



Grade 6 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 LouisianaStandards@la.gov so that we may use your input when updating this guide.

Posted August 2, 2017



Table of Contents

Introduction

Definitions of the Components of Rigor	2
A Special Note on Procedural Skill and Fluency	2
Recognizing the Components of Rigor	3
Focus in the standards	3

Grade 6 LSSM Rigor Alignments	4
---	---

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.

6th Grade

LSSM – 6 th Grade		Explicit Component(s) of Rigor		
Code	Standard	Conceptual Understanding	Procedural Skill and Fluency	Application
6.RP.A.1	<u>Understand</u> the concept of a ratio and use <u>ratio language</u> to describe a ratio relationship between two quantities. <i>For example, "The ratio of wings to beaks in the bird house at the zoo was 2:1, because for every 2 wings there was 1 beak." "For every vote candidate A received, candidate C received nearly three votes."</i>	✓		
6.RP.A.2	<u>Understand</u> the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and <u>use rate language</u> in the context of a ratio relationship. <i>For example, "This recipe has a ratio of 3 cups of flour to 4 cups of sugar, so there is $3/4$ cup of flour for each cup of sugar." "We paid \$75 for 15 hamburgers, which is a rate of \$5 per hamburger."</i>	✓		
6.RP.A.3	Use ratio and rate reasoning to solve <u>real-world and mathematical problems</u> , e.g., by reasoning about tables of equivalent ratios, <u>tape diagrams</u> , <u>double number line diagrams</u> , or equations.		✓	✓
6.RP.A.3a	<u>Make</u> tables of equivalent ratios relating quantities with whole-number measurements, <u>find</u> missing values in the tables, and <u>plot</u> the pairs of values on the coordinate plane. Use tables to <u>compare</u> ratios.	✓	✓	
6.RP.A.3b	<u>Solve unit rate problems</u> including those involving unit pricing and constant speed. <i>For example, if it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what unit rate were lawns being mowed?</i>			✓
6.RP.A.3c	<u>Find</u> a percent of a quantity as a rate per 100 (e.g., 30% of a quantity means $30/100$ times the quantity); <u>solve problems</u> involving finding the whole, given a part and the percent.		✓	✓
6.RP.A.3d	Use ratio reasoning to <u>convert</u> measurement units; <u>manipulate and transform</u> units appropriately when multiplying or dividing quantities.	✓	✓	
6.NS.A.1	<u>Interpret and compute</u> quotients of fractions, and solve <u>word problems</u> involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. <i>For example, create a story context for $(2/3) \div (3/4)$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $(2/3) \div (3/4) = 8/9$ because $3/4$ of $8/9$ is $2/3$. (In general, $(a/b) \div (c/d) = ad/bc$.) How much chocolate will each person get if 3 people share $1/2$ lb of chocolate equally? How many $3/4$-cup servings are in $2/3$ of a cup of yogurt? How wide is a rectangular strip of land with length $3/4$ mi and area $1/2$ square mi?.</i>	✓	✓	✓
6.NS.B.2	<u>Fluently</u> divide multi-digit numbers <u>using the standard algorithm</u> .		✓	
6.NS.B.3	<u>Fluently</u> add, subtract, multiply, and divide multi-digit decimals <u>using the standard algorithm</u> for each operation.		✓	
6.NS.B.4	<u>Find</u> the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to <u>express</u> a sum of two whole numbers 1-100 with a common factor as a multiple of a sum of two whole numbers with no common factor. <i>For example, express $36 + 8$ as $4(9 + 2)$.</i>		✓	

LSSM – 6 th Grade		Explicit Component(s) of Rigor		
Code	Standard	Conceptual Understanding	Procedural Skill and Fluency	Application
6.NS.C.5	<u>Understand</u> that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to <u>represent</u> quantities in real-world contexts, <u>explaining</u> the meaning of 0 in each situation.	✓		
6.NS.C.6	<u>Understand</u> a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to <u>represent</u> points on the line and in the plane with negative number coordinates.	✓		
6.NS.C.6a	<u>Recognize</u> opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; <u>recognize</u> that the opposite of the opposite of a number is the number itself, e.g., $-(-3) = 3$, and that 0 is its own opposite.	✓		
6.NS.C.6b	<u>Understand</u> signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; <u>recognize</u> that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.	✓		
6.NS.C.6c	<u>Find and position</u> integers and other rational numbers on a horizontal or vertical number line diagram; <u>find and position</u> pairs of integers and other rational numbers on a coordinate plane.	✓	✓	
6.NS.C.7	<u>Understand</u> ordering and absolute value of rational numbers.	✓		
6.NS.C.7a	<u>Interpret</u> statements of inequality as statements about the relative position of two numbers on a number line diagram. <i>For example, interpret $-3 > -7$ as a statement that -3 is located to the right of -7 on a number line oriented from left to right.</i>	✓		
6.NS.C.7b	<u>Write, interpret, and explain</u> statements of order for rational numbers in real-world contexts. <i>For example, write $-3^{\circ}\text{C} > -7^{\circ}\text{C}$ to express the fact that -3°C is warmer than -7°C.</i>	✓		
6.NS.C.7c	<u>Understand</u> the absolute value of a rational number as its distance from 0 on the number line; <u>interpret</u> absolute value as magnitude for a positive or negative quantity in a real-world situation. <i>For example, for an account balance of -30 dollars, write $-30 = 30$ to describe the size of the debt in dollars.</i>	✓		
6.NS.C.7d	<u>Distinguish</u> comparisons of absolute value from statements about order. <i>For example, recognize that an account balance less than -30 dollars represents a debt greater than 30 dollars.</i>	✓		
6.NS.C.8	Solve <u>real-world and mathematical problems</u> by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.		✓	✓
6.EE.A.1	<u>Write and evaluate</u> numerical expressions involving whole-number exponents.	✓	✓	
6.EE.A.2	<u>Write, read, and evaluate</u> expressions in which letters stand for numbers.	✓	✓	
6.EE.A.2a	<u>Write</u> expressions that record operations with numbers and with letters standing for numbers. <i>For example, express the calculation "Subtract y from 5" as $5 - y$.</i>	✓		

