Maryland
STATE DEPARTMENT OF EDUCATION

Grade 6

Maryland College and Career Ready Standards for Mathematics

Companion Guide

Mathematics Branch

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Purpose and Document Structure

PURPOSE OF COMPANION GUIDE

This document is designed to support a shared understanding of what each mathematics standard means, how it connects to other content, and how it can be authentically enacted in classrooms. It does not replace your high-quality instructional materials (HQIM), but instead works alongside them so that educators have a common interpretation of the mathematical expectations we set for students. Regardless of the HQIM in use, these documents provide clarity about the essence and intentions of the standards and illustrate how those expectations can be realized through instruction.

DOCUMENT STRUCTURE

Each domain begins with a set of cluster connections to the Numeracy Development Framework (NDF). These connections identify the ways in which individual clusters either:

- **Contribute to milestones:** The cluster builds prerequisite knowledge, skills, or ways of reasoning that *support progress toward* a milestone in the NDF, even if the milestone itself is not fully realized at this stage.
- **Directly contribute to milestones:** The cluster includes content and practices that are *explicitly named within* an NDF milestone, meaning student proficiency with this cluster demonstrates attainment of that milestone.

For each standard, the companion document provides:

- **Content Progression:** A description of the content that comes before and after that standard to highlight how it fits within a coherent learning trajectory.
- **Examples and Clarifications:** Explanations and expansions of the standard language that provide additional details about its intent. These may include illustrative examples, as well as common missteps to avoid that can narrow or distort the mathematical authenticity of the standard.
- **Student Opportunities for Mathematical Experience:** Statements describing the kinds of reasoning, modeling, problem solving, and sense-making students should have the chance to engage in as part of learning the content of the standard. Where relevant, these are connected to the Standards for Mathematical Practice (SMPs). Not every SMP is explicitly called out, but all can be present in any standard depending on how instruction is designed. What is included are non-exhaustive examples. This section also includes the following features:
    - For standards that directly represent a key milestone in the NDF, a **bold** statement reminds educators that students need multiple opportunities and varied ways to demonstrate proficiency with the concept(s).
    - Opportunities to connect with financial literacy are flagged with a **$** symbol. These indicators point to natural entry points for integration, but they should not limit educators from making additional meaningful connections to financial literacy where appropriate.

Standards for Mathematical Practice

"The Standards for Mathematical Practice (SMPs) describe varieties of expertise that mathematics educators at all levels should seek to develop in their students" (Common Core State Standards Initiative). The SMPs develop along a continuum as students progress mathematically, with each grade's content providing distinct opportunities for students to engage in and demonstrate the practices at an appropriate level of sophistication.

The SMPs should be integrated with content and not taught separately. As students participate in these practices on a regular basis, they become part of the mathematically productive habits of mind that support deep understanding. Intentionally incorporating opportunities to develop the SMPs enhances instruction and enriches students' mathematical engagement. Students who learn to use these eight mathematical practices as they engage with mathematical concepts and skills have a greater chance of developing conceptual understanding (Van de Walle, et al, 2014).

The table below highlights opportunities to develop the SMPs in general across the given grade band, while the companion guides for individual standards provide more specific connections to the content of each grade. Educators should utilize this resource to assist in planning for opportunities when the SMPs can be emphasized in daily instructional practice. To facilitate the incorporation of SMPs within instruction, notations have been made in the Companion Guide to indicate when a specific SMP may be applicable for a particular standard. These examples should not limit educators from making additional meaningful connections to SMPs where appropriate.

Standard for Mathematical Practice	What does it look like for middle school students?	How can middle school teachers support this practice?
Make sense of problems and persevere in solving them (SMP 1)	Students make sense of complex problems involving proportional relationships, expressions, geometry, or data. They identify relevant information and decide how to begin (e.g., creating a ratio table, writing an equation, or producing a sketch). As they work, they monitor progress and adjust strategies (e.g., revising an equation or trying a different proportional approach). They increasingly use reasonableness checks such as estimation or order of magnitude and remain engaged even when early attempts are unsuccessful. Identity shifts toward "I can work through this if I stay with it."	Teachers introduce non-routine tasks and meaningful contexts that require students to make strategic decisions rather than follow prescribed steps. They use mid-problem reflection prompts such as, "Is this helping you move forward?" or "Does this make sense so far?" Teachers expect productive struggle and resist stepping in too quickly, and reinforce perseverance and strategic thinking over speed. They intentionally recognize persistence and thoughtful effort, and support students' developing sense of themselves as capable problem solvers.

Standard for Mathematical Practice	What does it look like for middle school students?	How can middle school teachers support this practice?
Reason abstractly and quantitatively (SMP 2)	Students analyze increasingly complex quantitative relationships (e.g., ratios, rates, expressions, variables, and change over time) and use symbolic representations to reason about those relationships. They attend to what quantities and variables represent before and after manipulation and revise their work when the results don't match what the quantities represent. Students show growing awareness that symbolic reasoning reveals relationships among quantities while remaining connected to the context or situation.	Teachers present problems that require selecting appropriate representations (e.g., equations, tables, graphs) and prompt students to clarify meaning ("What does *x* represent here?"). They emphasize that abstraction is a way to reason about quantities and relationships, and they support students in using mathematics to make sense of those relationships rather than focusing only on executing procedures or producing answers.
Construct viable arguments and critique the reasoning of others (SMP 3)	Students use definitions, properties, and logical relationships to justify why a method or conclusion is valid (e.g., "Because these ratios are equivalent…" or "The angles must add to 180°…"). They question and compare others' reasoning to clarify understanding and identify when a claim lacks justification. Revising reasoning in response to evidence or critique becomes part of improving mathematical understanding.	Teachers provide opportunities for students to present their reasoning to classmates and support conclusions using visual or symbolic evidence. They intentionally facilitate exchanges among peers to deepen collective understanding and emphasize that strong arguments are grounded in evidence and logic. Students are encouraged to refine or strengthen their reasoning in response to questions or feedback, rather than simply maintain an initial claim.

