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Mathematics: Grade 6

Introduction

In the years prior to grade six, instruction will have included: (1) developing fluency with addition and subtraction of fractions, and developing understanding of the multiplication of fractions and of division of 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 (3) developing understanding of volume. Sixth graders continue their previous understanding of the meaning of fractions, the meaning of multiplication and division, and the relationship between multiplication and division to explain why the procedures for dividing fractions make sense. Students use visual models and equations to divide fractions to solve word problems. Students work with the system of rational numbers, including negative rational numbers focusing on the order and absolute value of numbers and location of points in all four quadrants of the coordinate plane. Students write and evaluate expressions and use expressions and formulas to solve problems. Students also solve simple one-step equations. Students build on their understanding of area in Grade 5 to deepen their understanding of volume and develop the concept of surface area. Students learn how to write statistical questions to survey and collect data. They discover that different ways to measure center produce different values and develop the understanding of how each measure can change how the data gets interpreted.

Critical Areas of Instruction for Sixth Grade

Critical Area 1: Connecting ratio and rate to whole number multiplication and division and using concepts of ratio and rate to solve problems. Students use reasoning about multiplication and division to solve ratio and rate problems about quantities. By viewing equivalent ratios and rates as deriving from, and extending, pairs of rows (or columns) in the multiplication table, and by analyzing simple drawings that indicate the relative size of quantities, students connect their understanding of multiplication and division with ratios and rates. Thus students expand the scope of problems for which they can use multiplication and division to solve problems, and they connect ratios and fractions. Students solve a wide variety of problems involving ratios and rates.
Critical Area 2: Completing understanding of division of fractions and extending the notion of number to the system of rational numbers, which includes negative numbers. Students use the meaning of fractions, the meanings of multiplication and division, and the relationship between multiplication and division to understand and explain why the procedures for dividing fractions make sense. Students use these operations to solve problems. Students extend their previous understandings of number and the ordering of numbers to the full system of rational numbers, which includes negative rational numbers, and in particular negative integers. They reason about the order and absolute value of rational numbers and about the location of points in all four quadrants of the coordinate plane.
Critical Area 3: Writing, interpreting, and using expressions and equations. Students understand the use of variables in mathematical expressions. They write expressions and equations that correspond to given situations, evaluate expressions, and use expressions and formulas to solve problems. Students understand that expressions in different forms can be equivalent, and they use the properties of operations to rewrite expressions in equivalent forms. Students know that the solutions of an equation are the values of the variables that make the equation true. Students use properties of operations and the idea of maintaining the equality of both sides of an equation to solve simple one-step equations. Students construct and analyze tables, such as tables of quantities that are in equivalent ratios, and they use equations (such as 3x = y) to describe relationships between quantities.
Critical Area 4: Developing understanding of statistical thinking. Building on and reinforcing their understanding of number, students begin to develop their ability to think statistically. Students recognize that a data distribution may not have a definite center and that different ways to measure center yield different values. The median measures center in the sense that it is roughly the middle value. The mean measures center in the sense that it is the value that each data point would take on if the total of the data values were redistributed equally, and also in the sense that it is a balance point. Students recognize that a measure of variability (interquartile range or mean absolute deviation) can also be useful for summarizing data because two very different sets of data can have the same mean and median yet be distinguished by their variability. Students learn to describe and summarize numerical data sets, identifying clusters, peaks, gaps, and symmetry, considering the context in which the data were collected. Students in grade 6 also build on their work with area in elementary school by reasoning about relationships among shapes to determine area, surface area, and volume. They find areas of right triangles, other triangles, and special quadrilaterals by decomposing these shapes, rearranging or removing pieces, and relating the shapes to rectangles. Using these methods, students discuss, develop, and justify formulas for areas of triangles and parallelograms. Students find areas of polygons and surface areas of prisms and pyramids by decomposing them into pieces whose area they can determine. They reason about right rectangular prisms with fractional side lengths to extend formulas for the volume of a right rectangular prism to fractional side lengths. They prepare for work on scale drawings and constructions in grade 7 by drawing polygons in the coordinate plane.

Please reference the California Mathematics Framework for elaboration on the standards, critical areas, major and supporting clusters, and instructional practices.

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Connecting Standards for Mathematical Practice and Content

The Standards for Mathematical Practice apply throughout each course and, together with the content standards, prescribe that students experience mathematics as a coherent, useful, and logical subject that makes use of their ability to make sense of problem situations. The standards for Mathematical Practice (MP) represent a picture of what it looks like for students to ***do*** mathematics, and to the extent possible, content instruction should include attention to appropriate practice standards. There are ample opportunities for students to engage in each practice in Sixth Grade; the table below offers some general examples of each practice in Grade 6.

