation of the students in the learning process. Instruction should engage students in the learning process rather than allowing them to be the passive recipients of information.

In general, each introduction of a new skill or concept should be developed with the idea that knowing mathematics is doing mathematics. Associated learning activities should arise from problem situations. Learning should include opportunities for appropriate project work, both group and individual assignments, discussions between teachers and students, practice, and teacher exposition. In addition, students should have the opportunity to formulate problems and questions that arise from their own interests frequently. Small group work can be both collaborative and cooperative. The ultimate goal of group work should be to enable the student to become a more independent thinker.

Problem Solving

Following the number theory section of grades one and two and throughout the document in grade levels four through eight, there are matrices that list the problem solving skills. At the top of each column is a number that corresponds to the numbered student objective in the preceding sections. Teachers fill in date(s) under the number indicating when a particular problem solving skill was taught.

Vocabulary

Each grade level has at least one table of vocabulary to be used by teachers and students to instruct, learn, and communicate mathematically. Students will demonstrate mastery of terms in written and oral forms. The use of correct mathematical terms is essential for consistent instruction and for mathematical applications to life situations.

Sequence

In general, the teacher may wish to follow the outline of the textbook, assuring that each stated student learning objective from the guidelines is taught.

Within each strand, student objectives are sequenced. It is not necessary to cover an entire strand before proceeding to another, nor is it desirable. Math content should be integrated not just between and among strands, but with other subject areas.

Grades Seven/Eight, Algebra I and Secondary

Some students will complete Algebra I by the end of eighth grade. In order to qualify for Algebra in the 8th grade, students must obtain a 90% on an eighth grade math exam.

However, the more important goal is that Catholic school students in the Diocese of Burlington have a rich and challenging middle school math experience, one that builds on the foundation of algebraic thinking begun and nurtured through the primary and intermediate levels. To achieve these goals, the Mathematics Curriculum Standards are labeled on the upper middle school level Grades Seven and Eight. Within those pages, it is expected that the skills, processes, and concepts labeled as "Introductory" will be mastered by eighth graders or seventh graders taking algebra in grade eight.

The secondary school structure is very different from its primary, intermediate, and middle school counterparts. That section of the document, more than any other, is based on the 2005 Vermont Mathematics Frameworks. The terms "introductory" and "mastered" have been replaced in this section with "core" and "extended." This is done to accommodate both required and elective math courses. High schools offer a variety of elective math courses.

Use of Technology

As in all areas of curriculum, technology can and should enhance learning of mathematics. There are countless website resources for student exploration and practice and for assisting teachers in lesson planning. Interactive whiteboards provide powerful opportunities for motivating and challenging students in the study of mathematics. Calculators, too, are a valuable tool in math instruction. The National Council of Teachers of Mathematics, in its position statement on the use of technology, states :

> *Calculators, computer software tools, and other technologies assist in the collection, recording, organization, and analysis of data. They also enhance computational power and provide convenient, accurate, and dynamic drawing, graphing, and computational tools. With such devices, students can extend the range and quality of their mathematical investigations and encounter mathematical ideas in more realistic settings.*
>
> *In the context of a well-articulated mathematics program, technology increases both the scope of the mathematical content and the range of the problem situations that are within students' reach. Powerful tools for computation, construction, and visual representation offer students access to mathematical content and contexts that would otherwise be too complex for them to explore. Using the tools of technology to work in interesting problem contexts can facilitate students' achievement of a variety of higher-order learning outcomes, such as reflection, reasoning, problem posing, problem solving, and decision making.*
>
> *Technologies are essential tools within a balanced mathematics program. Teachers must be prepared to serve as knowledgeable decision makers in determining when and how their students can use these tools most effectively.*

Source: http://www.nctm.org/about/position_statements/position_statement

While these tools do not replace the need to compute mentally, do reasonable paper and pencil computation, and learn facts, calculators, computers, hand held data devices, etc. must be accepted as valuable tools for learning and teaching mathematics. Their effectiveness depends on the ability of students to recognize reasonable answers.

Additionally, technological tools enable students to extend their problem solving ability beyond their knowledge of paper and pencil computation. This increases their math power. These tools also free students from tedious computation and allow them to concentrate on problem solving, both the posing and the solving of problems.

Calculators in grades 5-8 should include the following features: square root, reciprocal, exponent, +/- keys, algebraic logic, and constants. Some use of graphing calculators in algebra I is recommended.

All textbook publishers provide interactive websites for teachers, students, and parents. Almost all have the availability of online texts and often have proprietary software in conjunction with their series. This support includes lesson plans for teachers, practice and challenge opportunities for students, and activities for parents. In addition, both web and software resources offer a variety of choices in assessment tools. Teachers should investigate, select and use these resources carefully.

Instructional Resources

The materials needed to support math instruction **on every level** should reflect three sequential components of learning. First, the student needs multiple concrete experiences that illustrate a mathematical principle or process. Students should be given access to manipulatives (both physical and virtual) – those materials that can be organized, categorized, combined, separated, changed – that provide varied concrete experiences of mathematical thinking and processes. These materials should include, but are not limited to: unifix cubes, geoboards, spinners, coins, counters, pattern blocks, fraction pieces, algebra tiles, compasses, scales, scissors, rulers, protractors, graph paper, grid/dot paper. Samples of these are found in the teachers resources of any math text.

Once the student has recognized a general pattern, materials and instruction are provided to help the student explain, describe and represent what has taken place. The manipulation of materials is represented as an algorithm, a written record of thinking.

Finally, the student develops the ability to apply concrete experiences to new and abstract situations, often as problem solving.

Each classroom should provide a textbook for each student. This may be in print or electronic form. Additional classroom resources might include student workbooks, computer generated practice materials and games designed to develop mathematical thinking.

Care should be taken in the selection of materials to assure that all components (concrete, representational, and abstract) of learning are provided for each student.

All schools should have a membership in the National Council of Teachers of Mathematics.

Internet Resources

Websites of publishers (Listed in the Approved Programs and Texts)

Assessment

Assessment is a means of measuring performance. It illustrates how well we are accomplishing our stated mission, goals, and objectives to educate and form the whole person. Through an integrated system of standards and of multiple forms of evaluation, assessment measures:

- beliefs, attitudes and behaviors, which are expressions of our Catholic identity;
- content knowledge
- student achievement (individual and group) ; and the
- learning and teaching environment

(NCEA Statement on Accountability and Assessment in Catholic Education)

Pre-Assessment

Before embarking upon a new unit of instruction, teachers should check the assessment information noted in the previous year and pre-test for the purpose of gaining information about student skills and knowledge. This will enable the teacher to place less emphasis on skills or concepts already mastered, and to focus on introduction and mastery of new skills.

Assessments of students should match the learning outcome or goal. In all classrooms, a variety of assessments, both objective and subjective, should be used to enhance learning and measure progress. While students are learning new skills and concepts, teachers should constantly assess their progress to plan differentiated instruction. Assessments are both instructional tools for students while they are learning and accountability tools to determine if learning has occurred. These assessments should include, but are not limited to:

Performance Assessment:
Student formal and informal presentations **across the curriculum:**

- ✍ Recitations, speeches, debates, discussions, video or audio performances that include math concepts and skills
- ✍ Narratives that explain concepts and methods
- ✍ Written mathematical work across the curriculum
- ✍ Oral presentation and explanations (individual and group)

- ✍ Classroom performance (responses to discussions, questions, directions)
- ✍ Parent/Teacher/Student conferences
- ✍ Rubrics
- ✍ Portfolios
- ✍ Research papers, projects, presentations
- ✍ Reaction paper to articles
- ✍ Posters, brochures
- ✍ Model construction
- ✍ Anecdotal records
- ✍ Teacher observation of student math activities across the curriculum
- ✍ Informal and formal inventories
- ✍ Daily work
- ✍ Notebook checks
- ✍ Application of skills across the curriculum

Criterion/Norm Referenced Assessment:

- Standardized Tests
- Teacher/text created tests and quizzes (Written, oral, electronic)
- Fluency tests
- Teacher or text generated checklists of skills

Independent:

- Teacher observation
- Teacher-student conference
- Student self-correction and reflection on learning and performance
- Student self-assessment of goals
- Online programs that allow students to self-assess

Teachers should uses formative assessments throughout the instructional process to inform and differentiate instruction.

National Council of Teachers of Mathematics
Mathematics Standards

Instructional programs from kindergarten through grade twelve should enable all students to:

- understand numbers, ways of representing numbers, relationships among numbers, and number systems
- understand meanings of operations and how they relate to one another
- compute fluently and make reasonable estimates
- understand patterns, relations, and functions
- represent and analyze mathematical situations and structures using algebraic symbols
- use mathematical models to represent and understand quantitative relationships
- Analyze change in various contexts
- Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships
- Specify locations and describe spatial relationships using coordinate geometry and other representational systems
- Apply transformations and use symmetry to analyze mathematical situations
- Use visualization, spatial reasoning, and geometric modeling to solve problems
- Understand measurable attributes of objects and the units, systems, and processes of measurement
- Apply appropriate techniques, tools, and formulas to determine measurements
- Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
- Select and use appropriate statistical methods to analyze data

"We must expect all of our students to learn mathematics well beyond what we previously expected. We need all students to be more proficient than in the past, and we need many more students to pursue careers based on mathematics and science."

Seely, Cathy, NCTM

http://www.nctm.org/news/pastpresident/2005_03president.htm

Kindergarten
Number Theory, Estimation, and Operations

Goals
The students will: ● understand numbers, ways of representing numbers, relationships among number, and number sequence ● count to tell the number of objects ● compare numbers

Content	Student Objectives/Enabling Outcomes
Number Theory	1. Students will count by groups, add one more to groups, and compare groups. *Concepts and Skill Sets Mastered* The student will: • count using 1 to 1 correspondence • demonstrate understanding that the number of objects remains the same regardless of arrangement • count to answer "how many?" questions • compare numbers • compare two numbers between 1 and 10 presented as written numerals *Concepts and Skill Sets Introduced* The student will: • count to 100 by ones and by tens • count on from a given amount, orally and with models • write numbers from 0 to 20. Represent a number of objects with a written numeral 0-20. Count to tell the number of objects • identify and use zero • identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group 2. Students will represent and order 2 digit numbers using the base ten place value system. *Concepts and Skill Sets Mastered* The student will: • identify and name place values • use place value models to identify tens and ones *Concepts and Skill Sets Introduced* The student will: • identify ordinal position of objects first through tenth • identify number words to ten • identify and name place values to hundreds place • identify 10 more and 10 less than a number

Operations Whole Numbers	3. Students will add by counting and combining and subtract by separating, comparing, or counting on or back. *Concepts and Skill Sets Mastered* The student will: ● develop, describe, and use strategies to add and subtract one digit numbers

Kindergarten
Algebra: Patterns and Functions

Goals
The students will: ● understand patterns, relations, and functions ● represent and analyze mathematical situations and structures using algebraic symbols ● use mathematical models to represent and understand quantitative relationships ● analyze change in various contexts ● use operations, properties and algebraic symbols to determine equivalence and solve problems NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Patterns	1. Students will examine attributes of objects and describe their relationships. *Concepts and Skill Sets Introduced* The student will: ● sort, classify, and order objects by size, number, and other properties ● identify, describe, extend, and create patterns 2. Students will analyze change of quantity and quality using patterns. *Concepts and Skill Sets Introduced* The student will: ● skip count by 2,5,10
Functions	3. Students will represent the result of counting, combining, and separating sets of objects using number sentences. *Concepts and Skill Sets Introduced* The student will: ● model real-life situations that involve addition and subtraction of whole numbers using objects, pictures, and open sentences

Kindergarten
Geometry

Goals
The students will: • analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments about relationships NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Plane and Solid Figures	1. Students will classify plane figures and solids by common characteristics including examples with change of position. *Concepts and Skill Sets Introduced* The student will: • describe objects in the environment using names of shapes, and describe the relative positions of these objects using terms such as above, below, beside, in front of, behind, and next to • explore and identify plane (square, rectangles, circles, triangles, hexagons) and solid figures (cube, cone, cylinder, sphere) 2. Students will use calendars to measure time and will plan and sequence events. *Concepts and Skill Sets Introduced* The student will: • identify days of the week, months of the year, current year • identify time of the day as morning, afternoon, and evening • sequence events from first to last

Kindergarten
Measurement

Goals
The students will: • understand measurable attributes of objects and processes of measurement • apply appropriate techniques, tools to determine measurements

Content	Student Objectives/Enabling Outcomes
	1. Students will use measurable attributes to communicate measurement. *Concepts and Skill Sets Mastered* The student will: • describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object • compare two objects with a measurable attribute in common, to see which object has "more of/less of" the attribute, and describe the difference • classify objects into given categories

Kindergarten
Data Analysis, Statistics, and Probability

Goals
The students will: ● formulate questions that can be addressed with data; collect, organize, and display relevant data to answer them ● select and use appropriate statistical methods to analyze data ● develop and evaluate inferences and predictions that are based on data ● understand and apply basic concepts of probability NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Graphs	1. Students will collect, organize, and describe data. *Concepts and Skill Sets Mastered* The student will: ● make and interpret a real object, picture, and bar graphs ● read and use data from a graph, table, glyphs (coded pictures), and/or picture ● conduct simple surveys to gather data ● use a Venn diagram and other graphic organizers to sort items 2. Students will analyze data in tables and graphs. *Concepts and Skill Sets Mastered* The student will: ● use comparative language to describe/interpret data in tables and graphs

Grade K - Vocabulary

Number Theory, Operations and Estimation	Algebra	Geometry
Add Count on Equal Minus Number sentence Part Place Value: ones place tens place Plus Whole First Second Third Subtract Take away	Even Odd Pattern	Left and right Sides Two-dimensional figures Three-dimensional figures Vertex/vertices Circle Hexagon Rectangle Round Straight Square Triangle Different Alike Above Behind Below Neside In front of Next to Cone Cube Cylinder Roll Slide Sphere
Measurement	**Data Analysis, Statistics, Probability**	**Add vocabulary terms as needed**
Length Longer/shorter More/less Heavier Height Taller/shorter	Bar graph Picture graph Greater than/less than/equal to Less/more	

