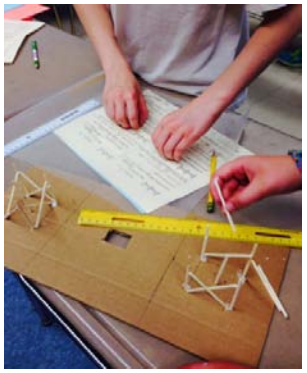
Bedford Public Schools

Grade 5 – Math

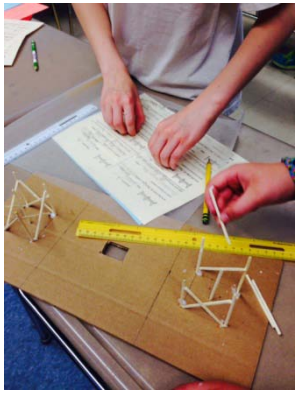
The fifth grade curriculum builds on and extends the concepts of number and operations in base ten and fractions, geometry, measurement and data while introducing concepts of algebraic thinking and expression, coordinate graphing and positive and negative numbers. In whole number operations, students are expected to be able to multiply multi-digit whole numbers using the standard algorithm and divide up to four-digit dividends by two-digit divisors. Students' understanding of place value expects them to recognize digits in any place value and analyze the relationship between digits in any place value to the same digit in places to either its right or left. They are also expected to read, write and compare decimals to the thousandths and be able to round these to any place. They are also expected to add, subtract, multiply and divide decimals to the hundredths and use these skills in problem-solving situations. In the area of fractions, students are expected to add and subtract fractions and mixed numbers with any denominator, multiply fractions and whole numbers by fractions, and divide whole numbers by a unit fraction (one in the numerator) or a unit fraction by a whole number and use these skills in problem-solving situations. In geometry, students are introduced to the coordinate plane and are expected to represent real-world problems by graphing points in only the first quadrant. They also build on their knowledge of 2-D shapes by classifying these in a hierarchy based on their properties. In measurement, students are introduced to the concept of volume of solid figures and are expected to know how to apply a formula and find the volume of rectangular prisms. They are also expected to extend their understanding of the standard and metric systems of measurement in length, weight and capacity and use these to solve real-world problems. In the area of data, they are expected to represent and interpret data using line plots to display sets of measurements infractions. In fifth grade, students are introduced to positive and negative numbers just to describe such measurements as temperature above/below zero, elevation above/below zero and credit/debit and use these in real-world problems. Finally, as an introduction to the skills needed for the algebra they will encounter in middle school, students learn to write and interpret numerical expressions and analyze patterns and relationships between corresponding terms.



Learning Expectations

Throughout all grades, there is an emphasis on the skills of mathematical practice that prepare children to be mathematically-proficient students. Therese skills include making sense of problems and persevering in solving them, assessing how reasonable their answers are, explaining in words (both orally and in writing) their understanding and reasoning, attending to precision in both calculations and in math language, using appropriate math tools, and looking for and extending patterns.

Assessments happen in multiple ways routinely throughout the school year to measure student progress. Assessments consist of informal as well as formal teacher observations, small group interviews, individual interviews and checkpoints, and written tests. Student progress is monitored carefully to ensure proficiency in both the mathematical content and the practice standards that are expected at each grade level.



Learning Expectations

Operations and Algebraic Thinking

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	Essential Questions In order to understand, students will need to consider questions such as . . .	Knowledge and Skills Learning this material will require students to . . .
Write and Interpret Numerical Expressions • There is an agreed upon order for which operations in a numerical expression are performed. First compute within parentheses. Second, evaluate all terms with exponents. Then do any multiplication and division calculations from left to right followed by any addition and subtraction calculations from left to right. • Some mathematical phrases can be represented using mathematical expressions.	• How are the values of an algebraic expression and a numerical expression found?	• Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols. • Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.
Analyze Patterns and Relationships • Relationships can be described and generalizations made for mathematical situations that have numbers or objects that repeat in predictable ways. For some relationships, mathematical expressions and equations can be used to describe how members of one set are related to members of another set.	• How are points graphed? • How can we show the relationship between patterns with given rules using a coordinate plane?	• Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** In order to understand, students will need to consider questions such as . . .	**Knowledge and Skills** Learning this material will require students to . . .
Analyze Patterns and Relationships (cont.) • Patterns can sometimes be used to identify a relationship between two quantities. Some real-world quantities have a mathematical relationship; the value of one quantity can be found if you know the value of the other quantity. • The coordinate system is a scheme that uses two perpendicular lines intersecting at a 0 to name the location of points on a plane. • Mathematical relationships represented by rules can also be represented by a graph of the rule. Ordered pairs that satisfy the rule can be used to graph the data.		

