

Mendham Township School District

Mathematics Curriculum - 2012

Grade 5 General & Advanced

In Grade 5, instructional time should focus on three critical areas: (1) developing fluency with addition and subtraction of fractions, and developing understanding of the multiplication of fractions and of division of fractions in limited cases (unit fractions divided by whole numbers and whole numbers divided by unit fractions); (2) extending division to 2-digit divisors, integrating decimal fractions into the place value system and developing understanding of operations with decimals to hundredths, and developing fluency with whole number and decimal operations; and (3) developing understanding of volume.

1. Students apply their understanding of fractions and fraction models to represent the addition and subtraction of fractions with unlike denominators as equivalent calculations with like denominators. They develop fluency in calculating sums and differences of fractions, and make reasonable estimates of them. Students also use the meaning of fractions, of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for multiplying and dividing fractions make sense. (Note: this is limited to the case of dividing unit fractions by whole numbers and whole numbers by unit fractions.)
2. Students develop understanding of why division procedures work based on the meaning of base-ten numerals and properties of operations. They finalize fluency with multi-digit addition, subtraction, multiplication, and division. They apply their understandings of models for decimals, decimal notation, and properties of operations to add and subtract decimals to hundredths. They develop fluency in these computations, and make reasonable estimates of their results. Students use the relationship between decimals and fractions, as well as the relationship between finite decimals and whole numbers (i.e., a finite decimal multiplied by an appropriate power of 10 is a whole number), to understand and explain why the procedures for multiplying and dividing finite decimals make sense. They compute products and quotients of decimals to hundredths efficiently and accurately.
3. Students recognize volume as an attribute of three-dimensional space. They understand that volume can be measured by finding the total number of same-size units of volume required to fill the space without gaps or overlaps. They understand that a 1-unit by 1-unit by 1-unit cube is the standard unit for measuring volume. They select appropriate units, strategies, and tools for solving problems that involve estimating and measuring volume. They decompose three-dimensional shapes and find volumes of right rectangular prisms by viewing them as decomposed into layers of arrays of cubes. They measure necessary attributes of shapes in order to determine volumes to solve real world and mathematical problems.

Grade 5 Overview

- **Operations and Algebraic Thinking**
 - Write and interpret numerical expressions.
 - Analyze patterns and relationships.

- **Number and Operations in Base Ten**
 - Understand the place value system.
 - Perform operations with multi-digit whole numbers and with decimals to hundredths.

- **Number and Operations—Fractions**
 - Use equivalent fractions as a strategy to add and subtract fractions.
 - Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

- **Measurement and Data**
 - Convert like measurement units within a given measurement system.
 - Represent and interpret data.
 - Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.

- **Geometry**
 - Graph points on the coordinate plane to solve real-world and mathematical problems.
 - Classify two-dimensional figures into categories based on their properties.

- **Mathematical Practices**
 1. 1. Make sense of problems and persevere in solving them.
 2. 2. Reason abstractly and quantitatively.
 3. 3. Construct viable arguments and critique the reasoning of others.
 4. 4. Model with mathematics.
 5. 5. Use appropriate tools strategically.
 6. 6. Attend to precision.
 7. 7. Look for and make use of structure.
 8. 8. Look for and express regularity in repeated reasoning.

CCCS	CCCS#	Comp & Content	Skills	Concepts
Operations and Algebraic Thinking 5OA				
Write and interpret numerical expressions.				
Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols	5OA1	Math Symbols (parentheses, brackets, and braces)	Evaluating expressions	Using order of operations to simplify expressions
Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation “add 8 and 7, then multiply by 2” as $2 \times (8 + 7)$. Recognize that $3 \times (18932 + 921)$ is three times as large as $18932 + 921$, without having to calculate the indicated sum or product.	5OA2	Double means twice as much Triple means 3X as much	Write simple expressions to represent calculations of numbers Evaluate the value of expression through inspection	
Analyze patterns and relationships				
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. For example, given the rule “Add 3” and the starting number 0, and given the rule “Add 6” and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.	5OA3		Graphing points in coordinate plane Create patterns using two rules Identify the rule associated with a specific pattern	
Number and Operations in Base Ten 5NBT				
Understand the place value system				
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.	5NBT1	Names of each place in a number		Each place is 10x greater than each place to its right + 1/10 th of each 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.	5NBT2	Identifying numbers are powers of 10 Definition of exponents		Explain patterns when multiplying or dividing by powers of 10 as: 1) movement of decimal point 2) addition of zeros
Read, write, and compare decimals to thousandths	5NBT3	Reading decimals to thousandths	Writing decimals to thousandths Comparing decimals to thousandths	
Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times (1/10) + 9 \times (1/100) + 2 \times (1/1000)$.	5NBT3A		Represent numbers in expanded form using base-ten numerals and number names	
Compare two decimals to thousandths based on meanings of the digits in each place, using $>$, $=$, and $<$ symbols to record the results of comparisons	5NBT3B	Symbols: $>$, $=$, $<$	Compare 2 decimals to thousandths using symbols	
Use place value understanding to round decimals to any place	5NBT4		Rounding decimals to any place	

