Standards for Mathematical Practices – Grade 5

The Common Core State Standards for Mathematical Practice are expected to be integrated into every mathematics lesson for all students Grades K-12. Below are a few examples of how these Practices may be integrated into tasks that students complete.

Mathematical Practice	Explanations and Examples
1. Make sense of problems and persevere in solving them.	Mathematically proficient students in grade 5 should solve problems by applying their understanding of operations with whole numbers, decimals, and fractions including mixed numbers. They solve problems related to volume and measurement conversions. Students seek the meaning of a problem and look for efficient ways to represent and solve it. They may check their thinking by asking themselves, "What is the most efficient way to solve the problem?", "Does this make sense?", and "Can I solve the problem in a different way?".
2. Reason abstractly and quantitatively.	Mathematically proficient students in grade 5should recognize that a number represents a specific quantity. They connect quantities to written symbols and create a logical representation of the problem at hand, considering both the appropriate units involved and the meaning of quantities. They extend this understanding from whole numbers to their work with fractions and decimals. Students write simple expressions that record calculations with numbers and represent or round numbers using place value concepts.
3. Construct viable arguments and critique the reasoning of others.	In fifth grade mathematical proficient students may construct arguments using concrete referents, such as objects, pictures, and drawings. They explain calculations based upon models and properties of operations and rules that generate patterns. They demonstrate and explain the relationship between volume and multiplication. They refine their mathematical communication skills as they participate in mathematical discussions involving questions like "How did you get that?" and "Why is that true?" They explain their thinking to others and respond to others' thinking.
4. Model with mathematics.	Mathematically proficient students in grade 5 experiment with representing problem situations in multiple ways including numbers, words (mathematical language), drawing pictures, using objects, making a chart, list, or graph, creating equations, etc. Students need opportunities to connect the different representations and explain the connections. They should be able to use all of these representations as needed. Fifth graders should evaluate their results in the context of the situation and whether the results make sense. They also evaluate the utility of models to determine which models are most useful and efficient to solve problems.
5. Use appropriate tools strategically.	Mathematically proficient fifth graders consider the available tools (including estimation) when solving a mathematical problem and decide when certain tools might be helpful. For instance, they may use unit cubes to fill a rectangular prism and then use a ruler to measure the dimensions. They use graph paper to accurately create graphs and solve problems or make predictions from real world data.
6. Attend to precision.	Mathematically proficient students in grade 5 continue to refine their mathematical communication skills by using clear and precise language in their discussions with others and in their own reasoning.

	Students use appropriate terminology when referring to expressions, fractions, geometric figures, and coordinate grids. They are careful about specifying units of measure and state the meaning of the symbols they choose. For instance, when figuring out the volume of a rectangular prism they record their answers in cubic units
7. Look for and make use of structure.	In fifth grade mathematically proficient students look closely to discover a pattern or structure. For instance, students use properties of operations as strategies to add, subtract, multiply and divide with whole numbers, fractions, and decimals. They examine numerical patterns and relate them to a rule or a graphical representation.
8. Look for and express regularity in repeated reasoning.	Mathematically proficient fifth graders use repeated reasoning to understand algorithms and make generalizations about patterns. Students connect place value and their prior work with operations to understand algorithms to fluently multiply multi-digit numbers and perform all operations with decimals to hundredths. Students explore operations with fractions with visual models and begin to formulate generalizations.

Grade 5 Critical Areas

The Critical Areas are designed to bring focus to the standards at each grade by describing the big ideas that educators can use to build their curriculum and to guide instruction.

The Critical Areas for fifth grade can be found on page 33 in the *Common Core State Standards for Mathematics*.

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).**
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. **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.**
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. **Developing understanding of volume.**
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.

Operations and Algebraic Thinking

- **Write and interpret numerical expressions.**

Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with these symbols

Student Friendly/"I Can" statements	Resources	A
1. Know the order of operations. 2. Use parentheses, brackets, and/or braces in numerical expression and evaluate them to find the solution.	http://nlvm.usu.edu	

Write simple expressions that record calculations with numbers, and interpret numerical expressions without evalua
express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three tim
without having to calculate the indicated sum or product.

Student Friendly/"I Can" statements	Resources	A
1. Write simple word expressions from numerical expressions. 2. Write numerical expressions from word expressions. 3. Interpret the relationship of the numbers in the expressions.		