Numbers and Operations in Base Ten

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	Essential Questions In order to understand, students will need to consider questions such as . . .	Knowledge and Skills Learning this material will require students to . . .
Understand the Place Value System • The Base Ten numeration system is a scheme for recording numbers using digits 0-9, groups of ten and place value. • Place value can be used to compare and order whole numbers and decimals. • Basic facts and place-value patterns can be used to find products when one factor is a multiple of 10 or a multiple of 100. • Numbers can be represented using a base number and an exponent for powers of ten. • Patterns can be used to mentally multiply and divide decimals by 10, 100, and 1,000. • Any number, measure, numerical expression, algebraic expression, or equation can be represented in an infinite number of ways that have the same value	• How are whole numbers and decimals written, compared and ordered? • How can place value patterns help in multiplying and dividing decimals by a power of 10? • What are the different ways numbers can be read and written?	• Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left. • Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. • Read, write and compare decimals to the thousandths. • Read , write and compare decimals (using <, >, =) to thousandths using base-ten numerals, number names, and expanded form (i.e. 347.392 = 3 x 100 + 4 x 10 + 7 x 1 + 3 x (1/10) + 9 x (1/100) + 2 x (1/1000). • Use place value understanding to round decimals to any place.

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** In order to understand, students will need to consider questions such as . . .	**Knowledge and Skills** Learning this material will require students to . . .
Perform Operations With Multi-Digit Whole Numbers and With Decimals to Hundredths • The standard multiplication algorithm breaks the calculation into simpler calculations using place values starting with ones, then tens, and so on. • There is more than one algorithm for each of the operations with rational numbers. • The sharing interpretation of division and money can be used to model the standard division algorithm. • Using basic facts and patterns can be helpful in dividing by multiples of 10. • Using area models and arrays can help students understand the algorithm for dividing by 2-digit divisors. • Dividing by 2-digit divisors is just an extension of the steps for dividing with 1-digit divisors. • Dividing with multi-digit divisors is an extension of the steps for dividing with 1 and 2-digit divisors quotient. • The standard multiplication algorithm involving decimals is an extension of the standard algorithm for multiplying whole numbers. • The steps for multiplying whole numbers by decimals are similar to the steps for multiplying two whole numbers. Place value determines the placement of the decimal point in a product.	• What are the standard algorithms for multi-digit multiplication and division? • What are the standard algorithms for finding products and quotients involving numbers with decimals? • How can place value strategies, properties of operations and/or the relationship between multiplication and division be helpful in dividing whole numbers? • How can using concrete models, drawings, strategies based on place value, properties of operations and/or the relationship between multiplication and division be helpful in performing operations with whole numbers and with decimals to hundredths?	• Fluently multiply multi-digit whole numbers using the standard algorithm. • Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors. • Add, subtract, multiply, and divide decimals to hundredths.

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** In order to understand, students will need to consider questions such as . . .	**Knowledge and Skills** Learning this material will require students to . . .
Multi-Digit Whole Numbers (cont.) • Steps for multiplying decimals are similar to steps for multiplying whole numbers. Place value determines the placement of the decimal point in the product. The product of two decimals less than one is less than either factor. • The location of decimals points in decimal division calculations can sometimes be decided by reasoning about the relative size of the given numbers. • The standard division algorithm involving decimals is an extension of the standard algorithm for dividing whole numbers. • A number divided by a decimal can be represented as an equivalent calculation using place value to change the divisor to a whole number.		

