Examples of Key Advances from Grade 5 to Grade 6

- Students' prior understanding of and skill with multiplication, division, and fractions contribute to their study of ratios, proportional relationships and unit rates (6.RP).

- Students begin using properties of operations systematically to work with variables, variable expressions, and equations (6.EE).

- Students extend their work with the system of rational numbers to include using positive and negative numbers to describe quantities (6.NS.C.5), extending the number line and coordinate plane to represent rational numbers and ordered pairs (6.NS.C.6), and understanding ordering and absolute value of rational numbers (6.NS.C.7).

- Having worked with measurement data in previous grades, students begin to develop notions of statistical variability, summarizing and describing distributions (6.SP).

Fluency Expectations or Examples of Culminating Standards

6.NS.B.2   Students fluently divide multidigit numbers using the standard algorithm. This is the culminating standard for several years' worth of work with division of whole numbers.

6.NS.B.3   Students fluently add, subtract, multiply, and divide multidigit decimals using the standard algorithm for each operation. This is the culminating standard for several years' worth of work relating to the domains of Number and Operations in Base Ten, Operations and Algebraic Thinking, and Number and Operations — Fractions.

6.NS.A.1   Students interpret and compute quotients of fractions and solve word problems involving division of fractions by fractions. This completes the extension of operations to fractions.

Examples of Major Within-Grade Dependencies

- Equations of the form $px = q$ (6.EE.B.7) are unknown-factor problems; the solution will sometimes be the quotient of a fraction by a fraction (6.NS.A.1).

- Solving problems by writing and solving equations (6.EE.B.7) involves not only an appreciation of how variables are used (6.EE.B.6) and what it means to solve an equation (6.EE.B.5) but also some ability to write, read, and evaluate expressions in which letters stand for numbers (6.EE.A.2).

- Students must be able to place rational numbers on a number line (6.NS.C.7) before they can place ordered pairs of rational numbers on a coordinate plane (6.NS.C.8). The former standard about ordering rational numbers is much more fundamental.

Examples of Opportunities for Connections among Standards, Clusters or Domains

- Students' work with ratios and proportional relationships (6.RP) can be combined with their work in representing quantitative relationships between dependent and independent variables (6.EE.C.9).

- Plotting rational numbers in the coordinate plane (6.NS.C.8) is part of analyzing proportional relationships (6.RP.A.3a, 7.RP.A.2) and will become important for studying linear equations (8.EE.C.8) and graphs of functions (8.F).[15]

- Students use their skill in recognizing common factors (6.NS.B.4) to rewrite expressions (6.EE.A.3).

- Writing, reading, evaluating, and transforming variable expressions (6.EE.A.1−4) and solving equations and inequalities (6.EE.B.7–8) can be combined with use of the volume formulas $V = lwh$ and $V = Bh$ (6.G.A.2).

- Working with data sets can connect to estimation and mental computation. For example, in a situation where there are 20 different numbers that are all between 8 and 10, one might quickly estimate the sum of the numbers as $9 \times 20 = 180$.

Examples of Opportunities for In-Depth Focus

6.RP.A.3   When students work toward meeting this standard, they use a range of reasoning and representations to analyze proportional relationships.

6.NS.A.1   This is a culminating standard for extending multiplication and division to fractions.

6.NS.C.8   When students work with rational numbers in the coordinate plane to solve problems, they combine and consolidate elements from the other standards in this cluster.

6.EE.A.3   By applying properties of operations to generate equivalent expressions, students use properties of operations that they are familiar with from previous grades' work with numbers — generalizing arithmetic in the process.

6.EE.B.7   When students write equations of the form $x + p = q$ and $px = q$ to solve real-world and mathematical problems, they draw on meanings of operations that they are familiar with from previous grades' work. They also begin to learn algebraic approaches to solving problems.[16]

Examples of Opportunities for Connecting Mathematical Content and Mathematical Practices

Mathematical practices should be evident *throughout* mathematics instruction and connected to all of the content areas highlighted above, as well as all other content areas addressed at this grade level. Mathematical tasks (short, long, scaffolded, and unscaffolded) are an important opportunity to connect

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[15] While not required by the standards, it might be considered valuable to expose students to time series data and to time graphs as an appealing way to work with rational numbers in the coordinate plane (6.NS.C.8). For example, students could create time graphs of temperature measured each hour over a 24-hour period in a place where, to ensure a strong connection to rational numbers, temperature values might cross from positive to negative during the night and back to positive the next day.