• **Analyze patterns and relationships.**

Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding tern
consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. *For ex*
3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting s
the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.

Student Friendly/"I Can" statements	Resources	A
1. Define coordinate plane, coordinates, axes, ordered pairs, corresponding terms. 2. Graph coordinate-pairs on a coordinate plane. 3. Given two rules, create a chart with both patterns on the chart. 4. Identify the relationship between the corresponding terms in the chart. 5. Graph the ordered pairs from the chart on a coordinate plane. 6. Determine the relationship of the corresponding terms from a coordinate graph. 7. Identify how the relationship would continue.	http://nlvm.usu.edu coordinate planes graph paper	

Number and Operations in Base Ten

• 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 it represents in the place to its left.

Student Friendly/"I Can" statements	Resources	A
1. Use place value to multiply decimals by powers of ten to convert them to whole numbers. 2. Understand that multiplying by 1/10 is the same as dividing by 10.	http://nlvm.usu.edu place value charts	

Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patt decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote pov

Student Friendly/"I Can" statements	Resources	A
1. Define exponents. 2. Explain that the number of zeros in a product represents the exponent of 10. 3. Explain that since a positive exponent denotes multiplication of 10, a negative exponent denotes division of 10. 4. Use whole-number exponents to denote powers of ten.	Place value charts Graph paper	

Read, write, and compare decimals to thousandths.

a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.3 + 3 × (1/10) + 9 × (1/100) + 2 × (1/1000).

Student Friendly/"I Can" statements	Resources	A
1. Read and write (words and numerical) decimals to the thousandths. 2. Read and write the expanded form of decimals with fractional notation.	Place value charts Mathplayground.com – Decention – Decimals, percents, fractions Base 10 blocks Fraction bars Decimal bars NLVM Mathisfun.com/definitions	

b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to comparisons.

Student Friendly/"I Can" statements	Resources	A
1. Compare two decimals to the thousandths using <, >, and = for recording.	Place value charts	

Use place value understanding to round decimals to any place.

Student Friendly/"I Can" statements	Resources	A
1. Round decimals to any place.	Place value charts	

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

Fluently multiply multi-digit whole numbers using the standard algorithm.		
Student Friendly/"I Can" statements 1. Multiply multi-digit whole numbers using the standard algorithm.	Resources http://nlvm.usu.edu graph paper for arrays youtube.com/watch	A
Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategi properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calcu rectangular arrays, and/or area models.		
Student Friendly/"I Can" statements 1. Divide four-digit dividends and two-digit divisors. 2. Explain quotient by using equations, rectangular arrays, and/or area models.	Resources Graph paper	A

Number and Operations—Fractions

• 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 eq
way as to produce an equivalent sum or difference of fractions with like denominators. *For example, 2/3 + 5/4 = 8/1*
general, a/b + c/d = (ad + bc)/bd.)

Student Friendly/"I Can" statements	Resources	A
1. Rename fractions as equivalent fractions. 2. Rename two fractions with unlike denominators as equivalent fractions with the same denominators. 3. Recognize that the product of two unlike denominators will create a common denominator. 4. Recognize that the common denominator created by the product of the two unlike denominators may not be the smallest denominator. 5. Add two fractions with unlike denominators after renaming the fractions to equivalent fractions with like denominators. 6. Subtract two fractions with unlike denominators after renaming the fractions to equivalent fractions with like denominators.	http://nlvm.usu.edu Use arrays to show simple unlike denominator fractions and how additional divisions of the arrays are necessary to get common denominators in order to add or subtract. Show that it might take multiple divisions to get the common denominator. Once students have an understanding of the arrays, write the numeric equivalent to the steps taken in explaining the arrays.	

Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of u
using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of f
mentally and assess the reasonableness of answers. *For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by ob*

Student Friendly/"I Can" statements	Resources	A
1. Solve real world addition and subtraction fraction problems. 2. Use benchmark fractions to mentally estimate the solutions. 3. Assess reasonableness of answers. 4. Recognize mistakes.	Plain paper Graph paper Fraction bars	

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

Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). Solve word problems involving div
leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to re
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 whol
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 wei
rice should each person get? Between what two whole numbers does your answer lie?

