Suggested Materials for This Domain: Provides teachers with a list of materials that will be helpful in introducing the concepts in this domain.

Domain Overview: Gives a brief description of the big ideas, allowing you to see how the mathematical ideas develop across grade levels.

Key Vocabulary: Vocabulary included in the domain with grade levels indicated. This terminology can be used for building a word wall in the classroom. Students should be able to use these terms in talking about mathematics. Standard for Mathematical Practice 6: Attend to Precision calls for students to use mathematical terminology appropriately.
Cluster: Statements that summarize groups of related standards. Note that standards from different clusters may sometimes be closely related, because mathematics is a connected subject.

Domain: General mathematical topic for this group of standards.

Identifying number for this cluster:
Grade, domain, cluster

Standards: Mathematical statements that define what students should understand and be able to do.

The Number System 6.NS.B

Cluster B

Standards for Mathematical Practice:
Although it is likely you will use a variety of Standards for Mathematical Practice in teaching each cluster, this section gives examples of how you might incorporate some of the practices into your instruction on this topic.

Each cluster begins with a brief description of the mathematics in that cluster.

Related Content Standards:
Provides a list of standards connected to this topic in other grade levels as well as standards in this grade level related to this topic that are in other domains. Consider the related standards as you plan instruction for each cluster.

Domain

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STANDARD 5 (6.NS.C.5)
Understand 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 represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

In this standard, students investigate positive and negative numbers (integers) in real-world scenarios as being opposite values or opposite directions such as 10° below zero (−10) and 10° above zero (+10). They are introduced to horizontal and vertical number lines to illustrate examples such as, “Our football team lost 7 yards on the first down.” Or, “It is freezing outside today and is 10 degrees below zero.” Or, “The bank statement for the middle school football team has a balance of $4,026. The coach bought new equipment for the team for a total of $4,400. How much money should the coach deposit into the football account in order to stop the account from being overdrawn?”

What the TEACHER does:
• Explore with multiple examples and experiences using positive and negative integers to represent real-world situations such as a bank account with credits and debits, temperature, and places above and below sea level.
• Investigate the use of both vertical and horizontal number lines to illustrate examples such as, “Our football team lost 7 yards on the first down.” Or, “It is freezing outside today and is 10 degrees below zero.” Or, “The bank statement for the middle school football team has a balance of $4,026. The coach bought new equipment for the team for a total of $4,400. How much money should the coach deposit into the football account in order to stop the account from being overdrawn?”
• Have students create their own examples to show on their number lines and explain the meaning of 0 in each situation.
• Pose questions such as, “When you look at the number line, what do you notice about the location of the negative numbers?” which will lead students to discover that all negative numbers are less than zero.

What the STUDENTS do:
• Understand that zero represents a position on the number line.
• Discover that every negative integer is less than zero.
• Understand that the meaning of zero is determined by the real-world context. For example, on a Celsius thermometer, everything below zero is negative, and everything above zero is positive.
• Represent real-world scenarios such as bank account balances, temperature, and sea level with integers.
• Use precise mathematical vocabulary to discuss positive and negative numbers.

Addressing Student Misconceptions and Common Errors:
Some sixth graders may believe the greater the magnitude of a negative number, the greater the number. To help with this misconception, continue to use examples such as the students have a horizontal number line with a depot starting at a positive number such as 15, and moving to the left means going to New York City. Ask the students which is greater, being 5 miles west or 15 miles east of New York City, a pattern of numbers getting smaller as you move left on the number line that should be established.

Notes:
Included is blank space beneath each standard for taking notes while studying the mathematical content. This might include vocabulary, materials, resources you want to use, or an explanation of the standard in your own words.

What the TEACHER does: An overview of actions the teacher might take in introducing and teaching the standard. This is not meant to be all-inclusive, but rather to give you an idea of what classroom instruction might look like. Illustrations may be included, detailing how to use materials to teach a concept when using models and representations called for in the standard.

What the STUDENTS do: Some examples of what students may do as they explore and begin to understand the standard. This is not intended to be directive, but rather to frame what student actions may look like.
Sample Planning Page: Provided is a complete sample planning page for one standard at the end of each grade level. While these are not complete lesson plans, they provide ideas, activities, and a structure for planning.

Standards for Mathematical Practice: The Mathematical Practices emphasized in this sample plan are included.

Goal: The purpose of this activity and how it connects to previous and future ideas is stated.

Planning Page: A planning template is provided at the end of each grade level.

Sample Planning Page 6.G.A

Geometry
Cluster A: Solve real-world and mathematical problems involving area, surface area, and volume.