Based upon “Common Core” 2010

Perform operations with multi-digit whole numbers and with decimals to hundredths.

Fluently multiply multi-digit whole numbers using the standard algorithm.	5NTB5		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, using strategies based on place value, the properties of operations and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	5NTB6		Divide whole numbers up to 4-digit dividends & 2-digit divisors Illustrate & explain the calculation by using equations, rectangular arrays and/or area models	Illustrate & explain the calculation by using equations, rectangular arrays and/or area models
Add, subtract, multiply, and divide decimals to hundredths, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction; relate the strategy to a written method and explain the reasoning used.	5NTB7		Add, subtract, multiply and divide decimals using concrete models and standard algorithms Explain reasoning used	

Number and Operations—Fractions 5NF

Use equivalent fractions as a strategy to add and subtract fractions

Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example, $\frac{2}{3} + \frac{5}{4} = \frac{8}{12} + \frac{15}{12} = \frac{23}{12}$. (In general, $\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$.)	5NF1	Knowledge of equivalent fractions Common denominator = LCM of denominators	Add and subtract fractions & mixed numbers with unlike denominators by writing equivalent fractions w/a common denominator	
Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. For example, recognize an incorrect result $\frac{2}{5} + \frac{1}{2} = \frac{3}{7}$, by observing that $\frac{3}{7} < \frac{1}{2}$.	5NF2	Benchmark fractions 0, $\frac{1}{2}$, 1	Solve word problems by addition and subtraction of fractions w/unlike denominators by using models Estimate sums & differences of fractions by using benchmark fractions	

Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

<p>Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. For example, interpret $3/4$ as the result of dividing 3 by 4, noting that $3/4$ multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size $3/4$. If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?</p>	<p>5NF3</p>	<p>A fraction is same as the quotient of numerator & denominator</p> <p>Interpret a fraction as division</p>	<p>Solve word problems in which division of whole number leads to fraction or mixed number quotients</p>	
<p>Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.</p>	<p>5NF4</p>		<p>Multiply a fraction by a fraction</p> <p>Multiply a fraction by a whole number</p>	
<p>Interpret the product $(a/b) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \div q \times b$. For example, use a visual fraction model to show $(2/3) \times 4 = 8/3$, and create a story context for this equation. Do the same with $(2/3) \times (4/5) = 8/15$. (In general, $(a/b) \times (c/d) = ac/bd$.)</p>	<p>5NF4A</p>			<p>Create a story context for multiplication of:</p> <p>1) fraction with fraction and 2) fraction with a whole number</p>
<p>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.</p>	<p>5NF4B</p>	<p>Definition of area of a rectangle</p>	<p>Finding area using fraction files</p> <p>Finding area by multiplying side lengths of sides</p>	<p>Area is equal to number of square units enclosed in a 2-D figure</p> <p>Derive area formula of rectangle $A = l \times w$</p>
<p>Interpret multiplication as scaling (resizing), by:</p>				
<p>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.</p>	<p>5NF5A</p>	<p>Definition of:</p> <p>1) scale factor 2) doubling 3) tripling</p>	<p>Comparing size of product to size of the scale factor used without multiplying</p>	<p>Understanding the impact on product (enlarge/reduce by size of scale factor) i.e.:</p> <ul style="list-style-type: none"> if the number is greater than one it will enlarge the number, (>1 =enlarge) if the number is greater than zero and less than 1 it will reduce the number ($0 < x < 1$ = reduce) based on the scale factor used