Student Friendly/"I Can" statements	Resources	A
1. Interpret fractions as division problems. 2. Solve word problems involving division of whole numbers in which the solution is a fraction or mixed number. 3. Use models to explain result.	http://nlvm.usu.edu plain paper graph paper	

Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

a. 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 sequ
For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the
8/15. (In general, (a/b) × (c/d) = ac/bd.)

Student Friendly/"I Can" statements	Resources	A
1. Understand that a fraction multiplied by a whole number is the same as the numerator of the fraction multiplied by the whole number and the product divided by the denominator. 2. Create a model showing the product of a fraction and a whole number. 3. Create a word story for the equation of product of whole number and a fraction. 4. Understand that when two fractions are multiplied, the product is the result of the product of the two numerators over the product of the two denominators. 5. Create a model showing the product of two fractions. 6. Create a word story for the equation of the product of two fractions.	Graph paper Fraction tiles Plain paper Lined paper	

b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fractio
that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find a
represent fraction products as rectangular areas.

Student Friendly/"I Can" statements	Resources	A
1. Find the area of fractional side lengths by tiling with the appropriate unit size. 2. Show that the area model is the same as multiplying the fractional side lengths. 3. Create fractional rectangular areas to represent fraction products.	Graph paper Fraction tiles	

Interpret multiplication as scaling (resizing), by:

a. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without perfo multiplication.

Student Friendly/"I Can" statements	Resources	A
1. Understand that when one factor stays the same and the other is changed by a fractional equivalent of the original the product of the new terms will be equal to the fractional equivalent of the new term when compared to the original product by using visual models. 2. Compare products when one factor changes without multiplying.	Graph paper	

b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a f a product smaller than the given number; and relating the principle of fraction equivalence $a/b = (n \times a)/(n \times b)$ to the 1.

Student Friendly/"I Can" statements	Resources	A
1. Explain why a product is greater than 1 when a number is multiplied by a fraction greater than 1. 2. Explain why a product is less than one when a number is multiplying by a fraction less than 1.	Graph paper Fraction tiles	

Solve real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction mod
represent the problem.

Student Friendly/"I Can" statements	Resources	A
1. Solve real world problems involving multiplication of fractions using visual models. 2. Solve real world problems involving multiplication of fractions using equations. 3. Solve real world problems involving multiplication of mixed numbers by using visual models. 4. Solve real world problems involving multiplication of mixed numbers using equations.	Graph paper Fraction tiles	

Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers

a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. *For example, creat*
4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to e
because (1/12) × 4 = 1/3.

Student Friendly/"I Can" statements	Resources	A
1. Use a visual fraction model to find the quotient of a unit fraction (numerator of 1) divided by a whole number. 2. Create a word story for the quotient of a unit fraction divided by a whole number.	Graph paper Fraction tiles	

b. Interpret division of a whole number by a unit fraction, and compute such quotients. *For example, create a story*
a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that
(1/5) = 4.

Student Friendly/"I Can" statements	Resources	A
1. Use a visual fraction model to find the quotient of a whole number divided by a unit fraction (numerator of 1). 2. Create a word story for the quotient of a whole number divided by a unit fraction.	Graph paper Fraction tiles	

c. Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole nu
by using visual fraction models and equations to represent the problem. *For example, how much chocolate will each*
1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?

Student Friendly/"I Can" statements	Resources	A
1. Solve real world problems involving division of unit fractions by whole numbers and division of whole numbers by unit fractions using visual models. 2. Solve real world problems involving division of unit fractions by whole numbers and division of whole numbers by unit fractions using equations.	Graph paper Fraction tiles	

Measurement and Data

• **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
conversions in solving multi-step, real world problems.

Student Friendly/"I Can" statements	Resources	A
1. Recognize units of measurement within the same system. 2. Divide and multiply to change units. 3. Convert units of measurement within the same system. 4. Solve multi-step, real world problems that involve converting.	http://nlvm.usu.edu metric and customary ruler meter stick and yard stick measuring cups and pint, quart, gallon containers scales with metric weights and ounces and pounds analog clock with second hand post-it notes Learner.org (Math in Daily Life) Movement of decimals – what do we see in the world?	