[16] For example, suppose Daniel went to visit his grandmother, who gave him $5.50. Then he bought a book costing $9.20 and had $2.30 left. To find how much money he had before visiting his grandmother, an algebraic approach leads to the equation $x + 5.50 − 9.20 = 2.30$. An arithmetic approach without using variables at all would be to begin with 2.30, then add 9.20, then subtract 5.50. This yields the desired answer, but students will eventually encounter problems in which arithmetic approaches are unrealistically difficult and algebraic approaches must be used.

content and practices. Some brief examples of how the content of this grade might be connected to the practices follow.

- Reading and transforming expressions involves seeing and making use of structure (MP.7). Relating expressions to situations requires making sense of problems (MP.1) and reasoning abstractly and quantitatively (MP.2).

- The sequence of steps in the solution of an equation is a logical argument that students can construct and critique (MP.3). Such arguments require looking for and making use of structure (MP.7) and, over time, expressing regularity in repeated reasoning (MP.8).

- Thinking about the point (1, *r*) in a graph of a proportional relationship with unit rate *r* involves reasoning abstractly and quantitatively (MP.2). The graph models with mathematics (MP.4) and uses appropriate tools strategically (MP.5).

- Area, surface area, and volume present modeling opportunities (MP.4) and require students to attend to precision with the types of units involved (MP.6).

- Students think with precision (MP.6) and reason quantitatively (MP.2) when they use variables to represent numbers and write expressions and equations to solve a problem (6.EE.B.6–7).

- Working with data gives students an opportunity to use appropriate tools strategically (MP.5). For example, spreadsheets can be powerful for working with a data set with dozens or hundreds of data points.

Content Emphases by Cluster[17]

Not all of the content in a given grade is emphasized equally in the standards. Some clusters require greater emphasis than the 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. 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 material will leave gaps in student skill and understanding and may leave students unprepared for the challenges of a later grade. All standards figure in a mathematical education and will therefore be eligible for inclusion on the PARCC assessment. However, the assessments will strongly focus where the standards strongly focus.

In addition to identifying the Major, Additional, and Supporting Clusters for each grade, suggestions are given following the table on the next page for ways to connect the Supporting to the Major Clusters of the grade. Thus, rather than suggesting even inadvertently that some material not be taught, there is direct advice for teaching it, in ways that foster greater focus and coherence.

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[17] Refer to pages 13–14 for further explanation of the cluster-level emphases. Refer also to the Common Core State Standards for Mathematics for the standards that fall within each cluster.

Ratios and Proportional Relationships

■   A. Understand ratio concepts and use ratio reasoning to solve problems.

The Number System

■   A. Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

○   B. Compute fluently with multi-digit numbers and find common factors and multiples.

■   C. Apply and extend previous understandings of numbers to the system of rational numbers.

Expressions and Equations

■   A. Apply and extend previous understandings of arithmetic to algebraic expressions.

■   B. Reason about and solve one-variable equations and inequalities.

■   C. Represent and analyze quantitative relationships between dependent and independent variables.

Geometry

□   A. Solve real-world and mathematical problems involving area, surface area and volume.

Statistics and Probability

○   A. Develop understanding of statistical variability.

○   B. Summarize and describe distributions.

Examples of Linking Supporting Clusters to the Major Work of the Grade

- Solve real-world and mathematical problems involving area, surface area, and volume: In this cluster, students work on problems with areas of triangles and volumes of right rectangular prisms, which connects to work in the Expressions and Equations domain. In addition, another standard within this cluster asks students to draw polygons in the coordinate plane, which supports other work with the coordinate plane in The Number System domain.