Numbers and Operations – Fractions

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** Learning this material will require students to . . .	**Knowledge and Skills** Learning this material will require students to . . .
Use Equivalent Fractions as a Strategy to Add and Subtract Fractions • Models can be used to show different ways of adding and subtracting fractions. • The same fractional amount can be represented by an infinite set of different but equivalent fractions. Equivalent fractions are found by multiplying or dividing the numerator and denominator by the same nonzero number. • A fraction in simplest form is when 1 is the only common factor of the numerator and denominator. • A number line can be used to determine the nearest half or whole a fraction is closest to. • Fractions with unlike denominators can be added or subtracted by replacing fractions with equivalent fractions with like denominators. The product of the denominators of two fractions is a common denominator of both.	• What does it mean to add and subtract fractions with unlike denominators? • What is a standard procedure for adding subtracting fractions with unlike denominators? • What visual models are useful in adding and subtracting fractions? • What are the procedures for estimating and finding products and quotients of fractions and mixed numbers? • What visual models are most useful to show multiplication and/or division of fractions?	• Add and subtract fractions with unlike denominators, including mixed numbers. • Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators. • Interpret a fraction as division of the numerator by the denominator (i.e. a/b = a ÷ b). Solve word problems involving division of whole numbers leading to answers in the form, fractions or mixed numbers. • Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction. • Interpret the product (a/b) x q as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations a x q ÷ b. • Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** Learning this material will require students to . . .	**Knowledge and Skills** Learning this material will require students to . . .
Fractions (cont.) • Fractional amounts greater than 1 can be represented using a whole number and a fraction. Whole number amounts can be represented as fractions. When the numerator and denominator are equal, the fraction equals 1. Fractions greater than 1 can be named using a whole number and a fraction or an improper fraction. • Apply and extend previous understandings of multiplication and division to multiply and divide fractions. • A fraction describes the division of a whole into equal parts, and it can be interpreted in more than one way depending on the whole to be divided. • The product of a whole number and a fraction can be interpreted in different ways. One interpretation is repeated addition. • Multiplying a whole number by a fraction involves division as well as multiplication. The product is a fraction of a whole number. • A unit square can be used to show the area meaning of fraction multiplication. • When you multiply two fractions that are both less than 1, the product is smaller than either fraction.		• Interpret multiplication as scaling (resizing) by: 1. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication. 2. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number. • Solve real-world problems involving multiplication of fractions and mixed numbers by using visual fraction models or equations to represent the problem • Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. 1. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. 2. Interpret division of a whole number by a unit fraction, and compute such quotients. 3. Solve real-world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions by using visual fraction models and equations to represent the problem.

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** Learning this material will require students to . . .	**Knowledge and Skills** Learning this material will require students to . . .
Fractions (cont.) • The inverse relationship between multiplication and division can be used to divide with fractions. • One way to find the product of mixed numbers is to change the calculation to an equivalent one involving improper fractions. • One way to find the quotient of a whole number divided by a unit fraction or a unit fraction divided by a whole number is to draw a picture. • The relative size of the factors can be used to determine the relative size of the product.		

The Number System

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** Learning this material will require students to . . .	**Knowledge and Skills** Learning this material will require students to . . .
Gain Familiarity With Concepts of Positive and Negative Integers • Numbers can be used for different purposes, and numbers can be classified and represented in different ways. • The set of numbers is infinite and ordered. Whole numbers, decimals and integers are real numbers. Each real number can be associated with a unique point on a number line.	• What are integers? • What are some uses of positive and negative integers?	• Use positive and negative integers to describe quantities such as temperature above/below zero, elevation above/below sea level or credit/debit.