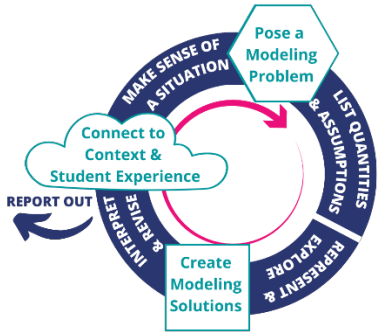
Standard for Mathematical Practice	What does it look like for middle school students?	How can middle school teachers support this practice?
Model with mathematics (SMP 4)	Students pose relational or "what if…?" questions ("What happens if the rate changes?", "When will they be equal?", "How long until…?"). They define explicit quantities (e.g., rate, unit rate, percent change, variables, or scale factor) and select representations (equations, inequalities, tables, graphs, geometric relationships) that fit the situation's structure. They analyze the model to test scenarios or examine how quantities co-vary, interpret results in context, and refine or replace the model when assumptions shift or results don't make sense. Their cycle becomes more deliberate: define relational quantities → represent → analyze → interpret → refine.	Teachers provide contexts where developing a model helps investigate a meaningful question (e.g., proportional situations, rate problems, geometric measurement, linear/nonlinear patterns). They guide students to define relevant quantities, choose representations that match the situation's structure, and justify why a selected representation is appropriate. As students test scenarios or encounter new information, teachers prompt them to revise or replace their models and discuss how changes affect interpretations. Model comparison focuses on which representation provides deeper insight into the situation, not simply on showing multiple forms.
Use appropriate tools strategically (SMP 5)	Students make deliberate choices among tools (e.g., coordinate graphs, dynamic geometry software, spreadsheets, ratio tables, algebra tiles, calculators) based on the demands of the task. They use tools to examine relationships, test ideas, or make predictions, and compare how different tools reveal different features of a situation (e.g., "The graph shows the intersection more clearly than the table"). Tool use becomes integrated into how they plan, investigate, and refine their mathematical thinking.	Teachers design tasks where multiple tools could be helpful and prompt students to articulate why one tool might be preferable ("What does the graph show that the equation doesn't?"). They guide students to evaluate efficiency, clarity, and appropriateness of tools, and they model how powerful digital tools (e.g., spreadsheets, graphing technology) support exploration, visualization, and insight.

Standard for Mathematical Practice	What does it look like for middle school students?	How can middle school teachers support this practice?
Attend to precision (SMP 6)	Students use precise mathematical language (e.g., ratio, rate, variable, expression, mean, median, distribution), notation, symbols, and units appropriate to the situation. They specify and interpret quantities within equations, graphs, and data displays, and they check for accuracy and consistency. Students recognize when imprecision (e.g., unclear labels, inconsistent notation, or incorrect vocabulary) leads to misunderstanding or errors, and they revise accordingly.	Teachers model accurate vocabulary, notation, and units, particularly when variables, proportional reasoning, geometric measures, or statistical measures are involved. They prompt students to clarify expressions ("What exactly does x represent here?"), distinguish between similar ideas, and revise work when imprecision obscures meaning. Precision becomes part of evaluating mathematical and statistical claims.
Look for and make use of structure (SMP 7)	Students identify structure in expressions, equations, proportional relationships, geometric relationships, and data displays. They rewrite expressions by recognizing their form (e.g., seeing $3(x + 4)$ as a product or noticing the distributive structure in $4x + 20$). They analyze proportional situations through the constant ratio or constant rate structure, see slope as a defining feature of linear relationships, and examine how quantities covary. Students use structural understanding to choose efficient strategies ("This is in the form $y = mx + b$, so I can see the rate and starting value") and to generalize or justify relationships.	Teachers make explicit the structure embedded in expressions, equations, proportional relationships, and geometric configurations. They invite students to identify structure before calculating and to describe how that structure supports a strategy ("What does this form tell you right away?"). Teachers emphasize how recognizing structure (e.g., constant rate, equal ratios, or the form of an expression) helps students reason more efficiently and connect ideas across representations.

Standard for Mathematical Practice	What does it look like for middle school students?	How can middle school teachers support this practice?
Look for and express regularity in repeated reasoning (SMP 8)	Students identify regularity in repeated reasoning across proportional, algebraic, and geometric situations. They observe how equivalent ratios maintain the same multiplicative relationship between quantities, how a constant rate of change produces predictable patterns in tables and graphs, and how repeated algebraic moves yield consistent results across different expressions. Students use these predictable behaviors to anticipate outcomes, choose efficient strategies, and begin forming conjectures about general rules (e.g., “It looks like this will increase by 3 every time x increases by 1”). They move from noticing regularity in examples to expressing generalized relationships.	Teachers design tasks where repeated calculations or representations reveal predictable behavior (e.g., tables of proportional relationships, sequences generated by constant differences, or algebraic reasoning that appears across multiple expressions). They prompt students to describe what stays the same and what changes in a consistent way, and to consider whether these observations might apply more generally (“Does this always happen? How do you know?”). Teachers support students in testing or refining emerging conjectures based on repeated reasoning and highlight when a general method or rule becomes evident through these patterns.

Modeling

Mathematical modeling is the process of using mathematics to interpret and make sense of the world. Developing and engaging with the modeling cycle is a critical part of building students' mathematical proficiency. As students progress through the grades, they take on greater responsibility in all aspects of the modeling cycle. They more independently formulate questions, define constraints, and distinguish between assumptions that can be made and facts that must be verified. They are provided growing opportunities to choose models and tools that help them explore a situation and uncover the underlying mathematics. They also become more adept at evaluating the validity of their solutions and revisiting earlier stages of the cycle when initial assumptions prove invalid or incomplete. Participation in the mathematical modeling cycle nurtures mathematical creativity, fosters productive discourse, encourages persistence when solutions are not straightforward, and supports the development of positive mathematics identity.



Mathematical modeling is a significant aspect of MCAP Grades 3-8. Modeling is assessed in alignment to grade-level content. Modeling items are both machine scored and constructed response. The constructed response items are scored using MCAP Mathematics Modeling Holistic Rubric. A calculator will be available for all modeling assessment items.

Opportunities to connect modeling with content standards are identified within the Companion Guide. These opportunities are entry points for integration, but they should not limit educators from making additional meaningful connections to modeling where appropriate.

Modeling Evidence Statements	What does this look like for middle school students?
M.1 Formulate a question about a particular context that can be answered using mathematics.	Students explore contexts and develop questions that can be answered with mathematics. As situations become more complex or less clearly defined, students learn to refine broad, informal questions into precise mathematical ones by identifying measurable quantities and relationships. For example, in a discussion about distracted driving, a vague question like “Is texting while driving dangerous?” can be reframed as “How far does a car travel in the time it takes to send a text?” or “How quickly can you stop at different speeds?” Through this process, students learn to pose mathematical questions that meaningfully guide investigation and analysis.
M.2 Determine the information needed and what assumptions must be made to answer a mathematical question about a context.	Students identify the information needed to answer a mathematical question and distinguish between assumptions they make and conditions imposed by the context. They consider what data is available, what quantities must be estimated or measured, and what constraints affect the situation, revisiting these decisions as their models evolve. For example, in a distracted driving context, students may ask, “How fast is the car going?” or “How long does it take to send a text?” They might assume a constant speed or average texting time in order to proceed, while recognizing that these assumptions affect the accuracy of their conclusions. By explicitly stating and revising assumptions, students learn how choices about information shape both the model and its limitations.
M.3 Represent a context mathematically by selecting and applying appropriate concepts, tools, and representations to define variables, model relationships, and/or identify constraints.	Students represent contexts by identifying relevant variables, constraints, and relationships, and by selecting mathematical representations that make those relationships visible. They move flexibly among verbal descriptions, tables, equations, graphs, and digital tools as needed to clarify how quantities are related and to support further analysis. For example, when exploring distracted driving, students might define variables for time and speed, represent the relationship with an equation, and use a graph to compare how stopping distance changes at different speeds.
M.4 Use a mathematical model to perform computations, make predictions, or answer the question posed about a context.	Students use their mathematical models to carry out calculations, test scenarios, and make predictions related to the original question. They analyze outputs from tables, graphs, or equations to identify patterns, compare cases, and evaluate how changes in inputs affect results. For example, students may use their model to predict stopping distances under varying conditions or compare outcomes when reaction time increases.
M.5 Interpret the results or conclusions of a mathematical model in terms of the original context or situation.	Students interpret the outputs of their mathematical models in relation to the original situation. They explain what numerical results, graphs, or relationships represent in context and describe what the model indicates about the scenario being studied. For example, in a distracted driving context, students may explain what a calculated stopping distance represents in real-world terms or describe how a graph shows the relationship between speed and distance traveled during a driver’s reaction time.