Standards for Mathematical Practice	**Example:**
MP1. *Make sense of problems and persevere in solving them.*	In grade six, students solve real-world problems through the application of algebraic and geometric concepts. These problems involve ratio, rate, area, and statistics. 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 questions such as these: "What is the most efficient way to solve the problem?" "Does this make sense?" "Can I solve the problem in a different way?" Students can explain the relationships between equations, verbal descriptions, and tables and graphs. Mathematically proficient students check their answers to problems using a different method.
MP2. *Reason abstractly and quantitatively.*	Students represent a wide variety of real world contexts through the use of rational numbers and variables in mathematical expressions, equations, and inequalities. Student contextualize to understand the meaning of number or variable as related to the problem and decontextualize to operate with symbolic representations by applying properties of operations or other meaningful moves. Teachers might ask, "How do you know" or "What is the relationship of the quantities?" to reinforce students' reasoning and understanding.
MP3. *Construct viable arguments and critique the reasoning of others.*	Students construct arguments using verbal or written explanations accompanied by expressions, equations inequalities, models, and graphs, tables, and other data displays (e.g., box plots, dot plots, histograms). They further refine their mathematical communication skills through mathematical discussions in which they critically evaluate their own thinking and the thinking of others students. They pose questions like "How did you get that?", "Why is that true?" and "Does that always work?" They explain their thinking to others and respond to others' thinking.
MP4. *Model with mathematics*	In grade six, students model problem situations symbolically, graphically, in tables, contextually, and with drawing of quantities as needed. Students form expressions, equations, or inequalities from real world contexts and connect symbolic and graphical representations. Students begin to explore covariance and represent inequalities. They use measure of center and variability and data displays (e.g., box plots and histograms) to draw inferences about and make comparisons between data sets. Students need many opportunities to connect and explain the connections between the different representations. They should be able to use any of these representations as appropriate to a problem context. Students should be encouraged to answer questions, such as "What are some ways to represent the quantities?" or "What formula might apply in this situation?"

Standards for Mathematical Practice	Example:
MP5. *Use appropriate tools strategically.*	Students consider the available tools, (including estimation and technology) when solving a mathematical problem. For instance, students in grade six may decide to represent figures on the coordinate plane to calculate area. Number lines are used to create dot plots, histograms, and box plots to visually compare the center and variability of the data. Visual fraction models can be used to represent division of fraction situations. Additionally, students might use physical objects and applets to construct nets and calculate the surface area of three-dimensional figures. Students should be encouraged to answer questions such as, "What approach are you considering trying first?" or "Why was it helpful to use…?"
MP6. *Attend to precision.*	Students 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 rates, ratios, geometric figures, data displays, and components of expressions, equations, or inequalities. When using ratio reasoning in solving problems, students are careful about specifying units of measure and labeling axes to clarify the correspondence with quantities in a problem. Students also learn to determine an appropriate degree of precision when working with rational numbers in a situational problem. Teachers might ask "What mathematical language definitions, properties… can you use to explain…?"
MP7. *Look for and make use of structure.*	Students routinely seek patterns or structures to model and solve problems. For instance, students recognize patterns that exist in ratio tables recognizing both the additive and multiplicative properties. Students apply properties to generate equivalent expressions (e.g., 6 + 3x = 3(2 + x) by distributive property) and solve equations (e.g., 2c + 3 =15, 2c = 12 by subtraction property of equality, c = 6 division property of equality). Students compose and decompose two- and three-dimensional figures to solve real world problems involving area and volume. Teachers might ask, "What do you notice when…?" or "What parts of the problem might you estimate, simplify…?"
MP8. *Look for and express regularity in repeating reasoning.*	In grade six, students use repeated reasoning to understand algorithms and make generalizations about patterns. During opportunities to solve and model problems designed to support generalizing, the notice that $\frac{a}{b} \div \frac{c}{d} = \frac{ab}{cd}$ and construct other examples and models that confirm their generalization. Students connect place value and their prior work with operations to understand algorithms to fluently divide multi-digit numbers and perform all operations with multi-digit decimals. Students informally begin to make connections between covariance, rates, and representations showing the relationships between quantities. Students should be able to answer questions, such as "How would we prove that…?" or "How is this situation like and different from other situations?"

Adapted CA Mathematics Framework 2015.

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Sixth Grade Content Emphasis by Cluster (PARCC/SBAC)

Not all of the 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 they take to master, and/or their importance to future mathematics or the demands of college and career readiness. In addition, an intense focus on the most critical material at each grade allows depth in learning, which is carried out through the 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 materials will leave gaps in student skill and understandings and may leave students unprepared for the challenges of a later grade. The following table identifies the Major Clusters, Additional Clusters, and Supporting Clusters for this grade. Also, Achieve the Core's Coherence Map supports within and across grade level coherence.