Standard: 6.G.A.4. Represent three-dimensional figures using nets made up of rectangles and triangles, and use these to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Standards for Mathematical Practice:

SFMP 4. Model with mathematics. Students use real-world three-dimensional objects to create nets and find surface area.

SFMP 6. Attend to precision. Students use correct vocabulary to talk about the parts of the nets and describe how to find surface area. Correct units should also be used.

SFMP 8. Look for and express regularity in repeated reasoning. Students find repetition in the dimensions of the individual rectangles that make up the three-dimensional box.

Goal:

Students find surface area by using what they already know about area and composite figures using nets.

Planning:

Materials: 1 cardboard box per pair of students (cereal box, USPS mailing box, etc.), rulers, scissors

Sample Activity:

• Model cutting apart a box to find its net. Then, allow students to cut apart their own boxes to find the nets.
• Review the concept of area. As students measure and find the areas of the individual rectangles on their nets, direct them to write the areas on the respective faces on both sides of the net.
• Fold the nets back into the three-dimensional boxes and ask students to find the total outside area of their boxes. Then, introduce the term surface area.
• Discuss anything students noticed that helped them calculate the surface area. Some students may notice shapes that were repeated as well as the location of those repeated shapes.

Questions/Prompts:

• Are students able to see the composite shapes that make up the net? Ask, "What shapes make up your net?"
• Are the students using the correct units? Ask, "What units do you use to find the area?"
• Do students notice that the nets have pairs of congruent rectangles? Ask, "How do you know these are congruent?"

Differentiating Instruction:

Struggling Students:

Some students may have difficulty physically cutting a box. In this case, the teacher may need to demonstrate the activity being done. This could be done by cutting a piece of construction paper and asking students to follow along. Students may need assistance to make sure they cut along the correct parts.

Extension:

Challenge students to formalize how they calculated the surface area of their boxes into a formula that will work for all rectangular prisms.

Materials: The materials used in the Sample Activity are listed.

Sample Activity: An example of an activity that addresses this standard is provided.

Questions/Prompts: This section provides questions or prompts you may use to help build student understanding and encourage student thinking.

Differentiating Instruction: Suggestions to address the need of struggling learners along with extension ideas to challenge other students are included here.
## Table 1 Standards for Mathematical Practice

<table>
<thead>
<tr>
<th>Standard for Mathematical Practice</th>
<th>What the Teacher Does</th>
<th>What the Students Do</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Make sense of problems and persevere in solving them.</td>
<td>• Provide students with rich tasks and real-world problems that focus on and promote student understanding of an important mathematical concept. • Provide time for and facilitate the discussion of problem solutions. o What are you asked to find? o How did you solve a similar problem before? o What is your plan for solving the problem? o Can you explain how you solved the problem? o Does your answer make sense? o Did you use a different method to check your answer?</td>
<td>• Actively engage in solving problems by working to understand the information that is in the problem and the question that is asked. • Use a variety of strategies that make sense to solve the problem. • Try a different strategy if the first strategy does not work. • Ask themselves if they used the most efficient way to solve the problem. • Ask themselves if their solution makes sense. • Solve real-world problems through the application of algebraic and geometric concepts.</td>
</tr>
<tr>
<td>2. Reason abstractly and quantitatively.</td>
<td>• Provide real-world scenarios to use real numbers and variables in mathematical expressions, equations, and inequalities. • Help students decontextualize to manipulate symbolic representations by applying properties of operations. • Help students understand the meaning of the number or variable as related to a problem.</td>
<td>• Use varied strategies, models, and drawings to think about the mathematics of a task and example. • Represent a wide variety of real-world situations through the use of real numbers and variables in mathematical expressions, equations, and inequalities. • Contextualize to understand the meaning of the number or variable as related to the problem and decontextualize to manipulate symbolic representations by applying properties. • Examine patterns in data and assess the degree of linearity of functions.</td>
</tr>
<tr>
<td>3. Construct viable arguments and critique the reasoning of others.</td>
<td>• Provide tasks that encourage students to construct mathematical arguments. • Expect students to explain their strategies and mathematical thinking to others. • Expect students to listen to the reasoning of others and respond to their thinking. • Help students to compare strategies and methods by asking questions such as: o How can you prove that your answer is correct? o What do you think about ________’s strategy? o How is your method different from ________’s? How is it similar? o Why is this true? Does it always work?</td>
<td>• Explain orally or in writing how the strategy and thinking using models, drawings, concrete Representations. • Critique and analyze the thinking and the thinking of other students. • Ask questions to one another and to the teacher to clarify their understanding. • Look for connections among different ways to solve problems. • Construct arguments using verbal or written explanations for expressions, equations, inequalities, models, and graphs, tables, and other data displays.</td>
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</tbody>
</table>