Modeling Evidence Statements	What does this look like for middle school students?
M.6 Critique the validity of a mathematical model and its conclusions. Revise assumptions, representations, or mathematical approaches based on the context, new understanding, or additional information.	Students critique the validity of their mathematical models and conclusions. They consider whether assumptions were realistic, whether important factors were omitted, or whether results align with what they know about the situation. Through comparison with alternative models or feedback from peers, students identify limitations and reconsider choices they made in representing the context. For example, in a distracted driving context, students may question an assumption that every text takes exactly five seconds or notice that reaction time was not accounted for. After comparing models or discussing differing results, they may adjust variables, incorporate additional factors, or refine their representations to better reflect the context.

Reasoning

Students who become adept at reasoning in mathematics are better able to transfer their learning to new and novel contexts and build confidence in their mathematical abilities. Reasoning is both a foundational skill for students and a critical focus of instruction for mathematics educators. Opportunities to reason should be embedded throughout all grade levels and students must be invited to justify their solutions, use multiple representations and tools to support conclusions, and engage in meaningful reflection. They should frequently be called upon to evaluate their own reasoning and that of others, decide whether a solution path is valid, identify and correct errors, and strengthen arguments. As outlined below, mathematical reasoning is a cornerstone skill that should be integrated across all grade-level content.

Reasoning is a significant topic in the MCAP assessment. Reasoning is assessed in alignment to grade-level content. Reasoning items are both machine scored and constructed response. The constructed response items are scored using MCAP Mathematics Reasoning Holistic Rubric. A calculator will be available for all Reasoning assessment items.

Opportunities to connect reasoning with content standards are identified within the Companion Guide. These opportunities are entry points for integration, but they should not limit educators from developing reasoning skills where appropriate.

Reasoning Evidence Statements	What does this look like for middle school students?
R.1 Use visual, symbolic, or contextual representations to explain mathematical ideas.	Students use visual, symbolic, and contextual representations to explain and justify mathematical ideas. They increasingly rely on equations, inequalities, graphs, and coordinate-plane representations while maintaining connections to tables, diagrams, and situations described in words. Rather than using representations only to compute, students use them to communicate how and why relationships hold. For example, a student might use a table and a graph to explain why two proportional relationships have the same rate of change or use an equation and a coordinate plane to justify how changing a parameter affects the shape or position of a graph. By explicitly connecting multiple representations, students strengthen their reasoning and clarify their mathematical thinking for themselves and others.
R.2 Identify and critique errors in reasoning, misapplied procedures, or invalid assumptions, and provide a mathematically valid alternative.	Students analyze mathematical arguments and solution paths to identify errors in reasoning and unjustified assumptions. As their work expands to rational numbers, equations, and functional relationships, they examine where reasoning breaks down (e.g., incorrect use of equality, flawed assumptions about relationships, or conclusions that do not follow from given information). For example, students may critique a solution that treats both sides of an equation as equivalent without actually preserving equality, assumes a linear relationship from limited data, or applies a rule in a way that contradicts the original conditions of the problem. They then revise the reasoning by restating assumptions, correcting the structure of the argument, or proposing an alternative explanation that is mathematically valid.

Reasoning Evidence Statements	What does this look like for middle school students?
R.3 Construct coherent chains of reasoning that connect mathematical properties, ideas, and evidence, such as examples or counterexamples, to support or refute mathematical statements or claims.	In Grades 6–8, students construct chains of reasoning by linking properties of operations, representations, and contextual evidence to justify mathematical claims. They explain why steps are valid when solving equations and inequalities, justify equivalence between expressions, and reason about relationships such as proportionality and linearity. Students support their conclusions by referencing concrete evidence (e.g., features of graphs, values in tables, or specific numerical examples) and by testing whether claims hold across multiple cases. When a claim does not hold, they use counterexamples to refine or reject it, ultimately strengthening their ability to reason logically and communicate mathematically sound arguments.
R.4 Identify and extend patterns or regularities to form general rules and justify their validity using mathematical reasoning.	Students identify regularity across numerical, algebraic, and geometric situations and use those patterns to form and justify general rules. In Grade 7, this includes recognizing consistent multiplicative relationships in proportional contexts, explaining why unit rate remains constant, and generalizing formulas such as the relationship between circumference and diameter. In Grade 8, students extend this work by analyzing repeated structure in linear relationships, explaining why slope represents a constant rate of change, and justifying general relationships such as the Pythagorean Theorem across all right triangles. Students support these generalizations by connecting observed patterns to mathematical properties (e.g., equivalence, proportionality, or invariance) and explaining why the rule holds beyond individual examples.

Numeracy Development Framework

Grade 6 marks a significant shift in students' numeracy development as they extend their understanding of number to include the full rational number system and begin to represent and analyze relationships more formally. This year establishes foundational ideas in proportional reasoning and algebra that shape students' mathematical experiences in middle school and beyond.

Within Number & Operation Sense, students expand their understanding of number to include positive and negative values, and build conceptual meaning through contexts such as gain and loss, elevation, and distance. They represent and interpret these values on the number line and use absolute value to reason about magnitude and difference. Throughout their work with rational numbers, students develop connections among fractions, decimals, and percents, and ultimately interpret them as different representations of the same quantities. Estimation continues to play an important role as students assess the reasonableness of results when working with these numbers.

In Algebraic Thinking, students move toward more formal and generalized ways of representing relationships. They write and interpret algebraic expressions using variables, represent expressions in equivalent forms, and use equations and inequalities to model situations and describe constraints. Students represent solutions on the number line, which reinforces connections between symbolic and visual representations. A central development in Grade 6 is the formalization of proportional reasoning: students use ratio tables and other representations to analyze proportional relationships, determine unknown values, and identify unit rates. They also describe how changes in one quantity are reflected in another, which is critical for their emerging functional reasoning about dependent relationships.

Geometric Reasoning and Measurement extends students' understanding of space through decomposition and representation. Students find the area of polygons by composing and decomposing them into familiar shapes and use nets to represent three-dimensional figures and determine surface area. They also extend their understanding of coordinate systems to draw polygons and determine side lengths.

