Grade 5 Guide to Rigor in Mathematics 2.0

In order to provide a quality mathematical education for students, instruction must be rigorous, focused, and coherent. This document provides explanations and a standards-based alignment to assist teachers in providing the first of those: a rigorous education. While this document will help teachers identify the explicit component(s) of rigor called for by each of the Louisiana Student Standards for Mathematics (LSSM), it is up to the teacher to ensure his/her instruction aligns to the expectations of the standards, allowing for the proper development of rigor in the classroom.

This rigor document is considered a "living" document as we believe that teachers and other educators will find ways to improve the document as they use it. Please send feedback to classroomsupporttoolbox@la.gov so that we may use your input when updating this guide.

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Definitions of the Components of Rigor

Rigorous teaching in mathematics does not simply mean increasing the difficulty or complexity of practice problems. Incorporating rigor into classroom instruction and student learning means exploring at a greater depth, the standards and ideas with which students are grappling. There are **three** components of rigor that will be expanded upon in this document, and each is equally important to student mastery: **Conceptual Understanding, Procedural Skill and Fluency,** and **Application**.

- **Conceptual Understanding** refers to understanding mathematical concepts, operations, and relations. It is more than knowing isolated facts and methods. Students should be able to make sense of why a mathematical idea is important and the kinds of contexts in which it is useful. It also allows students to connect prior knowledge to new ideas and concepts.
- **Procedural Skill and Fluency** is the ability to apply procedures accurately, efficiently, and flexibly. It requires speed and accuracy in calculation while giving students opportunities to practice basic skills. Students' ability to solve more complex application tasks is dependent on procedural skill and fluency.
- **Application** provides valuable context for learning and the opportunity to solve problems in a relevant and a meaningful way. It is through real-world application that students learn to select an efficient method to find a solution, determine whether the solution makes sense by reasoning, and develop critical thinking skills.

A Special Note on Procedural Skill and Fluency

While speed is definitely a component of fluency, it is not necessarily speed in producing an answer; rather, fluency can be observed by watching the speed with which a student engages with a particular problem. Furthermore, fluency does not require the most efficient strategy. The standards specify grade-level appropriate strategies or types of strategies with which students should demonstrate fluency (e.g., 1.OA.C.6 allows for students to use counting on, making ten, creating equivalent but easier or known sums, etc.). It should also be noted that teachers should expect some procedures to take longer than others (e.g., fluency with the standard algorithm for division, 6.NS.B.2, as compared to fluently adding and subtracting within 10, 1.OA.C.6).

Standards identified as targeting procedural skill and fluency do not all have an expectation of automaticity and/or rote recall. Only two standards, 2.OA.B.2 and 3.OA.C.7, have explicit expectations of students knowing facts from memory. Other standards targeting procedural skill and fluency do not require students to reach automaticity. For example, in 4.G.A.2, students do not need to reach automaticity in classifying two-dimensional figures.

Recognizing the Components of Rigor

In the LSSM each standard is aligned to one or more components of rigor, meaning that each standard aims to promote student growth in conceptual understanding, procedural skill and fluency, and/or application. Key words and phrases in the standards indicate which component(s) of rigor the standard is targeting: conceptual understanding standards often use terms like *understand*, *recognize*, or *interpret*; procedural skill and fluency standards tend to use words like *fluently*, *find*, or *solve*; and application standards typically use phrases like *word problems* or *real-world problems*. Key words and phrases are underlined in each standard to help clarify the identified component(s) of rigor for each standard.

Focus in the Standards

Not all content in a given grade is emphasized equally in the standards. Some clusters require greater emphasis than others based on the depth of the ideas, the time that they take to master, and/or their importance to future mathematics or the demands of college and career readiness. More time in these areas is also necessary for students to meet the Louisiana Standards for Mathematical Practice. To say that some things have greater emphasis is not to say that anything in the standards can safely be neglected in instruction. Neglecting material will leave gaps in student skill and understanding and may leave students unprepared for the challenges of a later grade. Students should spend the large majority of their time on the major work of the grade ( ). Supporting work ( ) and, where appropriate, additional work ( ) can engage students in the major work of the grade.