Grade One
Number Theory, Estimation, and Operations

Goals
The students will: • understand numbers, ways of representing numbers, relationships among numbers, and number systems • understand meanings of operations and how they relate to one another • compute fluently and make reasonable estimates NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Number Theory	1. Students will count by groups, add one more to groups, and compare groups. *Concepts and Skill Sets Mastered* The student will: • count, read, write, order, compare, expand and represent numbers to 120 • count on from a given amount, orally and with models • count back from 20 • identify one more and one less than a number • plot numbers to 100 on a number line • identify and use zero 2. Students will represent and order 2 digit numbers using the base ten place value system. *Concepts and Skill Sets Mastered* The student will: • identify ordinal position of objects first through tenth • identify and name place values • use place value models to identify tens and ones *Concepts and Skill Sets Introduced* The student will: • identify number words to ten • identify and name place values to hundreds place • identify 10 more and 10 less than a number

Fractions	6. Students will identify and compare equal parts of a whole. *Concepts and Skill Sets Mastered* The student will: • identify equal parts of a whole • make a whole of equal sized parts of familiar objects • identify halves and quarters using models *Concepts and Skill Sets Introduced* The student will: • read, write, and identify 1/2, 1/3, 2/3, 1/4, 2/4, 3/4 • differentiate halves, thirds and fourths from other fractional parts 7. Students will partition a set of objects into smaller groups with equal amounts. *Concepts and Skill Sets Introduced* The student will: ● identify half of a small set of objects considered to be the whole
Estimation	8. Students will describe quantitative relationships and develop benchmark representations. *Concepts and Skill Sets Mastered* The student will: ● estimate quantity of items in a group ● estimate and describe quantity with benchmark amounts such as 0, 10, and 100 *Concepts and Skill Sets Introduce* The student will: ● identify reasonable answers to problems that reflect real-world experience

Grade One
Algebra: Patterns and Functions

Goals
The students will: • understand patterns, relations, and functions • represent and analyze mathematical situations and structures using algebraic symbols • use mathematical models to represent and understand quantitative relationships • analyze change in various contexts • use operations, properties and algebraic symbols to determine equivalence and solve problems NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Patterns	1. Students will examine attributes of objects and describe their relationships. *Concepts and Skill Sets Mastered* The student will: • sort, classify, and order objects by size, number, and other properties • identify, describe, extend, and create pattern 2. Students will analyze change of quantity and quality using patterns. *Concepts and Skill Sets Mastered* The student will: • represent even and odd numbers concretely as pairs and leftover ones *Concepts and Skill Sets Introduced* The student will: • skip count by 2,5,10 • identify even and odd numbers to 100
Functions	3. Students will represent the result of counting, combining, and separating sets of objects using number sentences. *Concepts and Skill Sets Mastered* The student will: • model real-life situations that involve addition and subtraction of whole numbers using objects, pictures, and open sentences 4. Students will identify and represent quantities as equivalent or non-equivalent. *Concepts and Skill Sets Mastered* The student will: • identify and apply symbol of equality (=)

	• demonstrate equivalence using models *Concepts and Skill Sets Introduced* The student will: • balance simple number sentences by finding the missing numbers • identify and use symbols of inequality (<, >) 5. Students will understand and describe functional relationships. *Concepts and Skill Sets Introduced* The student will: • identify functional number relationships

Grade One
Geometry

Goals
The students will: • analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments about relationships • specify locations and describe spatial relationships using coordinate geometry and other representational systems • apply transformations and use symmetry to analyze mathematical situations • use visualization, spatial reasoning, and geometric modeling to solve problems NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Plane and Solid Figures	1. Students will classify plane figures and solids by common characteristics including examples with change of position. *Concepts and Skill Sets Mastered* The student will: • identify, sort and describe 2 dimensional figures • identify common objects in the environment that depict two and three dimensional figures • count vertices and faces of three dimensional figures • explore and identify solid figures (cube, cone, cylinder, sphere) • build and draw two and three dimensional shapes 2. Students will describe, name and interpret relative direction, location, proximity, and position of objects *Concepts and Skill Sets Mastered* The student will: • identify points inside, outside, or on a figure • use the descriptive terms: top, bottom, left, right, near, far, up, down, above, below, next to, close by • identify open or closed figures *Concepts and Skill Sets Introduced* The student will: • explore lines of symmetry • identify figures having the same size and shape

	3. Students will recognize and use geometric relationships to solve problems. *Concepts and Skill Sets Introduced* The student will: ● predict the results of putting together and taking apart two- and three-dimensional shapes

Grade One
Measurement

Goals
The students will: • understand measurable attributes of objects and the units, systems, and processes of measurement • apply appropriate techniques, tools and formulas to determine measurements NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Length	1. Students will use standard units to communicate measure. *Concepts and Skill Sets Mastered* The student will: • identify inch and foot as customary units of measurement • identify centimeter as standard metric measure • demonstrate approximate inch 2. Students will use concrete examples to make estimates and to determine and describe the reasonableness of answers to measurement problems. *Concepts and Skill Sets Mastered* The student will: • compare lengths of given objects using "longer" and "shorter" • compare capacity using "more" or "less" • compare mass of objects using a balance scale 3. Students will measure through direct comparison and repetition of units. *Concepts and Skill Sets Mastered* The student will: • estimate and measure length and height in non-standard units *Concepts and Skill Sets Introduced* The student will: • recognize and apply nonstandard units of measure • read Fahrenheit and Celsius thermometers • estimate and measure length and height in inches and centimeters

Money	6. Students will determine and compare coin values. *Concepts and Skill Sets Introduced* The student will: • name a penny, nickel, dime, quarter and dollar bill • identify the value of a penny, nickel, dime, quarter and dollar bill 7. Students will recognize, identify, and trade equivalent sets of coins. *Concepts and Skill Sets Introduced* The student will: • determine and compare values of sets of coins • count and show money to one dollar 8. Students will express monetary value in oral and written forms. *Concepts and Skill Sets Mastered* The student will: • use the cents sign (¢) *Introductory* The student will: • use dollar sign ($) 9. Students will solve problems involving money. *Concepts and Skill Sets Mastered* The student will: • add and subtract money to 12 cents

Grade One
Data Analysis, Statistics, and Probability

Goals
The students will: • formulate questions that can be addressed with data; collect, organize, and display relevant data to answer them • select and use appropriate statistical methods to analyze data • develop and evaluate inferences and predictions that are based on data • understand and apply basic concepts of probability NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Graphs	1. Students will collect, organize, and describe data. *Concepts and Skill Sets Mastered* The student will: • make and interpret a real object, picture, and bar graphs • make and interpret a tally chart • read and Use data from a graph, table and/or picture • conduct simple surveys to gather data *Concepts and Skill Sets Introduced* The student will: • choose and Use various methods to organize information including lists, systematic counting, sorting, graphic organizers, and tables 2. Students will analyze data in tables and graphs. *Concepts and Skill Sets Mastered* The student will: • use comparative language to describe/interpret data in tables and graphs
Probability	3. Students will determine the likelihood of certain events through simple games and experiments. *Concepts and Skill Sets Introduced* The student will: • observe, record, graph, and describe the results of simple probability activities and games • identify events as certain, possible or impossible

Grade 1 - Vocabulary

Number Theory, Operations and Estimation	Algebra	Geometry
Add Addend Addition number sentence Count on Difference Doubles fact Equal to Estimate Fact families Fractions: half third fourth Greater and less than Minus Part Place Value: ones place tens place hundreds place Plus Related facts Subtraction sentence Sum Whole	Even Odd Pattern	Angle Corners Face Left and right Open and closed figures Sides Symmetry Two-dimensional figures Three-dimensional figures Vertex/vertices
Measurement	**Data Analysis, Statistics, Probability**	**Add vocabulary terms as needed**
Estimate Length/height Centimeter Foot Inch Longer/shorter More/less Money cent ¢ dime dollar $ nickel penny quarter Temperature Thermometer Half hour Hour O'clock	Bar graph Data Picture graph Greater than/less than/equal to Less/more Possible/impossible/certain Tally Tally chart	

Grade Two
Number Theory, Estimation, and Operations

Goals
The students will: • understand numbers, ways of representing numbers, relationships among numbers, and number systems • understand meanings of operations and how they relate to one another • compute fluently and make reasonable estimates • use fractions to draw conclusions about the fairness and equity of resources NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Number Theory	1. Students will represent three digit numbers as groups of hundreds, tens, and ones in the base ten number system. *Concepts and Skill Sets Mastered* The student will: • count, order, compare, and expand numerals to 999 • demonstrate place values using models *Concepts and Skill Sets Introduced* • expand numerals by identifying the value of each digit in its place 2. Students will represent and order number concepts in verbal and written form. *Concepts and Skill Sets Mastered* The student will: • identify and name place values: hundreds, tens and ones • identify ordinal positions to twentieth • identify ordinal words to twentieth • identify number words to one hundred • read and write numerals to 999 *Concepts and Skill Sets Introduced* The student will: • read and write number words to one hundred • identify and name place values to the thousands place

Operations Whole Numbers	3. Students will represent the result of counting, combining and separating sets of objects using number sentences. *Concepts and Skill Sets Mastered* The student will: • model real-life situations that involve addition and subtraction of whole numbers, using objects, pictures and open sentences • write related fact families for addition and subtraction *Concepts and Skill Sets Introduced* The student will • Choose and justify the correct operation in a word problem (+, -) 4. Students will develop fact families using inverse relationships. *Concepts and Skill Sets Mastered* The student will: • relate the inverse relationship of addition and subtraction facts to 20 • complete a number of fact problems within a specific time limit • memorize addition and related subtraction facts to 20 • check subtraction with addition • read and write addition/subtraction and facts families. 5. Students will use concepts based on patterns and place values to add and subtract. *Concepts and Skill Sets Mastered* The student will: • add and subtract 3 digit numbers without regrouping • add and subtract 2 digit numbers with regrouping • add 1 and 2 digit numbers with 3 addends – column addition *Concepts and Skill Sets Introduced* The student will • add and subtract 3 digit numbers with regrouping • subtract 3 digit numbers with regrouping through zeroes 6. Students will describe the relationship between multiplication and division. *Concepts and Skill Sets Introduced* The student will: • relate skip counting and repeated addition to multiplication. • draw arrays to model multiplication • explore products to 25 • use models to demonstrate division (Make equal groups and use repeated subtraction.) • Use arrays to relate multiplication and division

	• illustrate repeated addition and subtraction on a number line
Fractions	7. Student will create portions of equal size to illustrate fractions. *Concepts and Skill Sets Mastered* The student will: • read, write and identify halves, thirds and fourths • identify more than one equal part of a region, area, or object • describe the significance of a numerator and denominator • compare parts of whole object and describe them as closer to zero, one half, or one whole *Concepts and Skill Sets Introduced* The student will: • read, write and identify all fractions • identify and model fractional parts of a set 9. Students will use models to compare fractions. *Concepts and Skill Sets Introduced* The student will: • use visual models to identify and compare fractions • model equivalent fractions (using manipulatives, pictures, graphics, etc.) • compare unit fractions • compare fractions with like denominators
Estimation	10. Students will identify and use equivalent representations of numbers to estimate and compute. *Concepts and Skill Sets Introduced* The student will: • round numbers to the nearest 10 and hundred • round to estimate sums of two digit numbers • use estimation strategies that result in reasonable answers to a problem

Grade Two
Algebra: Patterns and Functions

Goals
The students will: • understand patterns, relations, and functions • represent and analyze mathematical situations and structures using algebraic symbols • use mathematical models to represent and understand quantitative relationships • analyze change in various contexts NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Patterns	1. Students will identify, describe, create and extend a number of patterns. *Concepts and Skill Sets Mastered* The student will: • describe counting and number patterns • order numbers using just before, between, just after. • explore and solve problems involving simple number patterns. • identify missing objects in a pattern • identify objects with common or different attributes 2. Students will analyze change in quantity and quality using patterns. *Concepts and Skill Sets Mastered* The student will: • determine whether a number is even or odd using manipulatives • skip Count by 2,5,10 *Concepts and Skill Sets Introduced* The student will: • skip count by 100 • identify numbers as odd or even
Functions	3. Students will use number sentences to represent quantitative relationships. *Concepts and Skill Sets Mastered* The student will: • balance simple number sentences by finding the missing numbers • identify missing numbers to 20 in addition and subtraction sentences and justify the answer

	• determine and justify the missing addition/subtraction signs in addition and subtraction sentences 4. Students will identify and represent quantities as equivalent or non-equivalent. *Concepts and Skill Sets Mastered* The student will: • use concrete, pictorial, and verbal examples to demonstrate an understanding that = is a relationship that indicates equivalence • use commutative and associative property of addition • identify quantities as equivalent or non-equivalent • demonstrate balance or equivalence using models • identify and use symbols of inequality (<, >) 5. Students will identify functional number relationships. *Concepts and Skill Sets Mastered* The student will: • identify and justify missing numbers in addition and subtraction sentences *Introductory* The student will: • identify missing addends with 2 digit numbers

Grade Two
Geometry

Goals
The students will: • analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments about relationships • specify locations and describe spatial relationships using coordinate geometry and other representational systems • apply transformations and use symmetry to analyze mathematical situations • use visualization, spatial reasoning, and geometric modeling to solve problems NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Plane and Solid Figures	1. Students will classify and identify plane figures and solids by common characteristics. *Concepts and Skill Sets Mastered* The student will: • classify plane figures by size and shape • identify corners, sides, and points inside and outside of a figure • identify and create open and closed figures • relate solid figures to common items • identify, model/construct geometric solids by the attributes: face and edge *Concepts and Skill Sets Introduced* The student will: • describe plane and solid figures by number of sides and/or faces • describe the relationship between plane and solid figures • identify congruent figures • recognize, name, compare, and sort: cube, cylinder, cone, sphere, rectangular prism, and pyramid 2. The students will identify shapes as the same where there are changes in position. *Concepts and Skill Sets Introduced* The student will: • explore, identify and draw lines of symmetry in simple shapes and forms • recognize and create simple figures and drawings with symmetry

	3. Students will identify and generalize relationships between measurable attributes of plane and solid figures. *Concepts and Skill Sets Introduced* The student will: • find the area of squares and rectangles by modeling and counting square units • demonstrate ways to fill a region with different shapes • model and identify the perimeter of a polygon