In Reasoning with Data, Statistics, and Probability, students formally distinguish between statistical and non-statistical questions and represent data using histograms and box plots. They describe and compare distributions using measures of center and variability, including median, mean, and interquartile range. Students also begin to use probability language to describe likelihood and to reason about which outcomes are more or less likely in a given context, marking an early development of probabilistic thinking.

The developmental milestones identified in the Numeracy Development Framework for Grade 6 reflect a shift toward reasoning with rational numbers, representing relationships more formally, and analyzing variability and likelihood. This companion document highlights how these ideas align with Grade 6 standards and identifies the understandings most critical to monitor as students build toward more advanced proportional, algebraic, and statistical reasoning in later grades.

Number and Operation Sense (NOS)

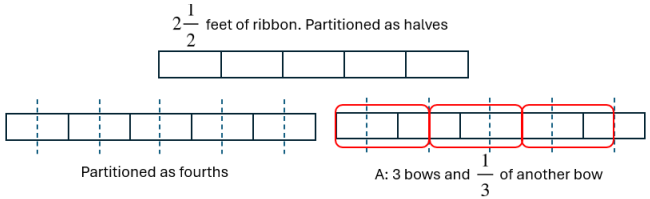
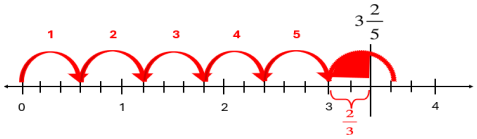
Number and Operation Sense (NOS) Clusters	Connections to the Numeracy Development Framework
6.NOS.A Apply and extend previous understandings of multiplication and division to divide fractions by fractions.	The standard within this cluster **directly contributes*** to the Grade 6 Number and Operation Sense milestones within the **Fractions & Decimals and Estimation strands** of the Numeracy Development Framework.
6.NOS.B Compute fluently with multi-digit numbers and find common factors and multiples.	Standards within this cluster **directly contribute*** to the Grade 6 Number and Operation Sense milestones within the **Operations, Fractions & Decimals, and Estimation strands** of the Numeracy Development Framework. They **contribute**** to the Grade 6 **Algebraic Thinking** milestones within the **Creating Equations & Inequalities strand** of the Numeracy Development Framework.
6.NOS.C Apply and extend previous understanding of numbers to the system of rational numbers.	Standards within this cluster **directly contribute*** to the Grade 6 Number and Operation Sense milestones within the **Number & Number Sets and Operations strands** of the Numeracy Development Framework. They **contribute**** to the Grade 6 **Geometric Reasoning & Measurement** milestones within the **Spatial Reasoning strand** of the Numeracy Development Framework.

***Directly contribute to milestones**: The cluster includes content and practices that are *explicitly named within* an NDF milestone, meaning student proficiency with this cluster demonstrates attainment of that milestone.
****Contribute to milestones**: The cluster builds prerequisite knowledge, skills, or ways of reasoning that *support progress toward* a milestone in the NDF, even if the milestone itself is not fully realized at this stage.

6.NOS.A APPLY AND EXTEND PREVIOUS UNDERSTANDING OF MULTIPLICATION AND DIVISION TO DIVIDE FRACTIONS BY FRACTIONS.

6.NOS.A.1: Divide fractions by fractions in context.

a. **Extend estimation strategies to estimate and assess the reasonableness of quotients.**
b. **Use and connect concrete and visual fraction models (e.g., linear, regional/area, and set models) and equations to divide.**
c. **Represent and explain the calculation by connecting fraction models, and/or equations to the meaning of division.**

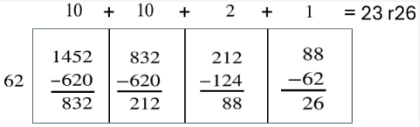
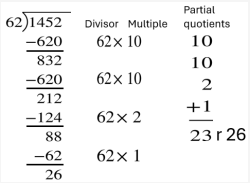
Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Multiply a fraction by a fraction (5.NOS.D.12). • Divide a whole number by a unit fraction or a unit fraction by a whole number (5.NOS.D.16). **Where are students going?** • Work with unit rates associated with ratios of fractions (7.AT.A.1).	• Focus on reasoning about the meaning of division with fractions. Students should interpret division situations such as how many groups, how much in each group, or how many of one quantity fit into another when fractions are involved. **Avoid focusing on rules (e.g., "keep – change – flip")**. • Before calculating, students estimate the size of a quotient by reasoning about the relationship between the numbers. Given $\frac{4}{5} \div \frac{1}{2}$ students reason that the quotient will be greater than 1 because $\frac{4}{5} > \frac{1}{2}$. Since $\frac{4}{5}$ is close to 1 and $1 \div \frac{1}{2} = 2$ (because there are 2 halves in 1), so $\frac{4}{5} \div \frac{1}{2}$ should be about 2. • **Bar model**: *You have $2\frac{1}{2}$ ft of ribbon to decorate gifts. Each bow takes $\frac{3}{4}$ ft of ribbon. How many bows can you make?*  • **Number line**: $3\frac{2}{5} \div \frac{3}{5} = 5\frac{2}{3}$  	• Interpret various division situations, such as partitioning a quantity into equal groups or determining how many groups of a given size fit into a quantity (SMP 2). • Compare and discuss different visual models to represent the same division situation and explain how each model shows the relationship between the quantities (SMP 3, SMP 5). • Explain the meaning of the quotient in context (SMP 4). • Critique common mistakes when interpreting models, such as counting partition marks instead of equal-sized groups or interpreting remainders in terms of the original whole rather than the group size. For example, in $3\frac{2}{5} \div \frac{3}{5}$, students may see "2 left over" and write $5\frac{2}{5}$ instead of recognizing that the remainder represents $\frac{2}{3}$ of another $\frac{3}{5}$ group (SMP 3). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Number & Operation Sense milestone in the Fractions & Decimals and Estimation strands of the Numeracy Development Framework.**

Previously 6.NS.A.1

6.NOS.B COMPUTE FLUENTLY WITH MULTI-DIGIT NUMBERS AND FIND COMMON FACTORS AND MULTIPLES.