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; and relating the principle of fraction equivalence $a/b = (nxa)/(nxb)$ to the effect of multiplying a/b by 1.	5NF5B		Explain why the product is greater when scale factor >1 and smaller when scale factor between 0 and 1	Understand that the process of writing equivalent fractions (multiplication & division of numerator & denominators by same numbers) is same as being multiplied or divided by 1
Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.	5NF6	Definition of mixed #	Solve real world problems involving multiplication of fractions and mixed numbers by using models or equations	
Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions	5NF7	Definition of 1) unit fractions 2) whole numbers	Divide unit fractions by whole numbers and whole numbers by unit fractions	
Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. For example, create a story context for $(1/3) \times 4$, and use a visual fraction model to show the quotient Use the relationship between multiplication and division to explain that $(1/3) \times 4 = 1/12$ because $(1/12) \times 4 = 1/3$.	5NF7A		Create a story context for division of unit fraction by a non-zero whole number and Calculate division of a non-zero whole number by a unit fraction	
Interpret division of a whole number by a unit fraction, and compute such quotients. For example, create a story context for $4 \times (1/5)$, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that $4 \times (1/5) = 20$ because $20 \times (1/5) = 4$.	5NF7B		Create a story context for: division of a whole number by a unit fraction Calculate quotient of whole number by unit fraction	
Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. For example, how much chocolate will each person get if 3 people share $1/2$ lb of chocolate equally? How many $1/3$ -cup servings are in 2 cups of raisins?	5NF7C		Solve real world problems involving division of unit fractions & whole numbers & whole numbers by unit fractions by using fraction models and equations	

Measurement and Data 5MD				
Convert like measurement units within a given measurement system				
Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems.	5MD1	Standard units of measure including metric & customary	Convert from one unit of measure to another within a given measurement system Use conversions to solve multi-step real world problems	
Represent and interpret data				
Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Use operations on fractions for this grade to solve problems involving information presented in line plots. For example, given different measurements of liquid in identical beakers, find the amount of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.	5MD2	Line plot	Making a line plot using fractions of a unit Using operations with fractions to solve problems presented in line plots	
Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition				
Recognize volume as an attribute of solid figures and understand concepts of volume measurement	5MD3	Volume measurement tools		Understand volume as the # of cubic units contained in a 3-D figure
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.	5MD3A	1x1x1 cube is a unit cube and is said to have one cubic unit of volume and is used to measure volume		
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.	5MD3B	A solid figure which can be packed w/o gaps or overlays using n unit cubes is said to have a vol. of n cubic units		
Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.	5MD4	Units of volume: Cubic centimeter Cubic inch Cubit feet	Measure volume by counting unit cubes then assigning the appropriate unit of volume (for ex 3 unit cubes = 3 cm cubed)	
Relate volume to the operations of multiplication and addition and solve real world and mathematical problems involving volume.	5MD5		Solve real world & mathematical problems involving volume	Relate volume to operations of \times & \div & derive vol. formula for right rect. prism
Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and 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, e.g., to represent the associative property of multiplication	5MD5A	Associate property umulative property	Calculate volume of a right rectangular prism by using unit cubes & then by multiplying edge lengths	Volume is calculated by multiplying the area of the base times the height
Apply the formulas $V = l \times w \times h$ and $V = b \times h$ 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.	5MD5B		Apply volume formulas $l \times w \times h$ and $B \times h$ for rectangular prisms w/whole # edge lengths in context of real world & mathematical problems	

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, applying this technique to solve real world problems.	5MD5C			
Geometry 5G				
Graph points on the coordinate plane to solve real-world and mathematical problems				
Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) 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 from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond (e.g., x-axis and x-coordinate, y-axis and y-coordinate).	5G1	Define coordinate plane parts (axes, origin, ordered pair, coordinates, x,y)	Understand the meaning of x,y coordinates as far as movement on the axis	
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	5G2		Graphing points in the first quadrant of the coordinate plane Interpret coordinate values of points of the context of the situation	
Classify two-dimensional figures into categories based on their properties				
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	5G3			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	5G4	Classify two-dimensional figures in a hierarchy based on properties		