Grade Two
Measurement

Goals
The students will: • understand measurable attributes of objects and the units, systems, and processes of measurement • apply appropriate techniques, tools and formulas to determine measurements NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Length Capacity	1. Students will determine and use various tools and units to estimate and measure. *Concepts and Skill Sets Mastered* The student will: • recognize and apply non standard units of measure • estimate and measure length and height in centimeters and inches • read Fahrenheit and Celsius thermometers • tell and/or show time to the half hour using both analog and digital clocks *Concepts and Skill Sets Introduced* The student will: • estimate and measure length and height in feet, yards, and meters • estimate and/or compute elapsed or projected time in terms of an hour or a minute • tell, write, and show time to the quarter hour, to five and one minute intervals • use *A.M.* and *P.M.* appropriately 2. Students will use measurement to determine and explain relative size of a given object. *Concepts and Skill Sets Mastered* The student will: • compare and order objects according to length 3. Students will use standard units and identify examples of measurements in daily life. *Concepts and Skill Sets Mastered* The student will: • identify cup, pint, quart, liter and gallon and relate to their use in real life compare and order objects according to capacity and/or weight • demonstrate balance or equivalence using models • identify pound as a unit of measure and relate use in real life

Money	4. Students will recognize, identify and trade sets of equivalent coins. *Concepts and Skill Sets Mastered* The student will: • count and show money to one dollar • find equivalent sets of coins 5. Students will express monetary values in oral and written forms. *Concepts and Skill Sets Mastered* The student will: ● use dollar sign *Concepts and Skill Sets Introduced* The student will: ● use decimal point in writing money amounts 6. The student will solve problems involving money. *Concepts and Skill Sets Introduced* The student will: ● make change up to $1.00

Grade Two
Data Analysis, Statistics, and Probability

Goals
The students will: ● formulate questions that can be addressed with data; collect, organize, and display relevant data to answer them ● select and use appropriate statistical methods to analyze data ● develop and evaluate inferences and predictions that are based on data ● understand and apply basic concepts of probability NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Graphs	1. Students will collect, organize, and describe data. *Concepts and Skill Sets Mastered* The student will: ● use a Venn diagram and other graphic organizers to sort items ● read and interpret vertical graphs, pictographs *Concepts and Skill Sets Introduced* The student will: ● create simple (picture, bar) graphs from given data
Probability	2. The student will determine the likelihood of certain events through games and simple experiments. *Concepts and Skill Sets Mastered* The student will: ● identify events as certain, possible or impossible, fair or unfair, relative to probability ● predict from sample data
Data Analysis	3. Students will pose questions to be answered through collection and analysis of data. *Concepts and Skill Sets Mastered* The student will: ● conduct simple surveys to gather data *Concepts and Skill Sets Introduced* The student will: ● demonstrate and explain survey findings ● create a tally chart using given data

Grade 2
Vocabulary

Number Theory, Operations and Estimation	**Algebra**	**Geometry**
Between Compare Digit Just before Just after Number line Ordinal Pattern Strategy Thousands Fourths Halves Thirds Estimation Regrouping	Associative Balance Commutative Equivalent Non-equivalent Quantity	Angle Area Face Flip Perimeter Plane figure Polygon Similar Symmetry Solid Turn side
Measurement	**Data Analysis, Statistics, Probability**	**Add vocabulary terms as needed**
Analog Area Celsius/Fahrenheit Change Degree Digital Dollar Elapsed time Gallon Half past Measure Meter Ounce Perimeter Pound Price Time Total Yard	Equal to fair/unfair Greater than/ less than Hoizontal Mode Predict Range Vertical	

Grade 3
Number Theory, Estimation, and Operations

Goals
The students will: • understand numbers, ways of representing numbers, relationships among numbers, and number systems • understand meanings of operations and how they relate to one another • compute fluently and make reasonable estimates NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Number Theory	1. Students will represent four digit numbers as groups of thousands, hundreds, tens, and ones in the base ten number system. *Concepts and Skill Sets Mastered* The student will: • identify and name place values to the hundred thousands place. • expand numerals by identifying the value of each digit in its place • count, order, compare, and expand numerals to 99,999 • read and write numerals and number words to 999,999 • describe the relationships of place values to regrouping *Concepts and Skill Sets Introduced* The student will: • identify and name place values to the millions place • count, order, compare, and expand numerals to 999,999 • read and write numerals to 999,999 2. Students will represent and order number concepts in verbal and written form. *Concepts and Skill Sets Mastered* The student will: • Read and write number words to 99,999 • Identify ordinal words to thirty-first (calendar-related)
Decimals	3. Students will extend whole number place value patterns, models, and notations to include decimals. *Concepts and Skill Sets Introduced* The student will: • model and write decimals in tenths and hundredths • relate money (pennies and dimes) to decimals • compare and order decimals of tenths and hundredths

	• locate decimals on a number line • count by tenths and hundredths

Operations: Whole Numbers	4. Students will develop fact families using inverse relationships *Concepts and Skill Sets Mastered* The student will: • relate the inverse relationship of addition and subtraction facts to 20 • complete a number of fact problems within a specific time limit • memorize addition and related subtraction facts to 20 • check subtraction with addition 5. Students will represent the result of counting, combining and separating sets of objects using number sentences. *Concepts and Skill Sets Mastered* The student will: • add and subtract 4 digit numbers with regrouping • add three or more addends (column addition) • subtract 3 digit numbers with regrouping through zeroes • choose and justify the correct operation in a word problem (+, -) • read and write addition/subtraction facts families *Concepts and Skill Sets Introduced* The student will: • add and subtract six digit numbers • multiply two and three digit numbers by a one digit number • use mental math to multiply by 10, 100, and 1000 • read and write multiplication/division facts families 6. Students will use concepts based on patterns and place value to multiply and divide *Mastery* The student will: • relate skip counting and repeated addition to multiplication • illustrate repeated addition and subtraction on a number line • draw arrays to model multiplication • memorize multiplication facts and related division facts through twelve times table *Introductory* The student will: • model division with remainders • divide with 2-digit dividends and 2-digit quotients • record division using an algorithm (long division)

	7. Students will demonstrate equivalence using properties of whole numbers. *Concepts and Skill Sets Introduced* The student will: ● recognize and apply the distributive property of multiplication 7. Students will express equivalent relationships between decimals and fractions whose denominator is ten or one hundred. *Concepts and Skill Sets Introduced* The student will: ● write fractions with denominators of 10 or 100 as decimals

Fractions	9. Students will represent fractions by sharing portions of equal size. *Concepts and Skill Sets Mastered* *The student will:* • model equivalent fractions (using manipulatives, pictures, graphics, etc.) • read, write and identify all fractions • identify and model fractional parts of a set *Introductory* The student will: ● find fractional parts of numbered groups 10. Students will use models and number lines to compare fractions. *Concepts and Skill Sets Mastered* The student will: • use visual models to identify and compare fractions • compare unit fractions • compare fractions with like denominators *Introductory* The student will: ● compare proper fractions with unlike denominators 11. Students will construct and use models to add and subtract like fractions. *Concepts and Skill Sets Introduced* The student will: ● add and subtract like fractions using models 12. Students will model and identify mixed numbers. *Introductory* The student will: ● identify mixed numbers

Estimation	13. Students will identify and use equivalent representations of numbers based on place value patterns to estimate and compute. *Concepts and Skill Sets Mastered* The student will: • select reasonable answers to a problem • round numbers to the nearest hundred • estimate sums and differences and describe the method of estimation *Concepts and Skill Sets Introduced* The student will: • estimate products and quotients and the method of estimation • round numbers to the nearest thousand • describe and use estimation strategies that can identify a reasonable answer to a problem when an estimate is appropriate • use front-end estimation • use compatible numbers to make reasonable estimates • determine and discuss the reasonableness of an answer 14. The student will use estimation strategies that result in reasonable answers to a problem. *Concepts and Skill Sets Mastered* The student will: • recognize when estimation is an appropriate problem-solving strategy

Grade Three
Algebra: Patterns and Functions

Goals
The students will: • understand patterns, relations, and functions • represent and analyze mathematical situations and structures using algebraic symbols • use mathematical models to represent and understand quantitative relationships • analyze change in various contexts NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Patterns	1. Students will analyze change in quantity and quality using patterns. *Concepts and Skill Sets Mastered* The student will: • skip count by 2, 5, 10, and 100. • identify numbers as odd or even • explore and describe multiplication fact patterns
Functions	2. Students will identify and represent quantities that are equivalent or non-equivalent. *Concepts and Skill Sets Mastered* The student will: • balance number sentences by finding the missing numbers • identify missing addends with 2 digit numbers • identify and justify missing numbers in multiplication and division facts • identify and use symbols for greater than (›),less than (‹) and not equal (≠) • create story problems using number sentences 3. Students will identify functional number relationships. *Concepts and Skill Sets Mastered* The student will: • choose multiplication or division to complete functions tables *Concepts and Skill Sets Introduced* The student will: • locate points on a coordinate grid by using ordered pairs

	4. The students will use properties of whole numbers to maintain equivalence. *Concepts and Skill Sets Introduced* The student will: • identify, express and apply the Commutative, Associative and Identity properties of addition and multiplication • identify, express and apply the Zero Property of Multiplication

Grade Three
Geometry

Goals
The students will: • analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments about relationships • specify locations and describe spatial relationships using coordinate geometry and other representational systems • apply transformations and use symmetry to analyze mathematical situations • use visualization, spatial reasoning, and geometric modeling to solve problems NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Plane and Solid Figures	1. Students will classify or identify plane figures and solids by common characteristics. *Concepts and Skill Sets Mastered* The student will: • recognize, name, compare, and sort: cube, cylinder, cone sphere, rectangular prism, and pyramid • describe plane and solid figures by number of edges and/or faces • describe the relationship between plane and solid figures *Concepts and Skill Sets Introduced* The student will: • identify and draw points, lines, line segments, and rays • classify angles as right, acute or obtuse • identify, compare and contrast intersecting, perpendicular and parallel lines • identify, describe, classify and draw polygons: quadrilaterals, pentagons, hexagons, octagons and classify triangles according to sides and angles 2. Students will identify shapes as the same where there are changes in position. *Concepts and Skill Sets Mastered* The student will: • identify translations, rotations, and reflections • explore, identify and draw lines of symmetry in simple shapes and forms • recognize and create simple figures and drawings with symmetry

	3. Students will recognize and use geometric relationships to solve problems. *Concepts and Skill Sets Mastered* The student will: • identify congruent figures • compute the perimeter of a polygon • find the area of squares and rectangles by modeling and counting square units • estimate the area of squares and rectangles *Concepts and Skill Sets Introduced* The student will: • identify similar figures • find the volume of rectangular prisms by modeling and counting cubic units • identify ways to tile or tessellate a region or shape using various polygons 4. Students will identify, draw and describe elements needed to explain spatial relationships. *Concepts and Skill Sets Introduced* The student will: • identify translations, rotations, and reflections • identify and draw points, lines, line segments, and rays • classify angles as right, acute or obtuse • identify, compare and contrast intersecting, perpendicular and parallel lines • explain the results of dividing, combining, and transforming shapes and the effects of slides, flips, and turns

Grade Three
Measurement

Goals
The students will: • understand measurable attributes of objects and the units, systems, and processes of measurement • apply appropriate techniques, tools and formulas to determine measurements NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Length Capacity Mass Temperature Time	1. Students determine and use various tools and units to estimate and measure. *Concepts and Skill Sets Mastered* The student will: • estimate and measure length and height in inches, feet, and yards • estimate and measure length and height in centimeters and meters • estimate and/or compute elapsed or projected time in terms of an hour or a minute using a clock • tell, write, and show time to the quarter hour, to five and one minute intervals • use *A.M.* and *P.M.* appropriately *Concepts and Skill Sets Introduced* The student will: • choose an appropriate unit to estimate length or distance (foot, yard, mile) • measure to the nearest half and quarter inch • estimate and measure length and height in millimeters and kilometers • identify a liter as 1000 milliliters • use a schedule, calendar, and/or a timeline to measure elapsed time 2. Students will use measurement to determine and explain relative size of a given objects and measures. *Concepts and Skill Sets Mastered* The student will: • memorize conversions for inches, feet, yards • identify the conversions for feet and yards • identify conversion factors in the metric system • compare and order objects according to capacity • compare and order objects according to weight • read Fahrenheit and Celsius thermometers and describe temperatures as hot, warm, or cold

	Concepts and Skill Sets Introduced The student will: • identify conversions for cups, pints, quarts, and gallons • identify conversion for pounds and ounces • identify conversion factors for seconds, minutes, hours, and days 3. Students will use standard units and identify and express examples of measurement in daily life. *Concepts and Skill Sets Mastered* • identify cup, pint, quart, gallon and apply to real life • identify liter and apply to real life • identify pound and ounce as units of measure and relate use in real life *Concepts and Skill Sets Introduced* The student will: ● tell time in two ways (minutes before the hour and minutes after the hour)
Money	4. Students will recognize, identify and trade sets of equivalent coins. *Concepts and Skill Sets Mastered* The student will: ● find equivalent sets of coins 5. Students will express monetary values in oral and written forms. *Concepts and Skill Sets Mastered* The student will: ● use decimal point in writing money amounts 6. Students will determine and compare coin values. 7. Students will solve problems involving money. *Concepts and Skill Sets Mastered* The student will: • make change to a dollar • add and subtract sums of money less than a dollar in columns aligning decimal points *Introductory* The student will: ● find a given sum of money using the least number of coins ● add amounts of money less than a dollar to sums greater than a dollar ● subtract amounts of money less than a dollar from amounts greater than a dollar

Grade Three
Data Analysis, Statistics, and Probability

Goals
The students will: • formulate questions that can be addressed with data; collect, organize, and display relevant data to answer them • select and use appropriate statistical methods to analyze data • develop and evaluate inferences and predictions that are based on data • understand and apply basic concepts of probability NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Graphs	1. Students will collect, organize and describe data *Concepts and Skill Sets Mastered* The student will: • use a variety of graphic organizers to sort items • read and interpret tally charts, frequency tables, bar graphs, and pictographs • create simple (picture, bar) graphs from given data • create a tally chart using given data *Concepts and Skill Sets Introduced* • create diagrams and charts to solve problems • read and interpret line graphs
Probability	2. The student will determine the likelihood of certain events through games and simple experiments. *Concepts and Skill Sets Mastered* The student will: • predict from sample data *Concepts and Skill Sets Introduced* The student will: • use results of experiments to predict future events • calculate probability of an event • express probability in verbal and numerical terms • identify events as more likely, equally likely, less likely