6.NOS.B.2: Fluently divide multi-digit numbers.

a. **Extend estimation strategies to estimate and assess the reasonableness of quotients.**
b. **Use strategies (e.g., partial quotients, inverse relationship between multiplication and division) to divide.**
c. **Use a standard algorithm to divide.**
d. **Determine and explain when a strategy or algorithm is most efficient.**

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Multiply multi-digit numbers with up to 4-digit dividends and 2-digit divisors (5.NOS.B.5). **Where are students going?** • Fluently multiply and divide multi-digit decimals (6.NOS.B.3). • Multiply and divide rational numbers (7.NOS.A.2).	• **Fluency is not defined by the use of a single algorithm**. Students should be able to use estimation, place-value reasoning, partial quotients, and the relationships between multiplication and division as well as an algorithm. Students may estimate quotients using approaches such as front-end estimation and compatible numbers. These strategies involve adjusting numbers to values that are easier to compute mentally while maintaining the scale of the problem. For $3482 \div 47$, students may reason that $3500 \div 50 \approx 70$. When estimating, avoid presenting division problems using computational form $47\overline{)3482}$. • Using partial quotient examples:   • Students should determine which strategy or algorithm is most efficient for a given problem based on the structure of the numbers and purpose of the calculation. Efficiency should be discussed in terms of clarity, number relationships, and mental effort; not speed.	• Discuss the appropriateness of different strategies for a given division problem, considering when approaches such as place-value reasoning, partial quotients, mental math, or the standard algorithm are most efficient, and recognizing that an algorithm is not always the most useful method (SMP 3, SMP 7). • Verify quotients using the inverse relationship between multiplication and division (SMP 2). • Collaboratively analyze errors or misconceptions in division work, and discuss how estimation, place-value reasoning, or multiplication can help identify and correct mistakes (SMP 3). • Engage in contextual situations where estimation is the most appropriate approach, discuss when an approximate quotient is sufficient and how the level of precision required depends on the context and purpose of the calculation (SMP 6). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Number & Operation Sense milestone in the Operations strand of the Numeracy Development Framework.**

Previously 6.NS.B.2

6.NOS.B.3: Fluently multiply and divide multi-digit decimals to the thousandths .

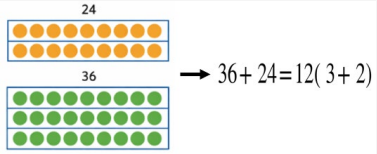
a. **Extend estimation strategies to estimate and assess the reasonableness of products and quotients.**
b. **Generalize whole number strategies to multiply and divide decimals.**
c. **Use a standard algorithm to multiply and divide decimals.**
d. **Determine and explain when a strategy or algorithm is most efficient.**

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Multiply and divide multi-digit whole numbers (5.NOS.B.4; 5.NOS.B.5). • Multiply and divide decimals to hundredths (5.NOS.B.7). **Where are students going?** • Solve multistep problems involving positive and negative rational numbers in any form (7.NOS.A.3).	• Students generalize strategies used with whole numbers (e.g., partial products/quotients, and place-value reasoning). They also use their understanding that division can be represented as a fraction to reason about decimal quotients (e.g., interpreting $3.6 \div 0.12$ as $\frac{3.6}{0.12}$) and how scaling both quantities by the same power of 10 creates an equivalent expression • Estimation is used primarily to assess reasonableness. For example, when solving 4.236×2.5 , students may reason that $4 \times 2.5 = 10$, so a result around 10 is reasonable. • Example: Area model example multiplication $3.102 \times 1.1 = 3.4122$ | | 3 | 0.1 | 0.00 | 0.002 | | 1 | 3 | 0.1 | 0.00 | 0.002 | | 0.1 | 0.3 | 0.01 | 0.000 | 0.0002 | • Example: Division by reasoning through equivalent expressions by scaling by the same power of 10 ($5.436 \div 0.12 = \frac{5.436}{0.12} = \frac{543.6}{12}$). Then partial quotients: $12\overline{)543.6}$ Divisor Multiple Partial quotients $-480 \leftarrow 12 \times 40$ 40 63.6 5 $-60 \leftarrow 12 \times 5$ 0.2 3.6 +0.1 $-2.4 \leftarrow 12 \times 0.2$ 45.3 1.2 $-1.2 \leftarrow 12 \times 0.1$ 0	• Reason about how multiplying or dividing by decimals changes magnitude (SMP 2). • Analyze and critique errors in decimal computation, such as aligning decimal points as in addition/subtraction when multiplying, or omitting placeholder zeros in partial products or quotients when working vertically (SMP 3). • Engage in tasks where students compare possible solution strategies without performing the calculations, and explain which approach would be most efficient for them based on place-value relationships (SMP 7, SMP 3). • Interpret and solve financial situations (e.g. determining how many items costing $0.75 each can be purchased with $6.30) and explain how the quotient represents the number of groups (SMP 2). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Number & Operation Sense milestone in the Estimation and Fractions & Decimals strands of the Numeracy Development Framework.**

Previously 6.NS.B.3

6.NOS.B.4: Identify the common factors and multiples of two whole numbers.

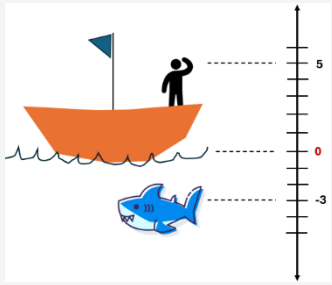
a. **Identify the greatest common factor of two whole numbers within 100.**
b. **Identify the least common multiple of two whole numbers within 12.**
c. **Express the sum of two whole numbers within 100 using the distributive property to factor out the common factor of the addends (e.g., express 36 + 8 as 4(9 + 2)).**

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Explain and apply concepts of factors for whole numbers 1-100 (4.NOS.C.8). • Write expressions that record calculations (5.AT.A.2). **Where are students going?** • Identify and create equivalent expressions (6.AT.B.7).	• Factors and multiples describe relationships between numbers. A factor divides a number evenly, while a multiple is the product of a number and another whole number. Students use these relationships to analyze numbers. Students may identify the greatest common factor (GCF) by listing factors, using factor pairs, or reasoning about the structure of numbers. For example, representing 24 and 36 with arrays shows the largest row size that both can be arranged is 12, so 12 is the GCF:  • Students may identify the least common multiple (LCM) by listing numbers or reasoning about number relationships. For example, multiples of 4 are 4, 8, **12**, 16, 20, ... and multiples of 6 are 6, **12**, 18, 24, ... so the LCM of 4 and 6 is 12. • Factoring a sum using the distributive property should be framed as highlighting the structure of numbers. This work builds on prior experiences interpreting expressions such as $3\times(18932+921)$ as "three times the quantity 18932 + 921." • Avoid teaching GCF and LCM primarily as procedural steps without connecting the ideas to the relationships among factors and multiples or without engaging students in reasoning about the structure of numbers.	• Represent contextual situations involving grouping with factors, such as determining the largest equal groups that can be made with no items left over, and interpreting GCF in that context (SMP 4). • Solve contextual problems involving repeating patterns or cycles where identifying the least common multiple helps determine when events align (SMP 4, SMP 7). • Analyze and critique reasoning about factors and multiples, including identifying and correcting misconceptions such as confusing common factors with common multiples or assuming the larger number must be the GCF (e.g., saying the GCF of 12 and 18 is 18) (SMP 3). • Compare different approaches for identifying common factors or multiples, and discuss how strategies (e.g., listing factors, reasoning with factor pairs, using arrays) highlight relationships between numbers (SMP 3, SMP 7).

Previously 6.NS.B.4

6.NOS.C APPLY AND EXTEND PREVIOUS UNDERSTANDING OF NUMBERS TO THE SYSTEM OF RATIONAL NUMBERS.