5^{th} Grade

LSSM – 5^{th} Grade		Explicit Component(s) of Rigor		
Code	Standard	Conceptual Understanding	Procedural Skill and Fluency	Application
5.OA.A.1	Use parentheses or brackets in numerical expressions, and evaluate expressions with these symbols.	✔	✔	
5.OA.A.2	Write simple expressions that record calculations with whole numbers, fractions and decimals, and interpret numerical expressions without evaluating them. *For example, express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18,932 + 9.21) is three times as large as 18,932 + 9.21, without having to calculate the indicated sum or product.*	✔		
5.OA.B.3	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.*	✔	✔	
5.NBT.A.1	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.	✔		
5.NBT.A.2	Explain and apply patterns in the number of zeros of the product when multiplying a number by powers of 10. Explain and apply patterns in the values of the digits in the product or the quotient, when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10. *For example, $10^0 = 1$, $10^1 = 10$ ... and $2.1 \times 10^2 = 210$.*	✔	✔	
5.NBT.A.3	Read, write, and compare decimals to thousandths.	✔	✔	
5.NBT.A.3a	Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2 × (1/1000).	✔	✔	
5.NBT.A.3b	Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.	✔		
5.NBT.A.4	Use place value understanding to round decimals to any place.	✔	✔	
5.NBT.B.5	Fluently multiply multi-digit whole numbers using the standard algorithm.		✔	
5.NBT.B.6	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, subtracting multiples of the divisor, and/or the relationship between multiplication and division. Illustrate and/or explain the calculation by using equations, rectangular arrays, area models, or other strategies based on place value.	✔	✔	

LSSM – 5th Grade		Explicit Component(s) of Rigor		
Code	Standard	Conceptual Understanding	Procedural Skill and Fluency	Application
5.NBT.B.7	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; justify the reasoning used with a written explanation.	✔	✔	
5.NF.A.1	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, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)*	✔	✔	
5.NF.A.2	Solve word problems involving addition and subtraction of fractions.			✔
5.NF.A.2a	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.			✔
5.NF.A.2b	Use benchmark fractions and number sense of fractions to estimate mentally and justify the reasonableness of answers. *For example, recognize an incorrect result 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.*	✔		
5.NF.B.3	Interpret a fraction as division of the numerator by the denominator (*a*/*b* = *a* ÷ *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?*	✔		✔
5.NF.B.4	Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.	✔	✔	
5.NF.B.4a	Interpret the product (*m*/*n*) x *q* as *m* parts of a partition of *q* into *n* equal parts; equivalently, as the result of a sequence of operations, *m* x *q* ÷ *n*. *For example, use a visual fraction model to show understanding, and create a story context for (m/n) x q.*	✔		
5.NF.B.4b	Construct a model to develop understanding of the concept of multiplying two fractions and create a story context for the equation. [In general, (*m*/*n*) x (*c*/*d*) = (*mc*)/(*nd*).]	✔		
5.NF.B.4c	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.	✔	✔	
5.NF.B.4d	Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.	✔	✔	

LSSM – 5th Grade		Explicit Component(s) of Rigor		
Code	Standard	Conceptual Understanding	Procedural Skill and Fluency	Application
5.NF.B.5	Interpret multiplication as scaling (resizing)	✔		
5.NF.B.5a	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.	✔		
5.NF.B.5b	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).	✔		
5.NF.B.5c	Explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number.	✔		
5.NF.B.5d	Relating the principle of fraction equivalence $a/b = (n \times a)/(n \times b)$ to the effect of multiplying a/b by 1.	✔		
5.NF.B.6	Solve real-world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.			✔
5.NF.B.7	Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.	✔	✔	
5.NF.B.7a	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) ÷ 4, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that (1/3) ÷ 4 = 1/12 because (1/12) × 4 = 1/3.*	✔	✔	
5.NF.B.7b	Interpret division of a whole number by a unit fraction, and compute such quotients. *For example, create a story context for 4 ÷ (1/5), and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that 4 ÷ (1/5) = 20 because 20 × (1/5) = 4.*	✔	✔	
5.NF.B.7c	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?*			✔
5.MD.A.1	Convert among different-sized standard measurement units within a given measurement and use these conversions in solving multi-step, real-world problems (e.g., convert 5 cm to 0.05 m; 9 ft to 108 in).		✔	✔
5.MD.B.2	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.*		✔	✔
5.MD.C.3	Recognize volume as an attribute of solid figures and understand concepts of volume measurement.	✔		
5.MD.C.3a	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.	✔		
5.MD.C.3b	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.	✔		

LSSM – 5th Grade		Explicit Component(s) of Rigor		
Code	Standard	Conceptual Understanding	Procedural Skill and Fluency	Application
5.MD.C.4	Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.		✔	
5.MD.C.5	Relate volume to the operations of multiplication and addition and solve real-world and mathematical problems involving volume.	✔	✔	✔
5.MD.C.5a	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.	✔	✔	
5.MD.C.5b	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.		✔	✔
5.MD.C.5c	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.	✔	✔	✔
5.G.A.1	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 in the ordered pair indicates how far to travel from the origin in the direction of one axis, and the second number in the ordered pair 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).	✔		
5.G.A.2	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.	✔	✔	
5.G.B.3	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.*	✔		
5.G.B.4	Classify quadrilaterals in a hierarchy based on properties. (Students will define a trapezoid as a quadrilateral with at least one pair of parallel sides.)		✔	