Data Analysis	3. The students will pose questions to be answered through collection and analysis of a data set. *Concepts and Skill Sets Mastered* The student will: ● conduct surveys to gather data

Grade 3 Vocabulary

Number Theory, Operations and Estimation	Algebra	Geometry
Ordinal Expanded Numeral form Greatest Least Standard form Arrays Dividend Divisor Multiple Quotient Multiplier Remainder Compatible Decimal Tenth Hundredth Whole number Denominator Numerator Mixed number Unit fraction Equivalent Fraction Estimation	Grid Ordered pair	Angles: acute, obtuse, right Degree Hexagon Intersecting Line Line segment Octagon Parallel lines Pentagon Perpendicular lines Polygon Point Quadrilateral Ray Triangles: isosceles, scalene, equilateral Volume
Measurement	**Data Analysis, Statistics, Probability**	**Add vocabulary terms as needed**
A.M./ P.M. Mile Milliliter Seconds	Equally/ less likely Frequency Likely Probability Survey	

Grade Four
Number Theory, Estimation and Operations

Goals
The students will: • understand numbers, ways of representing numbers, relationships among numbers, and number systems • understand that a variety of numerical representations can be used to describe quantitative relationships • understand meanings of operations and how they relate to one another • compute fluently and make reasonable estimates • use numbers and their properties to compute flexibly and fluently and to estimate measures and quantities reasonably • understand and describe patterns and functional relationships • represent and analyze quantitative relationships in a variety of ways • use operations and properties to determine equivalence and solve problems NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Number Theory	1. Students will represent numbers as groups of millions, thousands, hundreds, tens and ones in the base ten number system. *Concepts and Skill Sets Mastered* The student will: • identify and name place values to the hundred millions place • build place value models, draw diagrams and show equivalent representations for numbers to 9,999,999 in expanded form • use place value models, diagrams, number patterns and number lines to identify, order, round, and compare whole numbers to 100,000 • read, write, count, skip count, order, compare, and expand numerals to 9,999,999 • use ten as a repeated factor to define place value through hundred thousands • use mental math to multiply by 10, 100, and 1000 *Introductory* The student will: • identify and name place values to the hundred millions place

	2. Students will represent and order number concepts in verbal and written form. *Concepts and Skill Sets Mastered* The student will: ● read and write number words to the hundred millions 3. Students will use factors to explore, represent and classify numbers. *Concepts and Skill Sets Introduced* The student will: • memorize and apply divisibility rules for 2,5, 10 • recognize and identify prime and composite numbers to 100 • draw factor trees • identify the Least Common Multiple (LCM) given pairs of numbers less than or equal to 10 • identify the Greatest Common Factor (GCF) given pairs of numbers up to 81 • identify the written form n^2 • represent in pictorial form a 2x2 square • square a whole number • use exponents to the power of 2 4. The students will extend whole number place value patterns, models, and notations to include decimals. *Concepts and Skill Sets Mastered* The student will: • model, read and write decimals in tenths and hundredths • relate money (pennies and dimes) to decimals • compare and order decimals of tenths and hundredths (use symbols <, >, =, and ≠) • locate decimals on a number line • count by tenths and hundredths annex zeroes to create equivalent decimal numbers in the tenths and hundredths place • write decimal numbers to express fractions with denominators of 10 and 100 • identify place value in decimal numbers • relate decimals in tenths to fractions, and mixed numbers *Concepts and Skill Sets Introduced* The student will: ● model, read and write decimals to thousandths place in standard form and as number words

Operations Whole Numbers And Decimals	5. Students will add and subtract whole numbers written in vertical and horizontal form. *Concepts and Skill Sets Mastered* The student will: • add and subtract 6 digit numbers with and without regrouping • choose and justify the correct operation in a word problem (+, -) 6. Students will extend place value concepts and number properties to addition and subtraction of decimal numbers. *Concepts and Skill Sets Mastered* The student will: • construct and use models and pictures to add and subtract decimals • add and subtract decimals to hundredths 7. Students will use number patterns, basic facts, arrays, and place value models to multiply and divide whole numbers. *Concepts and Skill Sets Mastered* The student will: • relate multiplication and division to models with groups and rectangular arrays • multiply two and three digit numbers by a one digit number with regrouping • model and interpret division with remainders • divide three-digit dividends by a one-digit divisor to find quotients of two or three places with zeros and remainders • record division using an algorithm (long division) • divide three-digit dividends by multiples of 10 • divide multiples of 10, 100,1000 and 10,000 by multiples of 10 • identify and use the inverse relationships of multiplication and division to solve and check problems • determine the proper operation to solve a problem and justify the reasoning *Concepts and Skill Sets Introduced* The student will: • multiply to find products with multipliers that are multiples of 10, 100, 1000 • multiply four-digit numbers by a one-digit multiplier, two and three digit numbers by a two-digit multiplier • divide four-digit dividends by a one digit divisor to find three and four digit quotients with zeros and remainders • divide two- and three-digit dividends by two-digit divisors to find one digit quotients with and without remainders

	8. Identify whole number properties and apply them to whole number operations and algorithms. *Concepts and Skill Sets Mastered* The student will: • use arrays and explore using the distributive property [10 x (4+5) = (10 x 5) + (10 x 4)] to estimate, multiply and divide two and three digit numbers by one-digit factors • recognize and apply the distributive property of multiplication • identify and use the inverse relationships of multiplication and division to solve and check problems *Concepts and Skill Sets Introduced* The student will: • describe the Zero Property of Multiplication and its implication in division • use order of operations to evaluate arithmetic expressions with parentheses
Fractions	9. Students will model, identify, compare fractions and express them in equivalent forms. *Concepts and Skill Sets Mastered* The student will: • use visual/virtual models to identify and compare fractions • model equivalent fractions (using manipulatives, pictures, graphics, etc.) • read, write and identify all fractions • identify and model fractional parts of a set • find fractional parts of numbered groups • use division to find a fractional part of a set • locate and place fractions on a number line • identify equivalent fractions • find fractions that are equivalent using models • find equivalent fractions using multiplication and division • compare proper fractions with unlike denominators • identify mixed numbers *Concepts and Skill Sets Introduced* The student will: • identify and find the simplest form of a fraction • write fractions in lowest terms • apply the concepts of Greatest Common Factor and Least Common Multiple to fractions • use the Least Common Multiple to identify the lowest common denominator of a set of fractions • use models to change an improper fraction to a mixed number

	10. Students will compute with fractions. *Concepts and Skill Sets Mastered* The student will: • add and subtract like fractions • solve problems involving addition and subtraction of fractions with like denominators • use models and pictures to estimate reasonable answers when adding or subtracting decimals, fractions, and mixed numbers • write and solve multi-step word problems with fractions, including problems with extraneous information *Concepts and Skill Sets Introduced* The student will: • add and subtract two fractions where one denominator is a multiple of the other • add and subtract fractions with unlike denominators
Estimation	11. Students will use place value concepts, number patterns, and number properties to develop estimation and computation strategies. *Concepts and Skill Sets Mastered* The student will: • round numbers to the nearest thousand, ten thousand, hundred thousand • round decimal numbers to the nearest tenth and whole number • estimate products and quotients and describe the method of estimation • use benchmarks to understand the relative magnitude of numbers • describe and use estimation strategies that can identify a reasonable answer to a problem when an estimate is appropriate • use front-end estimation • use compatible numbers to make reasonable estimates • use clustering to estimate sums • determine and discuss the reasonableness of an answer and explain why a particular estimation strategy will result in an over or underestimate • use estimation to predict reasonable answers to measurement problems • write and solve multi-step word problems involving estimation *Concepts and Skill Sets Introduced* The student will: • round decimal numbers to the nearest hundredth • estimate decimal sums and differences using rounding
Rational Numbers, Ratio, Proportion, & Percent	13. Students will model, identify, compare and relate rational numbers. *Concepts and Skill Sets Introduced* The student will: • model and demonstrate ratios through the use of concrete objects and pictures • make comparisons and describe quantitative relationships using ratios • describe the relationship between decimals, fractions and percents

	• use models, pictures, and number patterns to solve simple problems involving ratio and proportions

Grade Four
Algebra

Goals
The students will: • understand patterns, relations, and functions • represent and analyze mathematical situations and structures using algebraic symbols • use algebraic symbols to determine equivalence and solve problems • use mathematical models to represent and understand quantitative relationships • analyze change in various contexts NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Patterns	1. Students will recognize, create and extend numerical and geometric patterns, using concrete materials, number lines, symbols, tables and words. *Concepts and Skill Sets Mastered* The student will: • create and extend patterns • explore and describe multiplication fact patterns • describe and write the rule for number, color, rhythmic and symbolic patterns • solve practical problems and extend patterns involving 10 and 100 more and less than a number *Concepts and Skill Sets Introduced* The students will: • extend and compare arithmetic and geometric sequences • make generalizations about patterns and relationships and test those generalizations
Functions	2. Students will recognize and demonstrate equivalence using number properties. *Concepts and Skill Sets Mastered* The student will: • identify, express and apply the commutative, and associative properties of whole numbers in addition and multiplication • identify, express and apply the zero property of multiplication • use commutative and associative properties, to estimate, compute and to solve problems • demonstrate equivalence with the commutative and associative properties of whole numbers • demonstrate the equivalence of both sides of an equation as the same value is added, subtracted, multiplied, or divided on each side • demonstrate equivalence with the commutative and associative properties of whole numbers

	• demonstrate the equivalence of both sides of an equation as the same value is added, subtracted, multiplied, or divided on each side • find missing numbers in number sentences • find missing symbols in number sentences (›), (‹), (=) and (≠) • find missing operation symbols in number sentences *Concepts and Skill Sets Introduced* The student will: ● demonstrate equivalence with the distributive property of whole numbers 3. Students will write equations to express relationships between numbers. *Concepts and Skill Sets Mastered* The student will: • use equations to describe the rules for number patterns • use equations to model word problems 4. Students will represent numerical relationships on a coordinate grid. *Concepts and Skill Sets Mastered* The student will: ● locate points on a coordinate grid (Quadrant I) using ordered pairs *Concepts and Skill Sets Introduced* The student will: ● use a table to explore functions and graph them on a coordinate grid (Quadrant I) 5. Students will recognize, use and simplify arithmetic and algebraic expressions. *Concepts and Skill Sets Introduced* The student will: • use variables to represent quantities in expressions and number sentences • choose and evaluate the number expression that matches a word phrase • evaluate variable expressions that involve a single operation

Grade Four
Geometry

Goals
The students will: • analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments about relationships • use properties and characteristics of two-and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems • use spatial reasoning, location and geometric relationships to solve problems • specify locations and describe spatial relationships using coordinate geometry and other representational systems • apply transformations and use symmetry to analyze mathematical situations • use visualization, spatial reasoning, and geometric modeling to solve problems NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Plane and Solid Figures	1. Students will describe geometric properties of plane and solid figures. *Concepts and Skill Sets Mastered* The student will: • build, draw, create, describe, and classify two- and three-dimensional figures sort polygons and solids by using characteristics such as the relationship of sides (parallel, perpendicular), kinds of angles (right, acute, obtuse), symmetry, and congruence • describe similarities and differences of two and three dimensional shapes in the environment using physical features such as number of sides, number of angles, lengths of sides and straight and curved parts • analyze two-dimensional shapes and determine lines of symmetry and congruence • analyze shapes with more than one line of symmetry • identify, describe and classify triangles according to sides and angles • identify, describe, classify and draw polygons: quadrilaterals, pentagons, hexagons, octagons • identify similar figures *Concepts and Skill Sets Introduced* The student will: • describe solid figures using faces, edges, and vertices 2. Students will identify, draw and describe elements needed to explain spatial relationships. *Concepts and Skill Sets Mastered* The student will: • identify translations, rotations, and reflections • identify and draw points, lines, line segments, and rays

	• classify angles as right, acute or obtuse • identify, compare and contrast intersecting, perpendicular and parallel lines • explain the results of dividing, combining, and transforming shapes and the effects of slides, flips, and turn 3. Students will identify and generalize relationships between measurable attributes of plane and solid figures. *Concepts and Skill Sets Mastered* The student will: • compute perimeter of a polygon using the formula • find the area of squares and rectangles • find strategies for estimating and measuring the perimeters and areas of irregular shapes • find the volume of rectangular prisms by modeling and counting cubic units • estimate the volume of rectangular prisms *Concepts and Skill Sets Introduced* The student will: • develop and apply the formula for finding area of squares and rectangles • describe relationships between the lengths of sides of rectangles and their areas and perimeters; generalize the patterns as simple formulas • identify and find the radius and diameter of a circle • identify and estimate the circumference of a circle 4. Students will use coordinate systems to identify and illustrate spatial location and geometric relationships. *Concepts and Skill Sets Mastered* The student will: • draw and interpret simple maps using coordinate systems and shapes or pictures • use coordinate grids to find position, distance and relative position

Grade Four
Measurement

Goals
The students will: • understand measurable attributes of objects and the units, systems, and processes of measurement • develop and apply appropriate techniques, tools and formulas to estimate and determine measurements • apply appropriate techniques, tools and formulas to determine measurements • use numbers and their properties to estimate measures and quantities reasonably NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Length Capacity Weight Temperature Time	1. Students will determine and use various tools and units to estimate and measure. *Concepts and Skill Sets Mastered* The student will: • choose an appropriate unit to estimate length or distance • identify and use the appropriate customary and metric units and tools for measuring length, area and perimeter • estimate, draw, and measure length and height to the nearest inch, half inch, quarter inch and centimeter • estimate and measure length and height in millimeters, decimeters, kilometers • define, identify, use and relate benchmarks to millimeter • develop and explain strategies for using nonstandard and standard referents to estimate measurement of length and area • solve practical problems that involve estimation and measurement of length, perimeter, and area • identify and use the appropriate customary and metric units and tools for measuring volume and capacity • solve practical problems that involve estimation and measurement of volume and capacity • compare and order objects according to capacity • identify and use the appropriate tools for measuring time • use a schedule, calendar, and/or a timeline to measure elapsed time • calculate elapsed time in minutes and hours • use a timetable • estimate and/or compute elapsed or projected time in terms of an hour or a minute using a clock • tell, write, and show time to the quarter hour, to five and one minute intervals • use *A.M.* and *P.M*. appropriately • use a schedule and a calendar to measure elapsed time • identify and use the appropriate customary and metric units and tools for measuring weight / mass