6.NOS.C.5: Use understanding of rational numbers as positive and negative numbers 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 rational numbers to represent quantities in context and explain the meaning of 0 in each situation.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Plotting, ordering, and comparing positive numbers throughout elementary grades. **Where are students going?** • Represent points on a number line with negative numbers (6.NOS.C.6). • Add and subtract rational numbers (7.NOS.A.1).	• Students interpret positive and negative numbers as describing position or change relative to a reference point. The meaning of a rational number in this application depends on the context and the reference point being used. In a bank account context, +25 may represent a deposit of $25 or a balance $25 above zero, while -25 may represent a debt or a balance $25 below zero. • Students distinguish between magnitude and direction when interpreting rational numbers. The negative sign does not mean "less," but rather indicates a value in the opposite direction relative to the reference point. • Students interpret 0 as the value that separates positive and negative quantities, such as sea level for elevation, a zero balance in a bank account, or neutral charge in electricity.  The sailor is 5 ft above the water and the shark is 3 ft below the water.	• Reason about opposites and symmetry around a reference point, and recognize that "opposite numbers" represent equal distances from 0 in opposite directions (SMP 7). • Frequently translate between contextual descriptions and numerical representations (SMP 2, SMP 4). • Engage in discourse about how the same number can have different meanings depending on context, and explain what positive, negative, and zero represent in each situation (SMP 3). • Analyze and critique reasoning about contextual quantities, such as identifying when a positive or negative value has been misinterpreted (e.g., treating -5° as colder than -10° because 5 is smaller than 10, or assuming a negative value always means "less" rather than indicating direction relative to the reference point, 0) (SMP 3).

Previously 6.NS.C.5

6.NOS.C.6: Represent a rational number as a point on vertical or horizontal number lines. Represent points on a number line with negative numbers.

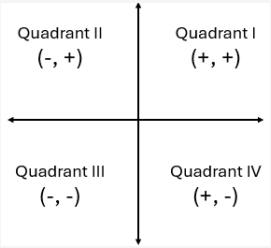
a. **Estimate quantities by reasoning about their location on a number line, their relationship to benchmark numbers, and by rounding.**
b. **Locate and interpret the positions of rational numbers on a number line.**
c. **Recognize and locate opposite signs of rational numbers as indicating locations on opposite sides of 0 on the number line.**

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Work with positive and negative numbers as describing quantities with opposite directions or values (6.NOS.C.5). **Where are students going?** • Model the addition of rational numbers as movement along a horizontal or vertical number line (7.NOS.A.1b).	• Students interpret each rational number as a point located a specific distance and direction from 0. Positive numbers lie to the right of zero (or above zero on a vertical number line), and negative numbers lie to the left of zero (or below zero). • Rational numbers include integers, fractions, and decimals and can all be located on the same number line. Estimating positions on a number line involves reasoning about magnitude, direction, and relationships to benchmarks. Students may place 0.48 close to 0.5 or estimate that -7.2 lies slightly to the left of -7. • Horizontal and vertical number lines should be used consistently and interchangeably to represent the same relationships between numbers. Students should recognize that the orientation does not change the meaning of distance, direction, or position. • Avoid asking students to place numbers on number lines without reasoning about benchmark numbers (e.g., 0, ½, 1, etc.) which supports an understanding of magnitude and distance relative to a reference point.	• Place fractions, decimals, and integers on the same continuous number line, and reason about relative direction and distance from 0 (SMP 2). • Construct number lines with appropriate scales to represent a given set of numbers by deciding how to partition intervals so that fractions, decimals, and integers can be accurately located and compared (SMP 2, SMP 7). • Model contextual quantities using number lines (SMP 4). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Number & Operation Sense milestone in the Numbers & Number Sets strand of the Numeracy Development Framework.**

Previously 6.NS.C.6

6.NOS.C.7: Intersect perpendicular number lines at the point (0,0) as the x-axis and y-axis to introduce the four quadrants of the Coordinate Plane. Represent points on the plane with positive and negative coordinates.

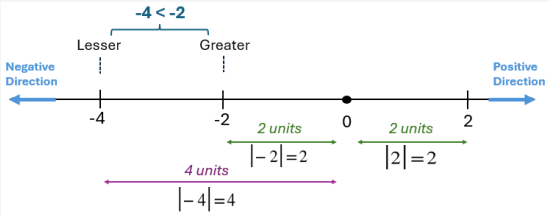
a. **Use understanding of the relationship between signs and value of coordinates in ordered pairs to reason about the location of an ordered pair without plotting.**
b. **Locate and interpret the positions of rational numbers on the Coordinate Plane, including how changes in the signs of ordered pairs reflect their location into different quadrants.**

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Graph, name, and interpret coordinate points in the first quadrant of the coordinate plane using ordered pairs (5.GR.D.6; 5.GR.D.7). **Where are students going?** • Explain what a point (x, y) on the graph of a proportional relationship represents (7.AT.A.3b).	• In Grade 5, students plotted points in Quadrant I using only positive coordinates. In Grade 6, extending number lines to include negative values allows the coordinate plan to represent all four quadrants. • Ordered pairs represent two independent quantities that together define a location in two-dimension space. Each coordinate describes position along a single axis, but when considered together, the pair identifies a unique point in the plane. • The signs of the coordinates determine the quadrant of a point and reveal structural patterns in the plane. Recognizing this pattern is an essential component of this standard.  • Students should understand that changing the sign of a coordinate reflects the point across an axis. For example, (4.2, 3.5) and (-4.2, 3.5) are reflected images across the y-axis. This helps students recognize symmetry and structure in the coordinate plane.	• Compare and describe relationships among points, such as identifying points that lie on the same horizontal or vertical line or that are reflections across an axis (SMP 7). • Model contextual situations using the coordinate plane by representing quantities such as position, elevation, or movement and interpreting what ordered pairs mean in context (SMP 4). • Engage in discussion to justify and critique reasoning about point location, including addressing common errors such as reversing coordinates (e.g., confusing (3, -2) with (-2, 3), misinterpreting signs (e.g., placing (4, 5) in Quadrant IV instead of Quadrant II), or treating negative values as smaller based only on the digits, rather than reasoning about their position relative to 0 (SMP 3).

Adopted 2025

6.NOS.C.8: Order rational numbers and interpret their absolute values.