Major Clusters (70%) Area of intensive focus where students need fluent understanding and application of the core.	**Supporting Clusters (20%)** Rethinking and linking areas where some material is being covered, but in a way that applies core understanding.	**Additional Clusters (10%)** Expose students to other subjects, though at a distinct level of depth and intensity.
Ratios and Proportional Relationships • Understand ratio concepts and use ration reasoning to solve problems. **The Number System** • Apply and extend previous understandings of numbers to the system of rational numbers. • Apply and extend previous understandings of multiplication and division to divide fractions by fractions. **Expressions and Equations** • Apply and extend previous understandings of arithmetic to algebraic expressions. • Reason about and solve one-variable equations and inequalities. • Represent and analyze quantitative relationships between dependent and independent variables.	**Geometry** • Solve real-world and mathematical problems involving area, surface area, and volume.[7]	**Statistics and Probability** • Develop understanding of statistical variability. • Summarize and describe distributions.

[7] In this cluster, students work on problems with areas of triangles and volumes of right rectangular prisms, which connects to work in Expressions and Equations domain. In addition, another standard within this cluster asks students to draw polygons in the coordinate plane in the Number System domain.

Depth Opportunities: 6.RP.3; 6.NS.1, 6.NS.8; 6.EE.3, 6.EE.7

6th Grade Required Fluency -

- 6.NS.2. Multi-digit division
- 6.NS.3 Multi-digit decimal operations

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SIXTH GRADE SCOPE AND SEQUENCE ~ YEAR AT A GLANCE				
Quarter	**Q1**	**Q2**	**Q3**	**Q4**
Big Ideas	**Exploring the Number System**	**Ratios, Rates and Expressions**	**Equations and Geometry**	**Statistics**
Domains	• The Number System	• The Number System • Ratios & Proportional Relationships	• Expressions and Equations • Geometry	• Geometry • Statistics and Probability
Concepts **Focus Standards**	Whole Numbers and Decimal (Ch. 1) 6.NS.2*, 6.NS.3*, 6.NS.4 Fractions (Ch. 2) 6.NS.1*, 6.NS.4, 6.NS.6c Rational Numbers (Ch. 3 – **First 4 Lessons**) 6.NS.5*, 6.NS.6a*, 6.NS.6c, 6.NS.7a, 6.NS.7b	Rational Numbers (Ch. 3 – **Last 6 Lessons**) 6.NS.6b, 6.NS.6c, 6.NS.7c, 6.NS.7d, 6.NS.8 Ratios, Rates and Percents (Ch. 4 & 5) 6.RP.1, 6.RP.2, 6.RP.3a*, 6.RP.3b*, 6.RP.3c* Units of Measurement (Ch. 6) 6.RP.3d*	Algebra: Expression (Ch. 7) 6.EE.1, 6.EE.2a, 6.EE.2b, 6.EE.2c, 6.EE.3, 6.EE.4, 6.EE.6 Algebra: Equations & Inequalities and Relationships between Variables (Ch. 8 & 9) 6.EE.5, 6.EE.7, 6.EE.8, 6.EE.9 Area (Ch. 10) 6.G.1, 6.G.3 **Embed:** 6.NS.3* **Supports:** 6.EE.1 & 6.EE.2c*	Surface Area and Volume (Ch.11) 6.G.2, 6.G.4 Data Displays and Measures of Center (Ch. 12) 6.SP.1, 6.SP.4, 6.SP.5a, 6.SP.5b, 6.SP.5c, 6.SP.5d Variability and Data Distributions (Ch. 13) 6.SP.2, 6.SP.3, 6.SP.4, 6.SP.5c, 6.SP.5d **Embed:** 6.NS.2*& 6.NS.3* **Supports:** 6.EE.1 & 6.EE.2c* Getting Ready for 7th Grade
Standards Assessed on Interim	**All Q1 Standards Listed Above Are Assessed On Interim 1**	**All Q2 Standards Listed Above Are Assessed On Interim 2 Along with Recursive Standards:** 6.NS.2*, 6.NS.3*, 6.NS.1*,6.NS.5*, 6.NS.6a*		
Additional HMH Tools & Resources	Found in Quarter 1 Planner	Found in Quarter 2 Planner	Found in Quarter 3 Planner	Found in Quarter 4 Planner
Common Assignment – HMH Performance Task	HMH Performance Task **Math Carnival** Critical Area – The Number System (6.NS.2, 6.NS.4, 6.NS.5, 6.NS.7)	HMH Performance Task **Trip to Mexico** Critical Area – Ratio & Proportional Reasoning (6.RP.1, 6.RP.2, 6.RP.3, 6.RP.3c, 6.RP.3d)	HMH Performance Task **Cooperstown Bound** Critical Area – Expressions & Equations (6.EE.2, 6.EE.3, 6.EE.6, 6.EE.7, 6.EE.9)	HMH Performance Task **A Home for Amigo** Critical Area – Geometry (6.G.1, 6.G.2, 6.G.3, 6.G.4)

Key: Standards in Major Clusters | Standards in Supporting Clusters | Standards in Additional Clusters

*** Denotes a recursive standard**

Text Boxes provide suggestions for connections to build coherence across standards and further support the major clusters.