	• compare and order objects according to weight • identify and use the appropriate customary and metric units and tools for measuring temperature • read Fahrenheit and Celsius thermometers and describe temperatures as hot, warm, or cold *Concepts and Skill Sets Introduced* The student will: • identify and use cubic units (inch, centimeter, mile, and kilometer) • identify and use kilogram and ton 2. Students will use measurement to determine and explain relative size of a given objects and measures. *Concepts and Skill Sets Mastered* The student will: • identify the conversions for feet, yards and miles • identify and memorize conversions for cups, pints, quarts, and gallons • identify conversion factors in the metric system • identify a liter as 1000 milliliters • define, identify, use and relate benchmarks to milliliter • solve practical problems that involve estimation and measurement of temperature • identify and memorize conversion factors for seconds, minutes, hours and days *Concepts and Skill Sets Introduced* The student will: • change customary units by multiplying and dividing • convert from one unit to another when measuring time and solve problems that involve elapsed time using clocks and calendars 3. Students will use standard units and identify and express examples of measurement in daily life. *Concepts and Skill Sets Mastered* The student will: • identify cup, pint, quart, gallon, liter, milliliter and apply to real life • solve practical problems that involve estimation and measurement of weight • define, identify, use and relate benchmarks to ounce and gram • identify pound and ounce as units of measure and relate use in real life • identify and memorize conversion for pounds and ounces • tell time in two ways (minutes before the hour/minutes after the hour)
Money	4. Students will recognize, identify and trade sets of equivalent coins. *Concepts and Skill Sets Mastered* The student will: • find equivalent sets of coins

	5. Students will express monetary values in oral and written forms. *Concepts and Skill Sets Mastered* The student will • use decimal point in writing money amounts 6. Students will solve problems involving money. *Concepts and Skill Sets Mastered* The student will: • apply and explain a variety of estimation strategies in problem-solving situations to add and subtract money amounts less than $10.00 and two- and three-digit numbers with and without regrouping • find a given sum of money using the least number of coins • add amounts of money less than a dollar to sums greater than a dollar • subtract amounts of money less than a dollar from amounts greater than a dollar • multiply and divide money using single digit multipliers/divisors 7. The student will determine and compare coin values. *Concepts and Skill Sets Mastered* The student will: • make change • add and subtract sums of money in columns aligning decimal points • round amounts of money to the nearest dollar

Grade Four
Data Analysis, Statistics, and Probability

Goals
The students will: ● formulate questions that can be addressed with data; collect, organize, and display relevant data to answer them ● collect, organize and display data using appropriate statistical and graphical methods. ● select and use appropriate statistical methods to analyze data ● analyze data sets to form hypotheses and make predictions ● understand and apply basic concepts of probability ● develop and evaluate inferences and predictions that are based on data ● understand and apply basic concepts of probability NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Graphs	1. Students will collect, organize and describe data. *Concepts and Skill Sets Mastered* The student will: • use, read, create and interpret a variety of graphic organizers, charts, and graphs • charts, graphs, etc. should include broken line graphs, bar graphs, picture graphs, Venn diagrams and simple circle graphs • use a variety of ways to collect, organize, record, analyze, and interpret data and identify patterns and trends *Concepts and Skill Sets Introduced* The student will: ● use technology to create spreadsheets and convert information into graphs
Probability	2. Students will determine the likelihood of certain events through games and simple experiments. *Concepts and Skill Sets Mastered* The student will: • make predictions and defend conclusions based on data • express probability in verbal and numerical terms *Concepts and Skill Sets Introduced* The student will: • conduct probability experiments and express the probability based on possible outcomes • express probability as a fraction • identify possible outcomes of events using combinations where order does not matter

Data Analysis	3. Students will pose questions to be answered through collection and analysis of a data set. *Concepts and Skill Sets Mastered* The student will: • conduct surveys to gather data • demonstrate and explain survey findings 4. Students will describe features of a data set *Concepts and Skill Sets Introduce* The student will: • compute the mean of a set of data • use range, mean, median, and mode to explain data • identify outliers

Grade 4 Vocabulary

Number Theory, Operations and Estimation	Algebra	Geometry
Billion Millions place Composite Divisible Exponent Greatest common factor (GCF) Least common multiple (LCM) Square Period Power Prime Denominator Equivalent fraction Lowest common denominator Mixed number Numerator Unit fraction Clustering Compatible numbers Front end estimation	Grid Ordered pair	Angles: acute obtuse right Center point Degree Hexagon Intersecting Line Line segment Octagon Parallel lines Pentagon Perpendicular lines Polygon Point Quadrilateral Ray Triangles: isosceles scalene equilateral Vertices Volume
Measurement	Data Analysis, Statistics, Probability	Add vocabulary terms as needed
A.M./P.M. Align Gram Mile Milliliter Seconds	Equally/less likely Frequency Likely Median Mean Mode Probability Survey	

Grade Five
Number Theory, Estimation, and Operations

Goals
The students will: • understand numbers, ways of representing numbers, relationships among numbers, and number systems • understand that a variety of numerical representations can be used to describe quantitative relationships • understand meanings of operations and how they relate to one another • compute fluently and make reasonable estimates • use numbers and their properties to compute flexibly and fluently • understand and describe patterns and functional relationships • represent and analyze quantitative relationships in a variety of ways • use operations and properties to determine equivalence and solve problems NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Number Theory	1. Students will represent numbers in expanded and regrouped forms in the base ten place value system. *Concepts and Skill Sets Mastered* The student will: • identify and name place values to the hundred billions place • build place value models, draw diagrams and show equivalent representations for whole numbers in expanded and regrouped form • use place value models, diagrams, number patterns and number lines to identify, order, round, and compare whole numbers to one billion • read, write, count, skip count, order, compare, and expand numerals to one billion 2. Students will extend whole number place value concepts to include decimal numbers that are also represented as fractions whose denominators are multiples of ten. *Concepts and Skill Sets Mastered* The student will: • build models and describe tenths and hundredths using equivalent ratio, fraction and decimal notation • use models to extend whole number place value concepts and patterns to decimals • read and write decimals to thousandths place in standard form as number words • compare and order decimals to thousandths place from greatest to least and from least to greatest (use symbols ›, ‹, = and ≠)

	• identify place value in decimal numbers and write decimals in expanded form (EX. 61.34 = 60 + 1 + 0.3 + 0.04) • express fractions with denominators of 10 and 100 as decimals • annex zeroes to create equivalent decimals • relate decimals in tenths and hundredths to fractions, mixed numbers, and number words *Concepts and Skill Sets Introduced* The student will: • read and write decimals to ten thousandths place in standard form as number words • use (greater than or equal, less than or equal) symbols (≥, ≤) 3. Students will use factors to explore, represent and classify numbers. *Concepts and Skill Sets Mastered* The student will: • memorize and apply divisibility rules for 2,3,5,6,9 and 10recognize and identify prime and composite numbers to 100 • use rectangular arrays to identify factor pairs and to classify numbers as prime, composite, and perfect squares • draw and use factor trees to determine all the factors of a number • identify the Least Common Multiple (LCM) given pairs of numbers less than or equal to 10 • identify the Greatest Common Factor (GCF) given pairs of numbers up to 81 • identify the written form n^2 • represent in pictorial form a 2x2 square • square a whole number • use exponents to the power of 2 • memorize the perfect squares of numbers from 1 to 15 • express a perfect square in exponent form *Concepts and Skill Sets Introduced* The student will: • draw and use factor trees to find all prime factors and write prime factorization of numbers • represent numbers by using exponents • change exponent form to standard numeral, write as repeated factors and vice versa • use order of operations including exponents

Estimation	4. Students will use place value concepts, number patterns and properties to develop and apply estimation and computation strategies. *Concepts and Skill Sets Introduced:* The student will: ● estimate and predict reasonable answers and recognize and explain when an estimate will be more or less than an exact answer ● explain orally and in writing when a situation requires an exact answer or when an estimate is sufficient ● develop, describe, and use a variety of ways to estimate and calculate with large numbers and connect the strategies to powers of ten ● use benchmarks to understand the relative magnitude of numbers ● use place value concepts, number patterns, the number line and the commutative, associative, and distributive properties to develop estimation and computation strategies ● select and apply the most suitable estimation strategy: rounding, clustering, front end (with adjustment), compatible numbers, compensation ● round decimals to the nearest ten thousandths place
Fractions	6. Students will model , identify and express equivalent forms of numbers expressed as whole numbers, fractions and mixed numbers. *Concepts and Skill Sets Mastered* The student will: • identify and find equivalent fractions • identify and find the simplest form of a fraction • write fractions in lowest terms • apply the concepts of Greatest Common Factor and Least Common Multiple to fractions • use models to change an improper fraction to a mixed number • locate and place fractions and mixed numbers on a number line • find fractional parts of numbered groups • recognize that multiplication by a unit fraction is equivalent to dividing by the fraction's denominator 7. Add and subtract fractions and mixed numbers using models, pictures and number sentences. *Concepts and Skill Sets Mastered* The student will: • construct and use models to add and subtract like and unlike fractions and mixed numbers • use equivalence and substitution with common denominators when adding and subtracting • add and subtract like and unlike fractions and mixed numbers expressing answers in simplest form

	• use models and pictures to estimate reasonable answers when adding or subtracting decimals, fractions, and mixed numbers *Concepts and Skill Sets Introduced* The student will: ● subtract mixed numbers with renaming 8. Students will use models and pictorial representations to develop concepts and methods by which to multiply and divide fractions and mixed numbers. *Concepts and Skill Sets Introduced* The student will: ● construct and use models and pictorial representations to multiply common fractions and mixed numbers ● use models to divide whole numbers by fractions and fractions by whole numbers ● model and describe when products or quotients with fractions and decimals can yield a larger or smaller result than either factor. ● identify reciprocal numbers ● apply reciprocal numbers to division of a whole number by a fraction ● write whole number division problems in fraction form and round the fraction form to estimate an answer to a division problem ● multiply and divide fractions, whole numbers and mixed numbers ● use cancellation in multiplication of fractions
Rational Numbers Ratio Proportion & Percent	9. Students will model, identify, compare and relate rational numbers. *Concepts and Skill Sets Mastered* The student will: ● build models to identify and compare ratios and describe quantitative relationships using fractions and decimal equivalents ● make comparisons and describe quantitative relationships using ratios ● illustrate and describe the relationship between decimals, fractions and percents ● represent a rational number in its equivalent fraction, decimal, ratio and percent forms with models, number patterns and common factors *Concepts and Skill Sets Introduced* The student will: ● choose and use benchmarks to approximate locations on number lines and coordinate grids ● estimate and find percents using benchmarks and number pattern

	9. Students will compare quantities and solve problems using ratios, rates and percents. *Concepts and Skill Sets Mastered* The student will: ● read, write, and illustrate ratios using three standard forms ● write fractions with a denominator of 100 as percent ● write percents as decimals and decimals as percents ● write percents as fractions in simplest form ● write money to $1.00 as a percent of a dollar ● use a table to generate equal ratios, write equal ratios, and tell if two ratios form a proportion *Concepts and Skill Sets Introduced* The student will: ● find the percent of a number ● find what percent one number is of another ● solve problems involving sales tax and discounts ● use cross products, multiplication and division to find equivalent ratios ● generate a table of equal ratios and graph the ordered pairs ● read and write rates, and change a rate to a unit rate
Integers	10. Students will explore numbers less than zero and extend the number line to illustrate integers. *Concepts and Skill Sets Mastered* The student will: ● use a number line to compare and order integers ● identify the absolute value of an integer ● identify opposite integers *Concepts and Skill Sets Introduced* ● use a model to add and subtract integers

Grade Five
Algebra

Goals
The students will: ● understand patterns, relations, and functions ● represent and analyze mathematical situations and structures using algebraic symbols ● use algebraic symbols to determine equivalence and solve problems ● use mathematical models to represent and understand quantitative relationships ● analyze change in various contexts NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Patterns	1. Students will represent, extend and analyze numerical and geometric patterns. *Concepts and Skill Sets Mastered* The student will: ● make generalizations about patterns and relationships and test those generalizations ● extend and compare arithmetic and geometric sequences ● represent geometric and numeric patterns using words, tables, graphs and equations ● analyze patterns and data to make predictions *Concepts and Skill Sets Introduced* The student will: ● determine the nature of changes in linear relationships using graphs, tables, and equations ● describe, analyze and extend numeric, geometric and statistical patterns 2. Students will recognize and demonstrate equivalence using number properties. *Concepts and Skill Sets Mastered* The student will: ● identify, express and apply the commutative and associative properties of whole numbers and identify properties of addition and multiplication ● use commutative and associative properties to solve problems, estimate, and compute ● demonstrate equivalence with the commutative, distributive and associative properties of whole numbers

	● demonstrate the equivalence of both sides of an equation as the same value is added, subtracted, multiplied, or divided on each side 3. Students will write expressions, equations and inequalities to express relationships between numbers. *Concepts and Skill Sets Mastered* The student will: ● model and solve one step equations using materials that model equivalence *Concepts and Skill Sets Introduced* The student will: ● represent mathematical relationships using variables in expressions, equations and inequalities ● describe how a change in one variable relates to a change in a second variable in a practical situation 4. Students will represent numerical relationships on a coordinate grid. *Concepts and Skill Sets Mastered* The student will: ● use a table to explore functions and graph them *Concepts and Skill Sets Introduced* The student will: ● locate points on a four quadrant coordinate grid by using ordered pairs ● generate a table of equal ratios and graph the ordered pairs 5. Students will recognize, use and simplify arithmetic and algebraic expressions. *Concepts and Skill Sets Mastered* The student will: ● use order of operations to evaluate single variable algebraic expressions with parentheses ● explain the difference between algebraic and arithmetic expressions ● use variables to represent quantities in expressions and number sentences ● evaluate variable expressions that involve a single operation *Concepts and Skill Sets Introduced* The student will: ● write and evaluate algebraic expressions with two variables

Grade Five
Geometry

Goals
The students will: • analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments about relationships • use properties and characteristics of two-and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems • use spatial reasoning, location and geometric relationships to solve problems • specify locations and describe spatial relationships using coordinate geometry and other representational systems • apply transformations and use symmetry to analyze mathematical situations • use visualization, spatial reasoning, and geometric modeling to solve problems NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Plane and Solid Figures	1. Students will describe and develop relationships between geometric properties of polygons and solids. *Concepts and Skill Sets Mastered* The student will: • use geometric relationships such as parallel, perpendicular, similar and • congruent to describe the attributes of sets and subsets of shapes and solids • make and test conjectures about geometric relationships • identify, describe and classify triangles according to sides and angles • identify, describe, classify and draw polygons *Concepts and Skill Sets Introduced* The student will: • represent the surface of three-dimensional objects through the use of a two dimensional net • identify, compare and contrast regular and irregular polygons 2. Students will identify, draw and describe elements needed to explain spatial relationships. *Concepts and Skill Sets Mastered* The student will: • identify line and rotational symmetry • identify translations, rotations, and reflections • explain the results of dividing, combining, and trans- forming shapes and the effects of slides, flips, and turns 3. Students will identify and generalize relationships between measurable attributes of plane and solid figures.