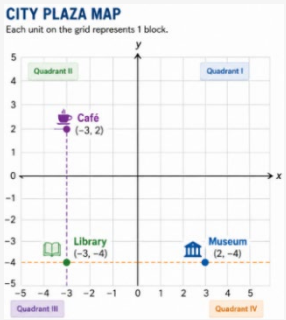
a. **Interpret statements of inequality as statements about the relative position of two numbers on a number line (e.g., interpret −3 > −7 as a statement that –3 is located to the right of –7 on a horizontal number line).**
b. **Write, interpret, and explain statements of order for rational numbers in context (e.g., write −3°C > −7°C to express the fact that −3°C is warmer than −7°C).**
c. **Use understanding of the absolute value of a rational number as its distance from 0 on the number line to interpret absolute value as magnitude for a positive or negative quantity in context (e.g., for an account balance of –30 dollars, write $|-30|=30$ to describe the size of the debt in dollars).**

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Graph points in the first quadrant of the coordinate plane using ordered pairs (5.GR.D.6). • Locate opposite signs of rational numbers as indicating locations on opposite sides of 0 on the number line (6.NOS.6c). **Where are students going?** • Write inequalities to represent a constraint or condition within a context (6.AT.C.9).	• Comparing rational numbers is grounded in reasoning about their location relative to 0. Students often inappropriately apply whole-number comparison reasoning to negative numbers (i.e., assuming numbers with larger digits are greater, like -12 > -3). • Magnitude and value must be distinguished when reasoning about numbers. A quantity can have a greater magnitude but a smaller value (e.g., -8 < -3, but $|-8|>|-3|$). This distinction is essential when interpreting contexts involving gains, losses, or temperature, for example. • Number line reasoning supports both ordering and magnitude. Students should connect position, distance, and direction to interpret and compare values.  • Avoid treating inequalities as rules about symbols or digits without connecting them to the meaning of the quantities being compared.	• Estimate and compare rational numbers using benchmark values (e.g., 0, ½, 1, or nearby integers) and explain how proximity to these benchmarks supports ordering (SMP 2). • Distinguish between magnitude and value and explain how a quantity can be farther from 0 yet still be less in value. For example, students compare elevations of -8 m and -3 m relative to sea level and reason that -8 m is lower (less in value), while it has greater magnitude because it is farther from sea level ($|-8|>|-3|$) (SMP 3). • Choose an appropriate representation (e.g., number line, inequality, absolute value, or context) to model and justify a comparison or relationship and explain how the representation best communicates their reasoning (SMP 4). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Number & Operation Sense milestone in the Operations strand of the Numeracy Development Framework.**

Previously 6.NS.C.7

6.NOS.C.9: Solve problems in context by graphing points (with the same first coordinate or the same second coordinate) in all four quadrants of the Coordinate Plane.

a. **Explain that points with the same x-coordinate or y-coordinate are located on same vertical or horizontal line respectively.**
b. **Use absolute value to calculate length of vertical and horizontal lines on Coordinate Plane.**

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Represent problems by graphing points in the first quadrant of the coordinate plane (5.GR.D.6). • Plot points in all four quadrants of the coordinate plane (6.NOS.C.7). **Where are students going?** • Draw and analyze polygons in the coordinate plane (6.GR.A.3). • Verify properties of parallelograms in the coordinate plane (IA1.GR.B.5).	• Students use the coordinate plane as a two-dimensional model of location and movement, where points represent positions and changes in coordinates represent movement across space. • Points with the same x-coordinate lie on the same vertical path, while points with the same y-coordinate lie on the same horizontal path. When two points share one coordinate, the distance between them can be found by examining only the coordinate that changes. • Absolute value is used to determine horizontal or vertical length, where segment length represents total distance traveled between positions, regardless of direction. • You are at the library and need to meet a friend at either the Café or the Museum. Which is the shorter distance from you? What is that distance?  Library to Café: Since the locations are on opposite sides of 0, add their distances from 0: $\lvert -4\rvert + \lvert 2\rvert = 4 + 2 = 6$ Library to Museum: Since the locations are on opposite sides of 0, add their distances from 0: $\lvert -3\rvert + \lvert 2\rvert = 3 + 2 = 5$ OR Library to Café $\lvert -4-2\rvert = \lvert -6\rvert = 6$; Library to Museum $\lvert -3-2\rvert = \lvert -5\rvert = 5$ Museum is closer and is 5 blocks from the Library. • Emphasize reasoning about location, alignment, and movement in space, rather than viewing the coordinate plane only as a place to plot isolated points.	• Use coordinates to model and solve problems involving location and movement in real spaces (e.g., city grids, buildings, maps, game boards) (SMP 4). • Anticipate alignment and distance before graphing by using shared coordinates to predict whether points lie on the same horizontal or vertical path and reasoning about how far apart they are (SMP 1, SMP 7). • Connect absolute value to movement and distance in the coordinate plane and explain why opposite directions can represent the same length and why distance is always nonnegative (SMP 2). • Compare routes or placements using coordinate reasoning and determine how changing a location changes horizontal or vertical distance and which positions best satisfy given constraints (SMP 4, SMP 8).

Previously 6.NS.C.8

Algebraic Thinking (AT)

Algebraic Thinking (AT) Clusters	Connections to the Numeracy Development Framework
6.AT.A Understand ratio concepts and use ratio reasoning to solve problems.	Standards within this cluster **directly contribute*** to the Grade 6 Algebraic Thinking milestones within the **Proportional Reasoning strand** of the Numeracy Development Framework. They **contribute**** to the Grade 6 Number & Operation Sense milestones within the **Numbers & Number Sets** strand of the Numeracy Development Framework.
6.AT.B Apply and extend previous understandings of arithmetic to algebraic expressions.	Standards within this cluster **directly contribute*** to the Grade 6 Algebraic Thinking milestones within the **Creating Equations & Inequalities strand** of the Numeracy Development Framework.
6.AT.C Reason about and solve one-variable equations and inequalities.	Standards within this cluster **directly contribute*** to the Grade 6 Algebraic Thinking milestones within **Creating Equations & Inequalities** and **Solving Equations & Inequalities strands** of the Numeracy Development Framework
6.AT.D Represent and analyze quantitative relationships between dependent and independent variables.	The standard within this cluster **directly contributes*** to the Grade 6 Algebraic Thinking milestones within the **Functional Reasoning strand** of the Numeracy Development Framework

***Directly contribute to milestones**: The cluster includes content and practices that are *explicitly named within* an NDF milestone, meaning student proficiency with this cluster demonstrates attainment of that milestone.
****Contribute to milestones**: The cluster builds prerequisite knowledge, skills, or ways of reasoning that *support progress toward* a milestone in the NDF, even if the milestone itself is not fully realized at this stage.

6.AT.A UNDERSTAND RATIO CONCEPTS AND USE RATIO REASONING TO SOLVE PROBLEMS.

6.AT.A.1 Use ratio language in context (e.g., "__ to __," "for every," "per") to describe a ratio relationship between two quantities, including part to part and part to whole (e.g., "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.").