• **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 fracti problems involving information presented in line plots. *For example, given different measurements of liquid in identi of liquid each beaker would contain if the total amount in all the beakers were redistributed equally.*

Student Friendly/"I Can" statements	Resources	A
1. Identify benchmark fractions (1/2, 1/4, 1/8) 2. Collect fractional data. 3. Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). 4. Solve problems involving information presented in line plots which use fractions of a unit (1/2, 1/4, 1/8) by adding, subtracting, multiplying, and dividing fractions.	http://nlvm.usu.edu number lines fraction tiles graph paper	

• **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.

a. 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

Student Friendly/"I Can" statements	Resources	A
1. Recognize that volume is the measurement of the space inside a solid three-dimensional figure. 2. Recognize a unit cube has 1 cubic unit of volume and is used to measure volume of three-dimensional shapes.	http://nlvm.usu.edu centimeter cubes cubes of various sizes Clear three dimensional cube that can be opened to fill with centimeter cubes	

b. A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic

Student Friendly/"I Can" statements	Resources	A
1. Recognize any solid figure packed without gaps or overlaps and filled with (*n)* "unit cubes" indicates the total cubic units or volume.	http://nlvm.usu.edu centimeter cubes cubes of various sizes Clear three dimensional cube that can be opened to fill with centimeter cubes	

Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

Student Friendly/"I Can" statements	Resources	A
1. Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.	http://nlvm.usu.edu centimeter cubes cubes of various sizes Clear three dimensional cube that can be opened to fill with centimeter cubes	

Relate volume to the operations of multiplication and addition and solve real world and mathematical problems invo

a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and sh same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the ba whole-number products as volumes, e.g., to represent the associative property of multiplication.

Student Friendly/"I Can" statements	Resources	A
1. Identify a right rectangular prism. 2. Find the volume of a right rectangular prism with whole number side lengths by packing it with unit cubes.	http://nlvm.usu.edu centimeter cubes right rectangular prisms Clear three dimensional prisms that can be opened to fill with centimeter cubes	

b. Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for rectangular prisms to find volumes of right rectangular prisms wi lengths in the context of solving real world and mathematical problems.

Student Friendly/"I Can" statements	Resources	A
1. Develop volume formula for a rectangle prism by comparing volume when filled with cubes to volume by multiplying the height by the area of the base, or when multiplying the edge lengths (LxWxH).the three dimensions in any order to calculate volume (Commutative and associative properties). 2. Find the volume of a right rectangular prism by the volume formula.	http://nlvm.usu.edu centimeter cubes right rectangular prisms Clear three dimensional prisms that can be opened to fill with centimeter cubes	

c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular pr
of the non-overlapping parts, applying this technique to solve real world problems.

Student Friendly/"I Can" statements	Resources	A
1. Recognize that volume is additive in that a complex 3-d figure can be broken down into understandable three-dimensional figures. 2. Solve real world problems by decomposing a solid figure into two non-overlapping right rectangular prisms and adding their volumes.	http://nlvm.usu.edu centimeter cubes right rectangular prisms Clear three dimensional prisms that can be opened to fill with centimeter cubes	

Geometry

• 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 line
coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its
that the first number indicates how far to travel from the origin in the direction of one axis, and the second number
the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond
coordinate, *y*-axis and *y*-coordinate).

Student Friendly/"I Can" statements	Resources	A
1. Define the coordinate system, perpendicular, coordinates 2. Identify the x- and y-axis 3. Locate the origin on the coordinate system 4. Identify coordinates of a point on a coordinate system 5. Recognize and describe the connection between the ordered pair and the x- and y-axis (from the origin)	http://nlvm.usu.edu coordinate graphs	

Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, a
values of points in the context of the situation.

Student Friendly/"I Can" statements	Resources	A
1. Graph points in the first quadrant 2. Represent real world and mathematical problems by graphing points in the first quadrant 3. Interpret coordinate values of points in real world context and mathematical problems	Coordinate planes Directions for maps Climbing rope Learners.org	

• **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 tha *rectangles have four right angles and squares are rectangles, so all squares have four right angles.*		
Student Friendly/"I Can" statements 1. Recognize that some two-dimensional shapes can be classified into more than one category based on their attributes. 2. Describe common attributes. 3. Name categories and determine which two-dimensional shapes go into which categories.	Resources Variety of two dimensional shapes.	A
Classify two-dimensional figures in a hierarchy based on properties.		
Student Friendly/"I Can" statements 1. Recognize if a two-dimensional shape is classified into a category, that it belongs to all subcategories of that category. 2. Classify two-dimensional shape according to categories and subcategories.	Resources Variety of two dimensional shapes.	A