	Concepts and Skill Sets Mastered The student will: • demonstrate and describe the relationship between area and perimeter when the dimensions of a polygon change • apply formulas to find the perimeter and area of squares and rectangles • develop and apply the formulas for perimeter and area of triangles • describe relationships between the lengths of sides of rectangles and their areas and perimeters and generalize the patterns as simple formulas • find strategies for estimating and measuring the perimeters and areas of irregular shapes *Concepts and Skill Sets Introduced* The student will: • develop strategies to determine the formula for the volume of rectangular solids • use a protractor to measure angles • use a compass to draw a circle • identify and measure the parts of a circle (radius, diameter, chord, central angle) • identify the meaning of pi • find the circumference of a circle using a formula • find the area of a circle • use angles to measure and classify polygons 4. Students will use coordinate systems to identify and illustrate spatial location and geometric relationships. *Concepts and Skill Sets Mastered* The student will: • draw and interpret simple maps using coordinate systems and shapes or pictures • plot points on the rectangular coordinate system and estimate and determine the distance between points

Grade Five
Measurement

Goals
The students will: • understand measurable attributes of objects and the units, systems, and processes of measurement • develop and apply appropriate techniques, tools and formulas to estimate and determine measurements • apply appropriate techniques, tools and formulas to determine measurements • use numbers and their properties to estimate measures and quantities reasonably NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Length Capacity Weight Temperature Time	1. Students determine and use various tools and units to estimate and measure. *Concepts and Skill Sets Mastered* The student will: • estimate and measure length and height in millimeters, decimeters, kilometers • define, identify, use and relate benchmarks in metric and standard systems • use cubic units (inch, centimeter, mile, and kilometer) • use the appropriate customary and metric units and tools for measuring volume and capacity • define, identify, use and relate benchmarks of capacity • identify and use kilogram and ton • use the appropriate customary and metric units and tools for measuring weight • define, identify, use and relate benchmarks of weight/mass • use the appropriate customary and metric units and tools for measuring temperature • tell, write, and show time 2. Students will use measurement to determine and explain the relative size of given objects and measures. *Concepts and Skill Sets Mastered* The student will: • identify the conversions for feet, yards and miles • identify conversion factors in the metric system • compare and convert measures of capacity • identify conversion for pounds and ounces • read Fahrenheit and Celsius thermometers including temperatures below zero • convert units of time

	3. Students will use standard units to identify and express examples of measurement in daily life. *Concepts and Skill Sets Introduced* The student will: • add and subtract measurements with regrouping recording answers in simplified form • explain the difference between mass and weight • find the change in temperature when one temperature is below zero and the other above • estimate and/or compute elapsed or projected time • tell time in two ways (minutes before the hour/minutes after the hour)
Money	4. Students will solve problems involving money. *Concepts and Skill Sets Mastered* The student will: • add, subtract, multiply and divide amounts of money • find a given sum of money using the least number of coins

Grade Five
Data Analysis, Statistics, and Probability

Goals
The students will: ● formulate questions that can be addressed with data; collect, organize, and display relevant data to answer them ● collect, organize and display data using appropriate statistical and graphical methods. ● select and use appropriate statistical methods to analyze data ● analyze data sets to form hypotheses and make predictions ● understand and apply basic concepts of probability ● develop and evaluate inferences and predictions that are based on data ● understand and apply basic concepts of probability NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Graphs	1. Students will collect, organize, describe and apply data. *Concepts and Skill Sets Mastered* The student will: • use, read, create and interpret a variety of graphic organizers, charts, and graphs (charts, graphs, etc. should include Venn diagrams, broken line graphs, bar graphs, picture graphs, circle graphs, and stem and leaf plot) • use a variety of ways to collect, organize, record, analyze, and interpret data and identify patterns and trends • analyze patterns and data to make generalizations and predictions • use technology to create spreadsheets and convert information into graphs *Concepts and Skill Sets Introduced* The student will: ● differentiate between numerical and categorical data and their appropriate representations
Probability	2. Students will determine the likelihood of certain events through games and simple experiments. *Concepts and Skill Sets Mastered* The student will : • make and test predictions of probability and fairness • design and conduct probability experiments and games of chance • express probability as a fraction

	Concepts and Skill Sets Introduced The student will: • conduct probability experiments and express the probability based on possible outcomes • relate the likelihood of an event to a numerical value • identify possible outcomes and express the likelihood of events as a fraction • identify possible outcomes of events using combinations (where order does not matter) and explore situations resulting in permutations (where order does matter).
Data Analysis	3. Students will pose questions to be answered through collection and analysis of a data set. *Concepts and Skill Sets Mastered* The student will: ● design and conduct surveys to gather data ● demonstrate and explain survey findings 4. Students will describe features of a data set. *Concepts and Skill Sets Mastered* The student will: ● compute the mean of a set of data ● use range, mean, median, and mode to explain data ● describe how a change in an outlier can change the measures of central tendency

Grade 5 Vocabulary

Number Theory, Operations and Estimation	Algebra	Geometry
Absolute value Associative property Benchmarks Clustering Compatible numbers Compensation Composite numbers Commutative property Distributive property Divisibility rules Exponents Front end estimation Greater than or equal to (≥) Less than or equal to (≤) Integer Prime numbers Product Proportion Quotient Ratio Reciprocal numbers Repeated factors Relative magnitude Rounding Short division algorithm Simplest form	Four quadrant grid Geometric sequences Ordered Pair	Angles: acute obtuse right Center point Chord Degree Diameter Hexagon Intersecting Line Line segment Net Octagon Parallel lines Pentagon Perpendicular lines Polygon Point Quadrilateral Radius Ray Symmetry (line and rotational) Triangles: isosceles scalene equilateral
Measurement	**Data Analysis, Statistics, Probability**	**Add vocabulary terms as needed**
Customary units Decimeters Kilometers Mass Millimeters Weight	Bro Survey Data set Equally/less likely Fairness Frequency Likely Median Mean Mode Outliers Probability	

Grade Six
Number Theory, Patterns, Estimation, and Operations

Goals
The students will: • understand numbers, ways of representing numbers, relationships among numbers, and number systems • understand that a variety of numerical representations can be used to describe quantitative relationships • understand meanings of operations and how they relate to one another • compute fluently and make reasonable estimates • use numbers and their properties to compute flexibly and fluently • understand and describe patterns and functional relationships • represent and analyze quantitative relationships in a variety of ways • use operations and properties to determine equivalence and solve problems NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Number Theory	1. Students will represent numbers in expanded and regrouped forms in the base ten place value system. *Concepts and Skill Sets Mastered* The student will: • locate, order and compare whole numbers on number lines, scales and the coordinate grid • compare large numbers using expanded forms and powers of ten • read, write, count, skip count, order, compare, round, and expand numerals to one billion *Concepts and Skill Sets Introduced* The student will: • express a standard form number in scientific notation and vice versa • identify negative exponents by examining patterns 2. Students will extend whole number place value concepts to include decimal numbers which are also represented as fractions whose denominators are multiples of ten. *Concepts and Skill Sets Mastered* The student will: • read and write decimals to ten thousandths place in standard form as number words

	3. Students will use factors to explore, represent and classify numbers. *Mastery* The student will: • memorize and apply the divisibility rules for 2,3,4,5,6,8,9,and 10 • find all prime factors and write prime factorization of numbers • represent numbers by using exponents • change exponent form to standard numeral, write as repeated factors and vice versa • use factors of composite numbers, powers of ten and divisibility rules to find products and missing factors • memorize and apply the rules for the order of operations including parentheses and exponents • identify the square root of perfect squares to 400 • recognize and use the radical sign (√)
Estimation	4. Students will use place value concepts, number patterns and properties to develop and apply estimation and computation strategies. *Concepts and Skill Sets Mastered* The student will: • estimate and predict reasonable answers and recognize and explain when an estimate will be more or less than an exact answer • explain orally and in writing when a situation requires an exact answer or when an estimate is sufficient • develop, describe, and use a variety of ways to estimate and calculate with large numbers and connect the strategies to powers of ten • use benchmarks to understand the relative magnitude of numbers • use place value concepts, number patterns, the number line and the commutative, associative, and distributive properties to develop estimation and computation strategies • select and apply the most suitable estimation strategy: rounding, clustering, front end (with adjustment), compatible numbers, compensation • round decimals to the nearest ten thousandths place
Operations: Whole numbers And decimals	5. Students will apply place value concepts and number properties to the addition, subtraction, multiplication and division of multi-digit numbers. *Concepts and Skill Sets Mastered* The student will: • recognize place value patterns when multiplying and dividing decimals by powers of 10 • use the distributive property [10 x (4+5) = (10 x 5) + (10 x 4)] to estimate, multiply and divide multi-digit numbers by one-digit factors • identify and use the inverse relationships of multiplication and division to solve and check problems • determine the proper operation to solve a problem and justify the reasoning

	• multiply and divide decimals by decimals • change a fraction to a decimal using division • write division problems in fraction form • express remainders in division as fractions • model and describe when products or quotients with fractions and decimals can yield a larger or smaller result than either factor • use the short division algorithm 6. Students will use models, number lines, scales and a coordinate grid to represent and illustrate decimal numbers and to express them in equivalent forms. *Concepts and Skill Sets Mastered* The student will • locate, order and compare decimals on number lines, scales and the coordinate grid • use models and common factors to identify equivalent fractions and their decimal representations • determine the decimal equivalents of fractions • convert fractions to decimals, decimals to fractions, and fractions to percents • write fractions as terminating and repeating decimals
Fractions	7. Students will model , identify and express equivalent forms of numbers expressed as whole numbers, fractions and mixed numbers. *Concepts and Skill Sets Mastered* The student will: • locate, order and compare fractions on number lines, scales and the coordinate grid • use models and common factors to identify equivalent fractions and their decimal representations 8. Students will add and subtract fractions and mixed numbers using models, pictures and number sentences. *Concepts and Skill Sets Mastered* The student will: • subtract mixed numbers with renaming • add and subtract fractions, whole numbers and mixed numbers using a variety of computational strategies 9. Students will use models and pictorial representations to develop concepts and methods by which to multiply and divide fractions and mixed numbers. *Concepts and Skill Sets Mastered* The student will: • Construct and use models and pictorial representations to multiply common fractions and mixed numbers

	• write whole number division problems in fraction form and round the fraction form to estimate an answer to a division problem • use models to divide whole numbers by fractions and fractions by whole numbers • model and describe why products or quotients with fractions and decimals can yield a larger or smaller result than either factor. • identify reciprocal numbers • apply reciprocal numbers to division of a whole number by a fraction • multiply and divide fractions, whole numbers and mixed numbers using a variety of computational strategies • use cancellation in multiplication of fractions
Rational Numbers Ratio Proportion & Percent	10. Students will model, identify, compare and relate rational numbers. *Concepts and Skill Sets Mastered* The student will: • choose and use benchmarks to approximate locations on number lines and coordinate grids • estimate and find percents using benchmarks and number patterns *Concepts and Skill Sets Introduced* The student will: • convert repeating decimals to fractions • write percents greater than 100% and less than 1% as decimals and fractions 11. Students will compare quantities and solve problems using ratios, rates and percents. *Concepts and Skill Sets Mastered* The student will: • memorize common percent-fraction equivalents (benchmarks) • find the percent of a number • find what a percent one number is of another • solve problems involving sales tax and discounts • use ratio and proportions to solve practical problems such as interpreting maps and scale drawings or identifying probability • use cross products, multiplication and division to find equivalent ratios • generate a table of equal ratios and graph the ordered pairs • read and write rates, and change a rate to a unit rate • convert between rates using ratios and proportions
Integers	12. Students will explore numbers less than zero and extend the number line to illustrate concepts and computation strategies of integers. *Concepts and Skill Sets Mastered* The student will: • define and recognize integers • use a number line to illustrate, compare and order integers

	• identify and demonstrate the absolute value of an integer • identify opposite integers • add, subtract, multiply and divide integers

Grade Six
Algebra

Goals
The students will: • understand patterns, relations, and functions • represent and analyze mathematical situations and structures using algebraic symbols • use algebraic symbols to determine equivalence and solve problems • use mathematical models to represent and understand quantitative relationships • analyze change in various contexts NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Patterns and Functions	1. Students will represent, extend and analyze numerical and geometric patterns. *Concepts and Skill Sets Mastered* The student will: • describe, analyze and extend numeric, geometric and statistical patterns • make generalizations about patterns and relationships and test those generalizations • extend and compare arithmetic and geometric sequences • represent geometric and numeric patterns using words, tables, graphs and equations • analyze patterns and data to make predictions • determine the nature of changes in linear relationships using graphs, tables, and equations 2. Students will recognize and demonstrate equivalence using number properties. *Mastery:* The student will: • identify, express and apply the commutative, distributive, and associative properties of whole numbers • demonstrate how to maintain equivalence in equations • model and solve one step linear equations by maintaining equivalence (use inverse operations 3. Stuents will write and analyze expressions, equations and inequalities that express relationships between numbers. *Concepts and Skill Sets Mastered* The student will: • represent mathematical relationships using variables in expressions, equations and inequalities