## Table 2 Effective Teaching Practices

<table>
<thead>
<tr>
<th>Teaching Practice</th>
<th>Purpose</th>
<th>What the Teacher Does</th>
<th>What the Students Do</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Establish mathematics goals to focus learning.</td>
<td>• Set goals to guide Instructional decisions. • Expect students to understand the purpose of a lesson beyond simply repeating the words in the standard.</td>
<td>• Consider broad goals as well as the goals of the unit and the lesson, including: o What is to be learned? o Why is the goal important? o Where do students need to go? o How can learning be extended?</td>
<td>• Make sense of the new concepts and skills, making connections to previously learned Grades K–8 concepts. • Make sense of the mathematics in the task. • Work to make sense of the task and persevere in solving problems. • Use a variety of models and materials to make sense of the mathematics in the task. • Connect themselves and others to make sense of the answer.</td>
</tr>
<tr>
<td>2. Implement tasks that promote reasoning and problem solving.</td>
<td>• Provide opportunities for students to engage in exploration and make sense of important mathematics. • Encourage students to use procedures in ways that are connected to understanding.</td>
<td>• Choose tasks that: o are built on current student understandings o have various entry points with multiple ways for the problems to be solved, are interesting to students.</td>
<td>• Work to make sense of the task and persevere in solving problems. • Use a variety of models and materials to make sense of the mathematics in the task. • Connect themselves and others to make sense of the answer.</td>
</tr>
<tr>
<td>3. Use and connect mathematical representations.</td>
<td>• Lead students to connect conceptual understanding of procedural skills using models and representations.</td>
<td>• Use tasks that allow students to use a variety of representations. • Encourage the use of different representations, including concrete manipulatives, models, and symbolic representations that support students in explaining their thinking and reasoning.</td>
<td>• Use materials to make sense of problem situations. • Connect representations to mathematical concepts and the structure of big ideas for ratios and proportional relationships, expressions, and equations, the number system, statistics, and probability, geometry, and functions.</td>
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<tr>
<td>4. Facilitate meaningful mathematical discussions.</td>
<td>• Provide students with opportunities to share ideas, clarify their understanding, and develop convincing arguments. • Allow discussion to advance mathematical thinking for the whole class.</td>
<td>• Engage students in explaining their mathematical reasoning in small group and classroom discussions. • Facilitate dialog among students that supports sense making of a variety of strategies and approaches. • Scaffold classroom discussions so that connections between representations and mathematical ideas occurs.</td>
<td>• Explain their ideas and reasoning in small groups and with the entire class. • Listen to the reasoning of others. • Ask questions of others to make sense of their ideas.</td>
</tr>
</tbody>
</table>
CCSS Where to Focus Grade 6 Mathematics

This document shows where students and teachers should spend the large majority of their time in order to meet the expectations of the standards.

Students should spend at least 65% 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.1

MAJOR, SUPPORTING, AND ADDITIONAL CLUSTERS FOR GRADE 6

Emphasis on major work of each cluster level is reflected in the Common Core State Standards for Mathematics for the state to standardize that fall within each cluster.

Key:
- Major Clusters
- Supporting Clusters
- Additional Clusters

6.RP. A
- Understand ratio concepts and use ratio reasoning to solve problems.

6.NS. A
- Apply and extend previous understandings of multiplication and division to divide fractions by fractions.

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

6.NS. C
- Apply and extend previous understandings of numbers to the systems of rational numbers.

6.EE. A
- Apply and extend previous understandings of arithmetic to algebraic expressions.

6.EE. B
- Reason about and solve one-variable equations and inequalities.

6.EE. C
- Represent and analyze quantitative relationships between dependent and independent variables.

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

6.SP. A
- Develop understanding of statistical variability.

6.SP. B
- Summarize and describe distributions.

HIGHLIGHTS OF MAJOR WORK IN GRADES K–8

K–2 Addition and subtraction – concepts, skills, and problem solving; place value
3–5 Multiplication and division of whole numbers and fractions – concepts, skills, and problem solving
6 Ratios and proportional relationships; early expressions and equations
7 Ratios and proportional relationships; arithmetic of rational numbers
8 Linear algebra and linear functions

REQUIRED FLUENCIES FOR GRADE 6

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

Reproducibles: A variety of reproducibles can be duplicated and used by students in the classroom when working with concrete materials.

Reproducible 1. Percent Wheel

Instructions: Cut out two wheels on cardstock. Cut along the dotted line to the center of each wheel. Insert the wheels into each other through the cuts. Position the wheels back-to-back. You should be able to use the lines on each side when the wheels are together.