Measurement and Data

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** Learning this material will require students to . . .	**Knowledge and Skills** Learning this material will require students to . . .
Convert Like Measurement Units Within a Given Measurement System • Convert among different-sized standard measurement units within a given measurement system. • Relationships between measurement units of the same length can be expressed as an equation (i.e. 1 ft = 12 in.). Relationships exist that enable you to convert between units of length by multiplying or dividing. • Relationships between measurement units of weight/mass can be expressed as a ratio (i.e. 1 lb to 16 oz or 1 lb = 16 oz).	• What are the customary measurement units and how are they related? • What are the metric measurement units and how are they related? • How can the place value system be useful in converting among different-sized metric units within a given measurement system?	• Convert among different-sized standard measurement units within a given measurement system (i.e., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real-world problems.
Represent and Interpret Data • Some questions can be answered by collecting and analyzing data, and the questions to be answered determines the data that needs to be collected and how best to collect it. Data can be represented visually using tables, charts and graphs. The type of data determines the best choice of visual representation. • Each type of graph is most appropriate for certain kinds of data. A line plot organizes data on a number line and is useful for showing visually how a set of data is distributed.	• How can line plots be used to represent data and answer questions? • How can numbers be used to describe certain data sets?	• Make a line plot to display a data set of measurements in fractions of a unit (i.e. 1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots.

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** Learning this material will require students to . . .	**Knowledge and Skills** Learning this material will require students to . . .
Geometric Measurement: Understand Concepts of Volume and Relate Volume to Multiplication and Addition • Three-dimensional or solid figures have length, width, and height. Many can be described, classified and analyzed by their faces, edges, and vertices. Many everyday objects closely approximate standard geometric solids. • The shape of a solid can sometimes be determined by analyzing different views of the solid. • Volume is a measure of the amount of space inside a solid figure. Volume can be measured by counting the number of cubic units needed to fill a three-dimensional object. • The volume of some objects can be found by breaking apart the object into other objects for which the volume of each can be found. • The formula of V=l x w x h can be used to find the volume of a rectangular prism.	• How can three-dimensional shaped be represented and analyzed? • What does the volume of a rectangular prism mean and how can it be found?	• Recognize volume as an attribute of solid figures and understand concepts of volume measurement. • Know that a cube with side length 1 unit, called a “unit cube,” is said to have “one cubic unit” of volume, and can be used to measure volume. • Know that a solid figure which can be packed without gaps or overlaps using n unit cubes is said to have a volume of n cubic units. • Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units. • Relate volume to the operations of multiplication and addition and solve real-world and mathematical problems involving volume. • Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes. Show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes to represent the associative property of multiplication. • Apply the formulas V = l x w x h and V = b x h for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems.

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	Essential Questions Learning this material will require students to . . .	Knowledge and Skills Learning this material will require students to . . .
Geometric Measurement (cont.)		• Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, apply this to solve real-world problems.

Geometry

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	Essential Questions Learning this material will require students to . . .	Knowledge and Skills Learning this material will require students to . . .
Graph Points On the Coordinate Plane to Solve Real-World and Mathematical Problems • The coordinate system is a scheme that used two perpendicular lines intersecting a 0 to name the location of points in the plane. • The ordered pairs of the end points of vertical and horizontal line segments can be used to find the length of the segments. • A graph of a rule contains all of the points on the coordinate grid whose x- and y-coordinates satisfy the rule.	• How are points graphed? • How can we show the relationship between sequences on a graph?	• Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel horizontally from the origin in the direction of one axis, and the second number indicates how far to travel vertically in the direction of the second axis, with the

Enduring Understandings In order to meet the standards, the students will need to understand that . . .	**Essential Questions** Learning this material will require students to . . .	**Knowledge and Skills** Learning this material will require students to . . .
Graph Points (cont.) • Mathematical relationships represented by rules can also be represented by a graph of the rule. Ordered pairs that satisfy the rule can be used to graph the data.		convention that the names of the two axes and the coordinates correspond (i.e. x-axis and x-coordinate, y-axis and y-coordinate). • Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.
Classify Two-Dimensional Figures Into Categories Based On Their Properties • Two- and three-dimensional objects with or without curved surfaces can be described, classified, and analyzed by their attributes. • Plane shapes have many properties that make them different from one another. Polygons can be described and classified by their sides and angles. • Two-dimensional shapes can be categorized based on their properties. • Two-dimensional figures can be classified in a hierarchy based on their properties.	• How can polygons, triangles, and quadrilaterals be described, classified and named?	• Understand that attributes belonging to a category of two-dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles. • Classify two-dimensional figures in a hierarchy based on properties.