LSSM – 6 th Grade		Explicit Component(s) of Rigor		
Code	Standard	Conceptual Understanding	Procedural Skill and Fluency	Application
6.EE.A.2b	Identify parts of an expression using mathematical terms (sum, term, product, factor, quotient, coefficient); <u>view</u> one or more parts of an expression as a single entity. For example, describe the expression $2(8 + 7)$ as a product of two factors; view $(8 + 7)$ as both a single entity and a sum of two terms.	✓	✓	
6.EE.A.2c	<u>Evaluate</u> expressions at specific values of their variables. Include expressions that arise from formulas used in real-world problems. <u>Perform</u> arithmetic operations, including those involving whole-number exponents, in the conventional order when there are no parentheses to specify a particular order (Order of Operations). For example, use the formulas $V = s^3$ and $A = 6s^2$ to find the volume and surface area of a cube with sides of length $s = 1/2$.		✓	
6.EE.A.3	<u>Apply</u> the properties of operations to <u>generate</u> equivalent expressions. For example, apply the distributive property to the expression $3(2 + x)$ to produce the equivalent expression $6 + 3x$; apply the distributive property to the expression $24x + 18y$ to produce the equivalent expression $6(4x + 3y)$; apply properties of operations to $y + y + y$ to produce the equivalent expression $3y$.	✓	✓	
6.EE.A.4	<u>Identify</u> when two expressions are equivalent (i.e., when the two expressions name the same number regardless of which value is substituted into them). For example, the expressions $y + y + y$ and $3y$ are equivalent because they name the same number regardless of which number y stands for.	✓		
6.EE.B.5	<u>Understand</u> solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? <u>Use substitution</u> to determine whether a given number in a specified set makes an equation or inequality true.	✓	✓	
6.EE.B.6	Use variables to represent numbers and write expressions when solving a <u>real-world or mathematical problem</u> ; <u>understand</u> that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.	✓	✓	✓
6.EE.B.7	Solve <u>real-world and mathematical problems</u> by writing and solving equations and inequalities of the form $x + p = q$ and $px = q$ for cases in which p , q and x are all nonnegative rational numbers. Inequalities will include $<$, $>$, \leq , and \geq .		✓	✓
6.EE.B.8	<u>Write</u> an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. <u>Recognize</u> that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; <u>represent</u> solutions of such inequalities on number line diagrams.	✓	✓	
6.EE.C.9	<u>Use variables</u> to represent two quantities in a real-world problem that change in relationship to one another; <u>write</u> an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. <u>Analyze</u> the relationship between the dependent and independent variables using graphs and tables, and <u>relate</u> these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and write the equation $d = 65t$ to represent the relationship between distance and time.	✓	✓	
6.G.A.1	Find the area of right triangles, other triangles, special quadrilaterals, and polygons <u>by composing</u> into rectangles or <u>decomposing</u> into triangles and other shapes; apply these techniques in the context of solving <u>real-world and mathematical problems</u> .	✓	✓	✓

LSSM – 6 th Grade		Explicit Component(s) of Rigor		
Code	Standard	Conceptual Understanding	Procedural Skill and Fluency	Application
6.G.A.2	Find the volume of a right rectangular prism with fractional edge lengths <u>by packing</u> it with unit cubes of the appropriate unit fraction edge lengths, and <u>show</u> that the volume is the same as would be found by multiplying the edge lengths of the prism. Apply the formulas $V = lwh$ and $V = bh$ to find volumes of right rectangular prisms with fractional edge lengths in the context of solving <u>real-world and mathematical problems</u> .	✓	✓	✓
6.G.A.3	<u>Draw</u> polygons in the coordinate plane given coordinates for the vertices; <u>use coordinates</u> to <u>find</u> the length of a side joining points with the same first coordinate or the same second coordinate. Apply these techniques in the context of solving <u>real-world and mathematical problems</u> .	✓	✓	✓
6.G.A.4	<u>Represent</u> three-dimensional figures using nets made up of rectangles and triangles, and <u>use the nets</u> to <u>find</u> the surface area of these figures. Apply these techniques in the context of solving <u>real-world and mathematical problems</u> .	✓	✓	✓
6.SP.A.1	<u>Recognize</u> a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers. <i>For example, "How old am I?" is not a statistical question, but "How old are the students in my school?" is a statistical question because one anticipates variability in students' ages.</i>	✓		
6.SP.A.2	<u>Understand</u> that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.	✓		
6.SP.A.3	<u>Recognize</u> that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.	✓		
6.SP.B.4	<u>Display</u> numerical data in plots on a number line, including dot plots, histograms, and box plots.		✓	
6.SP.B.5	<u>Summarize</u> numerical data sets in relation to their context, such as by:	✓	✓	
6.SP.B.5a	<u>Reporting</u> the number of observations.	✓		
6.SP.B.5b	<u>Describing</u> the nature of the attribute under investigation, including how it was measured and its units of measurement.	✓		
6.SP.B.5c	<u>Giving</u> quantitative measures of center (median and/or mean) and variability (interquartile range), as well as <u>describing</u> any overall pattern and any striking deviations from the overall pattern with reference to the context in which the data were gathered.	✓	✓	
6.SP.B.5d	<u>Relating</u> the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.	✓		