	• describe how a change in one variable relates to a change in a second variable in a practical situation *Introductory* The student will: • represent numerical and contextual situations with algebraic expressions, equations and inequalities • use variables as placeholders, to denote a pattern, to write a formula and to represent a function or relation • contrast constants and variables 4. Students will represent numerical and linear relationships in graphic forms. *Concepts and Skill Sets Mastered* The student will: • locate points on a four quadrant coordinate grid by using ordered pairs • use a table to explore functions and graph them • determine the nature of changes in linear relationships using graphs, tables, and equations 5. Students will recognize, use , simplify and evaluate arithmetic and algebraic expressions. *Concepts and Skill Sets Mastered* The student will: • write and evaluate algebraic expressions with two variables • use order of operations to evaluate expressions including exponents *Concepts and Skill Sets Introduced* The student will: • evaluate algebraic expressions and formulas

Grade Six
Geometry and Measurement

Goals
The students will: • analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments about relationships • use properties and characteristics of two-and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems • use spatial reasoning, location and geometric relationships to solve problems • specify locations and describe spatial relationships using coordinate geometry and other representational systems • apply transformations and use symmetry to analyze mathematical situations • use visualization, spatial reasoning, and geometric modeling to solve problems • understand measurable attributes of objects and the units, systems, and processes of measurement • develop and apply appropriate techniques, tools and formulas to estimate and determine measurements • apply appropriate techniques, tools and formulas to determine measurements • use numbers and their properties to estimate measures and quantities reasonably NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Plane and Solid Figures	1. Students will describe and develop relationships between geometric properties of plane and solid figures. *Concepts and Skill Sets Mastered* The student will: • make and test conjectures about geometric relationships • classify polygons according to their transformational properties • use the relationships of sides and angles to classify sets of polygons • make and test conjectures about side and angle relationships and congruence • identify, compare and contrast regular and irregular polygons • identify and measure the parts of a circle (radius, diameter, chord, central angle) • describe the relationships between and among radius, diameter, circumference and area of a circle • use angles to measure and classify polygons • identify and classify angles as complementary and supplementary 2. Students will identify, draw and describe elements needed to explain spatial relationships. *Concepts and Skill Sets Mastered* The student will: • represent the surface of three-dimensional objects through the use of two-dimensional nets

	• identify rotational symmetry and points of rotation *Concepts and Skill Sets Introduced* The student will: • use spatial reasoning location and geometric relationships to solve problems 3. Students will identify and generalize relationships between measurable attributes of plane and solid figures. *Concepts and Skill Sets Mastered* The student will: • determine the volume of rectangular solids • describe the relationships between the measures of area of two-dimensional objects and volume of three dimensional objects • use the rectangle as a basic shape to model and develop formulas for the area of triangles, parallelograms, trapezoids and circles • use a compass to draw a circle • find the area of a circle • use a protractor to measure angles • identify, compare and contrast regular and irregular polygons • identify the meaning and value of pi • find the circumference of a circle using a formula *Concepts and Skill Sets Introduced* The student will: • develop and use formulas to determine the volume of pyramids and cylinders • calculate the surface area of a rectangular prism 4. Students use coordinate systems to identify and illustrate spatial location and geometric relationships. *Concepts and Skill Sets Mastered* The student will: • draw and interpret maps and diagrams using coordinate systems and shapes or pictures *Concepts and Skill Sets Introduced* The student will: • construct similar polygons on coordinate grids • describe the similarity of polygons as a result of dilations (reductions or enlargements) and their effects on measurements 5. Students develop and apply units, systems and formulas to solve measurement problems. *Concepts and Skill Sets Mastered* The student will: • use different ratios to convert between units of length, area, and volume in the customary and metric systems

	• recognize and use powers of ten as conversion ratios in the metric system • compute customary and metric measurements with regrouping recording answer in simplified form • select, justify, convert, metric and standard units of measurement • explain the difference between mass and weight

Grade Six
Data Analysis, Statistics, and Probability

Goals
The students will: ● formulate questions that can be addressed with data; collect, organize, and display relevant data to answer them ● collect, organize and display data using appropriate statistical and graphical methods. ● select and use appropriate statistical methods to analyze data ● analyze data sets to form hypotheses and make predictions ● understand and apply basic concepts of probability ● develop and evaluate inferences and predictions that are based on data ● understand and apply basic concepts of probability NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Graphs	1. The students will collect, organize, describe and apply data. *Concepts and Skill Sets Mastered* The student will: ● use, read, create, interpret, and compare a variety of graphic organizers, charts, and graphs (to iinclude Venn diagrams, histograms, broken line graphs, bar graphs, picture graphs, circle graphs, stem and leaf, and scatter plots) *Concepts and Skill Sets Introduced* The student will: ● recognize misleading graphs
Probability	2. The students will determine the possible outcomes and likelihood of certain events through games and simple experiments. *Concepts and Skill Sets Mastered* The student will : • conduct probability experiments and express the probability based on possible outcomes • relate the likelihood of an event to a numerical value • identify possible outcomes and express the likelihood of events as a fraction • explain that probabilities are more reliable to use as predictors when there is a large number of trials • describe the relationship between the number of trials in an experiment and the predicted outcomes • design and conduct probability experiments and make predictions about outcomes that are equally likely or not equally likely • express probabilities as fractions, ratios, decimals and percents

Data Analysis	3. The students will pose questions to be answered through collection and analysis of a data set. *Concepts and Skill Sets Mastered* The student will: • use a variety of ways to collect, organize, record, analyze, and interpret data and identify patterns and trends • use technology to create spreadsheets and convert information into graphs • use extended numeric, geometric and statistical patterns to identify trends and justify predictions • differentiate between numerical and categorical data and their appropriate representations 4. The students will describe and analyze features of a data set. *Concepts and Skill Sets Mastered* The student will: • analyze patterns and data to make generalizations and predictions • describe the shape of data sets using measures of spread (range and outliers) and central tendency (mode, median, and mean) • recognize that changes in a data set can affect the mode, median, mean, and range *Concepts and Skill Sets Introduced* The student will: • recognize misleading data

GRADE 6
Vocabulary

The student will use correct math terms in Concepts and Skill Sets Mastered activities. These terms include, but are not limited to:

Number Theory, Patterns, Estimation, and Operations	Algebra	Geometry and Measurement	Data Analysis, Statistics, Probability
Coordinate grid Standard form Scientific notation Prime factorization Exponent Square root, squares Radical (√) Properties Rounding, Clustering Front end estimation Compatible numbers Compensation Powers of ten Distributive property Inverse Algorithm Equivalent fractions Terminating/repeating Decimals Scales Reciprocal Rational numbers Percents Ratio Proportion Cross products Ordered pairs Rate Unit rate Integers Absolute value	Arithmetic and geometric sequences Linear Variable Function Relation Constants Quadrant	polygons Regular and irregular Polygons Quadrilateral Pentagon Hexagon Octagon Congruence Radius Diameter Chord Central angle Nets Protractor Pi Pyramids Cylinders Prism Dilations Intersecting Center point Line ray Right angle Line segment Volume Point Degree Angle Perpendicular lines Parallel lines Triangles: isosceles, Scalene, equilateral	Venn diagram Frequency Stem and leaf Scatter plots Outcomes Outliers Misleading data Likely Equally likely less likely Probability Survey Mean Median

Grades Seven

Number Theory, Estimation, and Operations

Goals
The students will: • understand numbers, ways of representing numbers, relationships among numbers, and number systems • understand that a variety of numerical representations can be used to describe quantitative relationships • understand meanings of operations and how they relate to one another • compute fluently and make reasonable estimates • use numbers and their properties to compute flexibly and fluently • understand and describe patterns and functional relationships • represent and analyze quantitative relationships in a variety of ways • use operations and properties to determine equivalence and solve problems NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Number Theory	1. Students will represent numbers in expanded and regrouped forms in the base ten place value system. *Concepts and Skill Sets Mastered* The student will: • locate, order and compare whole numbers on number lines, scales and the coordinate grid • compare large numbers using expanded forms and powers of te • read, write, count, skip count, order, compare, round, and expand numerals to one billion 2. Students will use powers of ten and scientific notation to write very large and very small numbers. *Concepts and Skill Sets Mastered* The student will: • express a standard form number in scientific notation and vice versa • identify negative exponents by examining patterns • use powers of ten and positive exponents to express and compare magnitude of very large numbers and connect to scientific notation • develop, describe and use a variety of methods to estimate and calculate with very large numbers

	Concepts and Skill Sets Introduced The student will: • use powers of ten and negative exponents to write decimals as fractions • use powers of ten and positive and negative exponents to express and compare magnitude of very large and very small numbers and connect to scientific notation • find the results of multiplication and division with powers of ten using patterns in operating with exponents 3. Students will use factors to explore, represent and classify numbers. *Concepts and Skill Sets Mastered* The student will: • find prime factors and write prime factorization of numbers • represent numbers by using exponents • change exponent form to standard numeral, write as repeated factors and vice versa • use order of operations including exponents • find the square and the square root of a number (both positive and negative) *Concepts and Skill Sets Introduced* The student will: • find prime factorizations of integers and monomials • find GCF of integers and monomials
Estimation	4. Students will use place value concepts, number patterns and properties to develop and apply estimation and computation strategies to include negative numbers. *Concepts and Skill Sets Mastered* The student will: • develop, describe, and use a variety of ways to estimate and calculate with very large and very small numbers and connect the strategies to powers of ten • use place value concepts, number patterns, the number line and the commutative, associative, and distributive properties to develop estimation and computation strategies • estimate to predict outcomes and determine reasonableness of results and to describe whether an estimate is an over- or underestimate
Operations: Whole numbers and integers	5. Students will apply place value concepts and properties of numbers to the addition, subtraction, multiplication and division of multi-digit integers. *Concepts and Skill Sets Mastered* The student will: • solve problems with positive and negative numbers using models and number lines

	• use the order of operations to compute and solve a variety of multi-step problems, including those with parentheses and exponents • use absolute value in solving problems • add, subtract, multiply and divide integers
Fractions Decimals: Rational numbers, ratio proportion, & percent	6. Students will represent practical situations and solutions to problems using the appropriate symbolic form –fractions, decimals, or percents. *Concepts and Skill Sets Mastered* The student will: • convert fractions to decimals, decimals to fractions, fractions to percents, and percents to fractions (including repeating decimals) • write percents greater than 100% and less than 1% as decimals and fractions • write fractions as terminating and repeating decimals and vice versa • estimate and compute with fractions, decimals, mixed numbers, improper fractions, ratios, proportions, and percents • use the distributive property to multiply and divide mixed numbers and decimals • write and use ratios, rates, and unit rates • write and solve proportions • use proportions to solve problems involving geometric figures • use proportions and similar figures to measure objects indirectly • solve problems involving percents • estimate and use common applications of percents *Concepts and Skill Sets Introduced* The student will: • estimate and solve problems involving percent of increase and decrease 7. Students will identify, compare, and relate rational numbers. *Concepts and Skill Sets Mastered* The student will: • rewrite rational numbers in equivalent fraction, decimal, ratio, and percent forms with number patterns and common factors • classify numbers in the real number system (counting, whole, integer, rational, and irrational) *Concepts and Skill Sets Introduced* The student will: • compare, locate, label, and order rational numbers on number lines, scales, coordinate grids and measurement tools • identify a rational number between any two rational numbers • find absolute values of rational numbers • simplify rational expressions • multiply and divide rational expressions • add and subtract rational expressions with like and unlike denominators

Grades Seven

Algebra

Goals
The students will: • understand patterns, relations, and functions • represent and analyze mathematical situations and structures using algebraic symbols • represent and analyze quantifiable relationships in a variety of ways • use algebraic symbols to determine equivalence and solve problems • use mathematical models to represent and understand quantitative relationships • analyze change in various contexts NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Patterns	1. Students will use tables, graphs, rules and words to investigate, describe, and analyze functional relationships in a variety of patterns. *Concepts and Skill Sets Mastered* The student will: • determine the nature of changes in linear relationships using graphs, tables, and equations • describe, analyze, and extend numeric, geometric and statistical patterns • make generalizations about patterns and relationships and test those generalizations • represent, extend, and compare geometric and numeric patterns using words, tables, graphs and equations • analyze patterns and data to make predictions *Concepts and Skill Sets Introduced* The student will: • write recursive and explicit functions to generalize patterns • recognize and solve problems of direct variation
Functions	2. Students will recognize and demonstrate equivalence using number properties. *Concepts and Skill Sets Mastered* The student will: • demonstrate how to maintain equivalence in equations • model and solve one step linear equations by maintaining equivalence (use inverse operations)

	Concepts and Skill Sets Introduced The student will: • model and solve two-step linear equations using a variety of methods (i.e., concrete materials, algebra tiles, pictorial representations, etc.) 3. Students will write and analyze expressions, equations and inequalities that express relationships between numbers. *Concepts and Skill Sets Mastered* The student will: • represent numerical and contextual situations with algebraic expressions, equations, and inequalities • use variables in patterns, formulas, functions and relations • contrast constants and variables • simplify expressions that contain rational numbers 4. Student will use numbers, symbols, and words to represent and describe mathematical relationships. *Concepts and Skill Sets Mastered* The student will: • write verbal expressions as algebraic expressions and sentences as equations • use graphs, tables, equations and verbal descriptions to represent and analyze changes in linear and nonlinear relationships • recognize that a linear relationship has a constant rate of change called slope *Concepts and Skill Sets Introduced* The student will: • evaluate expressions with exponents • evaluate expressions with square roots • write an equation given some of the solutions • find the slope of a line • identify the *x* and *y* intercepts • identify and write the equation for a line in point-slope, slope-intercept and standard forms 5. Students will analyze physical phenomena and patterns to identify relationships and make generalizations. *Concepts and Skill Sets Mastered* The student will: generalize mathematical situations using variables in expressions, equations and inequalities • determine the nature of changes in linear relationships using graphs, tables, and equations • describe in context how a change in one variable relates to a change in a second variable

	• identify the independent and dependent variables in a given situation • identify, express and apply the commutative, distributive, and associative properties of whole numbers *Concepts and Skill Sets Introduced* The student will: • identify the characteristics of functions and relations, including domain and range 6. Students will identify relationships that are linear and nonlinear and compare and contrast their properties using tables, graphs, equations and verbal descriptions. *Concepts and Skill Sets Mastered* The student will: • use tables and graphs to measure and describe changes • graph linear equations on an xy-axis • graph functions from ordered pairs *Concepts and Skill Sets Introduced* The student will: • determine whether a relation is a function • find function values • interpret and draw graphs of functions • describe what a line will look like before it is graphed, i.e. if the line is in a positive or negative direction, and how steep the line should be by analyzing the slope • solve linear equations for "y" given the linear equation in any other form • determine the solutions of linear equations (0, 1, or an infinite number) • use functional notation to express algebraic relationships 7. Students will solve problems using a variety of algebraic representations. *Concepts and Skill Sets Mastered* The student will: • represent numerical and contextual situations with algebraic expressions, equations and inequalities • evaluate algebraic expressions and formulas • simplify algebraic expressions by combining like terms • solve problems using concrete, verbal, symbolic, graphic and tabular representations *Concepts and Skill Sets Introduced* The student will: • solve equations in one variable that contain absolute value expressions • add and subtract polynomials • multiply and divide monomials • multiply a polynomial by a monomial • multiply binomials • simplify expressions involving powers of monomials and products and quotients of monomials

Grades Seven
Geometry and Measurement

Goals
The students will: • analyze characteristics and properties of two and three dimensional geometric shapes and develop mathematical arguments about relationships • use properties and characteristics of two-and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas and solve problems • use spatial reasoning, location and geometric relationships to solve problems • specify locations and describe spatial relationships using coordinate geometry and other representational systems • apply transformations and use symmetry to analyze mathematical situations • use visualization, spatial reasoning, and geometric modeling to solve problems • understand measurable attributes of objects and the units, systems, and processes of measurement • develop and apply appropriate techniques, tools and formulas to estimate and determine measurements • apply appropriate techniques, tools and formulas to determine measurements • use numbers and their properties to estimate measures and quantities reasonably NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	**Student Objectives/Enabling Outcomes**
Plane and solid figures	1. Students describe and develop relationships between geometric properties of plane and solid figures. *Concepts and Skill Sets Mastered* The student will: • identify which classes of polygons have line and/or rotational symmetry • identify and classify angles as complementary or supplementary • develop and use formulas to determine the volume of pyramids, cylinders, prisms, and cones • calculate the surface area of a rectangular prism, pyramids, cylinders, and cones *Concepts and Skill Sets Introduced* The student will: • describe the effect of scale factors on the length, area, and volume ratios of similar polygons, circles, and solids • make and test conjectures about the relationships among angles, sides, perimeters, and areas of congruent and similar polygons (including the Pythagorean Theorem)

	2. Students identify, draw, and describe elements needed to explain spatial relationships. *Concepts and Skill Sets Mastered* The student will: • draw and interpret nets, cross-sections, and front, side, and top views of various solids • use rectangular grids to represent polygons and perform transformations (translations, rotations, reflections, and dilations) • describe the effect of transformations on polygons with line and/or rotational symmetry • construct similar polygons on coordinate grids • describe the similarity of polygons as a result of dilations (reductions or enlargements) and their effects on measurements • use spatial reasoning, location, and geometric relationships to solve problems *Concepts and Skill Sets Introduced* The student will: • apply transformations (rotate or turn, reflect or flip, translate or slide, and dilate or scale) to geometric figures represented on a graph • identify applications of transformations, such as tiling, fabric design, art, and scaling 3. Students will identify and generalize relationships between measurable attributes of plane and solid figures. *Concepts and Skill Sets Mastered* The student will: • develop and use formulas to determine the surface area of three-dimensional objects *Concepts and Skill Sets Introduced* The student will: • verify the Pythagorean Theorem, using diagrams, concrete materials, and measurement • apply the Pythagorean Theorem to find the missing length of a side of a right triangle when given the lengths of the other two sides

Grade Seven
Data Analysis, Statistics, and Probability

Goals
The students will: • formulate questions that can be addressed with data; collect, organize, and display relevant data to answer them • collect, organize and display data using appropriate statistical and graphical methods • select and use appropriate statistical methods to analyze data • analyze data sets to form hypotheses and make predictions • understand and apply basic concepts of probability • develop and evaluate inferences and predictions that are based on data • understand and apply basic concepts of probability NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes
Graphs and Data Analysis	1. Students will collect and construct appropriate representations of data. *Concepts and Skill Sets Mastered* The student will: • formulate questions, design surveys and samplings • organize and analyze gathered data and defend the analysis • organize and display data using graphical representations • make and defend predictions based on patterns and trends *Concepts and Skill Sets Introduced* The student will: • collect , organize, display, compare, and analyze large data sets • construct a variety of data displays including box and whisker plots • identify where measures of central tendency and dispersion are found in graphical displays 2. Students will describe and analyze features of a data set and justify conclusions. *Concepts and Skill Sets Mastered* The student will: • find, use and interpret measures of central tendency and spread, including mode, median, mean, range, and outliers • identify trends and justify conclusions • recognize that changes in a data set can affect the mode, median, mean, and range • compare two sets of data based on their distributions and measures of central tendency • recognize misleading graphs

	Concepts and Skill Sets Introduced The student will: • make predictions from scatter plots using or estimating a line-of-best-fit • make and evaluate statistical claims and justify conclusions with evidence • make inferences and evaluate reasonable hypotheses based on experimental data • analyze and interpret data using descriptive statistics, including range, mode, median, quartiles, outliers, and mean • describe the role of random sampling, random number generation, and the effects of sample size on statistical claims
Probability	3. Students will determine probabilities and outcomes. *Concepts and Skill Sets Mastered* The student will: • identify experimental probability by gathering data from experiments • identify theoretical probability by analyzing possible and likely outcomes • conduct experiments and compare experimental to theoretical probabilities • solve problems involving the probability of simple and compound events in familiar contexts *Concepts and Skill Sets Introduced* The student will: • distinguish between combinations and permutations as ways to predict possible outcomes in certain situations • use combinations and permutations, trees, and networks (counting strategies) in a variety of contexts • identify when order is irrelevant in determining a solution

Vocabulary

The student will use correct math terms in Concepts and Skill Sets Mastered activities. These terms should include, but are not limited to:

Number Theory	Algebra	Geometry	Data Analysis
Absolute value	Binomials	Angles:	Histograms
Additive inverse	Constants	acute	Stem and leaf plots
Base	Direct variation	right	Scatter plots
Coefficient	Domain	obtuse	Outlier
Combining like terms	Equation/inequality	straight	
Compatible numbers	Expression	vertical	
Counting numbers	Equations	Area	
Counting principle	Formulas	Circumference	
Difference	Functions	Complementary	
Equal to	Functional notation	Cosine	
Equivalent fraction	grid	Cone	
Exponent	Independent and	Congruent	
Exponential	dependent variables	Cylinder	
Event	Inverse operations	Diameter	
Factor tree	Ordered pair	Degree	
Grouping symbols	Patterns	Hypotenuse	
Integers	Point slope	Laterak area	
Irrational numbers	Polynomials	Lateral height	
Monomials	Properties:	Leg	
Negative exponents	associative	Perpendicular lines	
Negative integer	commutative	Parallel lines	
Operations	distributive	Perfect square	
Opposite integers	identity	Rotational symmetry	
Order of operations	inverse	Sine	
Percent of:	Range	Triangle:	
change	Recursive functions	acute	
increase	Relations	equilateral	
decrease	Rise over run ($\Delta y/\Delta x$)	isoscele	
Parentheses	Slope	scalene	
Pattern	Slope intercept	Pentagon	
Pemdas	Solution	Polygon	
Positive integers	System of equations	Prism	
Power	Terms	Pythagorean Theorem	
Prime factors	Variable	Quadrilateral	
Probability	Variable expression	Radius	
Product	Variable equation	Regular polygon	
Quotie	Variable inequalities	Rhombus	
Radical	Xy-axis	Scale	
Radical expression	X and y intercepts	Slant height	
Radical expression		Surface area	
Radicand		Supplementary	
Rational expressions		Tangent	
Rational numbers		Trapezoid	
Real numbers		Volume	
Reciprocal		Protractor	
Relatively prime		Compass	
Scientific notation		Chord	

Similar figures Square root Terminating/repeating Decimals Unit fraction Whole numbers		Pi Circumference	

Algebra I
Grades 8/9

Goals
The students will: ● understand and describe patterns and functional relationships ● represent and analyze quantitative relationships in a variety of ways ● use operations, properties and algebraic symbols to determine equivalence and solve problems ● use properties and characteristics of two- and three-dimensional shapes and geometric theorems to describe relationships, communicate ideas, and solve problems ● use spatial reasoning, location, and geometric relationships to solve problems ● develop and apply units, systems, formulas and appropriate tools to estimate and measure NCTM, 2000 Vermont Mathematics Curriculum Framework

Content	Student Objectives/Enabling Outcomes

Patterns, Functions & Operations	1. Students will analyze physical phenomena, functions, and patterns to identify and describe relationships and make generalizations about patterns and functions. The student will: • write recursive and explicit functions to generalize patterns • use a table or graph to evaluate algebraic expressions • recognize and use the properties of identity and equality • use the distributive, commutative and associative properties to evaluate and simplify expressions and solve linear problems • describe relationships and make generalizations about patterns and functions • identify the characteristics of functions and relations, including domain and range 2. Students will generalize mathematical situations and patterns with algebraic expressions, equations and inequalities. The student will: • solve compound inequalities and graph their solutions • evaluate expressions with exponents • evaluate expressions with square roots • find squares of sums and differences • solve and graph absolute value equations and inequalities • identify, describe, create and generalize numeric, geometric and statistical patterns with tables, graphs, words and symbolic rules • make and justify predictions based on patterns • write an equation given some of the solutions 3. Students will identify relationships that are linear and nonlinear and compare and contrast their properties using tables, graphs, equations and verbal descriptions. The student will: • use tables and graphs to measure and describe changes • graph linear equations on an xy-axis • graph functions from ordered pairs • determine whether a relation is a function • find function values • interpret and draw graphs of functions • describe what a line will look like before it is graphed, i.e. if the line is in a positive or negative direction, and how steep the line should be by analyzing the slope • solve linear equations for "y" given the linear equation in any other form • determine the solutions of linear equations (0, 1, or an infinite number) • use functional notation to express algebraic relationships

	4. Students will describe the effects of characteristics of linear relationships on the way the relationships are represented verbally and in tables, graphs and equations. The student will: • recognize, extend and write formulas for arithmetic sequences • simplify expressions using order of operations • classify numbers within the real number system • graph exponential functions • graph quadratic functions 5. Students will solve problems using various algebraic methods, formulas, and properties. The student will: • write and evaluate algebraic expressions and solve open sentences • solve real world problems using linear equations • solve equations involving perfect squares • solve problems using the Pythagorean Theorem • solve quadratic equations by graphing, completing the square, and using the quadratic formula • use dimensional analysis with multiplication and division • recognize and solve problems of direct variation • solve problems of inverse variation
Numerical and Algebraic Reasoning and Quantitative Relationships	6. Students will develop numerical representations to describe quantitative relationships using the appropriate symbolic form. The student will: • graph rational numbers on a number line • find absolute values of rational numbers • simplify rational expressions • multiply and divide rational expressions • add and subtract rational expressions with like and unlike denominators • solve rational equations • simplify mixed expressions and complex fractions • find prime factorizations of integers and monomials • find GCF of integers and monomials • factor polynomials using the distributive property • factor trinomials and perfect square trinomials • simplify radical expressions using the product property of square roots and the Quotient Property of Square Roots • add, subtract, and multiply radical expressions • solve radical equations

	7. Students will represent and analyze linear and non-linear functions and relations symbolically and with tables and graphs. The student will: • determine the constant rate of change in a linear relationship and recognize this as the slope of a line • compare and contrast the graphs of lines with the same slope versus those with different slopes • use slope as rise over run • interpret slope and y-intercepts from contextual situations, graphs, and linear equations • given two linear relationships in context, identify a common solution • find the inverse of a relation • use an equation or graph to determine domain and range. • graph inverse variation
Ratios, Proportions and Percents	8. Students will develop strategies for computation and estimation using ratio, proportion and percents to solve problems. The student will: • write and use ratios, rates, and unit rates • write and solve proportion • solve problems involving percents • estimate and use common application of percents
Operations, Properties, and Algebraic Symbols	9. Students will manipulate equations, inequalities and functions to solve problems. The student will: • solve equations in one variable that contain absolute value expressions • solve multi-step equations using algebraic properties • solve systems of inequalities by graphing • write, graph and solve problems as variation equations • graph inequalities on the coordinate plane • find the difference between two points on the coordinate plane • solve real world problems involving linear inequalities • solve systems of equations by using elimination with addition, subtraction, and multiplication • solve systems of equations by graphing • solve real world systems of equations problems • use a graphing calculator to investigate graphs of inequalities • use tables, graphs, and equations to represent mathematical relationships and solve real-world problems • multiply monomials • simplify expressions involving powers of monomials and products and quotients of monomials • simplify expressions containing negative exponents • express numbers in scientific and standard notation

	• multiply and divide numbers expressed in scientific notation • solve problems involving polynomials, binomials, and monomials • solve equations involving polynomials • sultiply polynomials and binomials
Data Analysis, Probability, Statistics	EXTENDED (if time) 13. Students will construct appropriate representations of data based on the size and kind of data set and the purpose for its use. The student will: • interpret points on a scatter plot • write lines of fit • identify data with exponential behavior • identify various sampling techniques • organize data in matrices • addition, subtraction, and scalar multiplication of matrices

Vocabulary

The student will use correct math terms in Concepts and Skill Sets Mastered activities. These terms should include, but are not limited to:

Patterns, Functions, Operations	Numerical and Algebraic Reasoning Quantitative Relationships	Ratios Proportions Percents	Operations, Properties, and Algebraic Symbols	Data Analysis Probability Statistics
Axis Axis of symmetry Constant Decay Degree Direct variation Discriminate Domain Exponent Exponential Growth/decay Evaluate Function Intercept Inverse Inverse operations Irrational numbers Rational numbers Like/unlike terms Linear Maximum Minimum Numerical expression Order of operations Ordered pairs Pythagorean Theorem Quadratic equation Quadratic formula Range Radical expressions Real numbers Root/solution Simplify Slope Point-slope form Slope-intercept form of a line Standard form of a line Variable Direct variable Independent variable Vertex	Absolute value Base Coefficient Composite Congruent Constant Difference of squares Greatest Common Factor (LCF) Least Common Multiple (LCM) Prime Prime factorization Radical Rational expression Reciprocal Slope Square of a sum	Axes X coordinate Y coordinate Ratio Rate Unit rate Sine Cosign Tangent	Binomial Monomial Polynomial Trinomial	Scatter plot Matrices