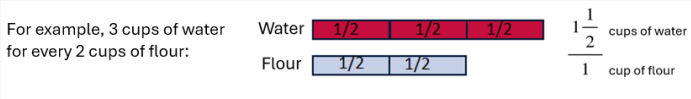
Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Interpret and represent multiplicative comparisons (4.AT.A.1). • Interpret multiplication as scaling (5.NOS.D.14). **Where are students going?** • Identify and represent proportional relationships (7.AT.A.2; 7.AT.A.3).	• A ratio describes a multiplicative relationship between two quantities. Students interpret ratios as comparisons that indicate how much of one quantity there is relative to another. • This standard introduces students to the meaning of "per" as "for each one." For example, "55 miles per hour" can be interpreted as 55 miles for every 1 hour, or a ratio of 55:1. • Students distinguish between part-to-part and part-to-whole relationships. For example, in a Chesapeake Bay field study, students collected 2 blue crabs and 3 rockfish, the ratio of blue crabs to rockfish is 2:3 (part-to-part), while the ratio of blue crabs to total animals collected is 2:5 (part-to-whole). • Common contexts include buying and consuming (e.g., cost per item), games and collections, measurement situations, and simple rates. Students explain what a ratio means in the situation, not just how it is written. • Avoid interpreting ratios as differences between quantities (additive reasoning) rather than multiplicative relationships, such as describing a ratio of 2:1 as "1 more" instead of "for every 2 of one quantity, there is 1 of another."	• Generate multiple ratios from a given context, including part-to-part and part-to-whole relationships, and classify each ratio based on the quantities being compared (SMP 2, SMP 7). • Work with contexts that include a third quantity (e.g., a total) and write as many valid ratios as possible. Students then organize and discuss how each ratio represents a different comparison (SMP 2, SMP 7). • Analyze and critique errors in ratio interpretation, such as confusing part-to-part with part-to-whole relationships or misidentifying the quantities being compared (SMP 3, SMP 6). • Engage in discussion to justify ratio statements and respond to alternative interpretations from peers (SMP 3).

Previously 6.RP.A.1

6.AT.A.2 Represent and use unit rates, written as fractions ($\frac{a}{b}, b \neq 0$) with whole number numerators and denominators, in context.

a. Use unit rate language in the context of a ratio relationship (e.g., "The recipe has a ratio of 3 cups of flour to 4 cups of sugar so there is $\frac{3}{4}$ cup of flour for each cup of sugar.")

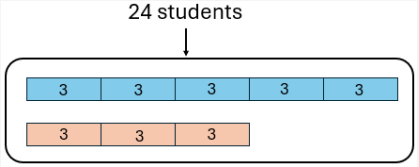
b. Solve unit rate problems, for example those involving unit pricing and constant speed (e.g., "If it took 7 hours to mow 4 lawns, then at that rate, how many lawns could be mowed in 35 hours? At what rate were lawns being mowed?").

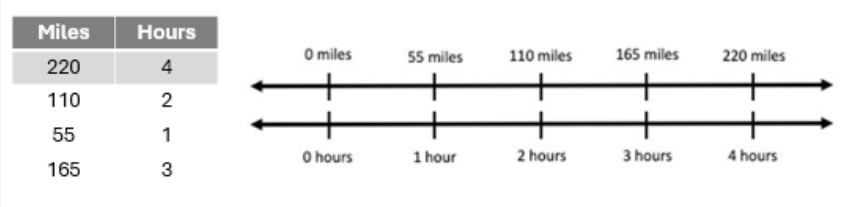
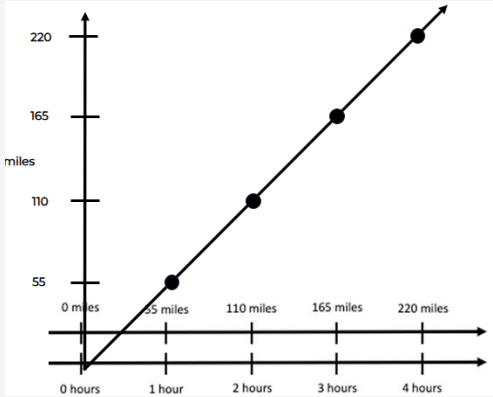
Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Divide unit fractions by whole numbers and whole numbers by fractions (5.NOS.D.16). • Interpret fractions as division of numerator by denominator (5.NOS.D.10). **Where are students going?** • Compute unit rates associated with ratios of fractions (7.AT.A.1). • Identify and represent proportional relationships (7.AT.A.2; 7.AT.A.3).	• Including units and labels is essential for interpreting unit rates. Writing quantities such as $\frac{55\ miles}{1\ hour}$ helps students maintain the meaning of the relationship and avoid confusion between ratios and fractions. • Visual models and ratio representations support understanding of unit rates. Students can use these to scale a relationship to a quantity of 1 so that the unit rate is visible and conceptually understood.  • Unit rates can be interpreted in different and related ways depending on the quantities and which is set to 1. For example, a situation can be described in lawns per hour or hours per lawn, depending on the question being asked. • Ratios and fractions are not the same. A fraction is a number, while a ratio describes a multiplicative relationship between two quantities. Avoid statements such as "a ratio is just a fraction" or treating unit rates as a "just divide" procedure.	• Use and connect multiple representations to reason about unit rates, explain how each representation reveals the same multiplicative relationship and supports finding the value per one unit in different ways (SMP2, SMP 7). • Use context to reason about and compare unit rates by interpreting what each rate means (e.g., more per one unit) rather than relying only on computation and number comparison (SMP 2). • Use unit rates to analyze and compare pricing in financial contexts (e.g., cost per item or cost per ounce) and explain how the unit rate supports decisions about value (SMP 4). **$** • Analyze and critique reasoning about unit rates, including identifying misconceptions such as interpreting a unit rate without reference to "per one," reversing quantities (e.g., confusing miles per hour with hours per mile), or losing the meaning of the quantities being compared (SMP 3, SMP 6).

Previously 6.RP.A.2

6.AT.A.3 Use ratio and rate reasoning to solve problems in context by reasoning about tables of equivalent ratios, tape diagrams, double number lines, or the Coordinate Plane.

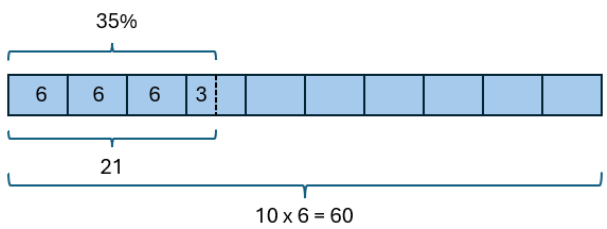
a. **Generate, compare and find missing values of equivalent ratios and unit rates using multiple representations.**
b. **Plot the pairs of values on the Coordinate Plane (in quadrant 1) to represent unit rates and make connections between representations.**
c. **Use ratio reasoning to convert measurement units (e.g., money, time, length within the same system); manipulate and transform units appropriately when multiplying or dividing quantities.**

Content Progression	Examples and Clarifications	Students should have the opportunity to…
Where are students coming from? • Graph points in the first quadrant of the coordinate plane using ordered pairs (5.GR.D.6). • Use unit rates to solve problems (6.AT.A.2) **Where are students going?** • Identify and represent proportional relationships (7.AT.A.2; 7.AT.A.3).	• Students use their understanding that equivalent ratios represent a single multiplicative relationship and that they are generated by scaling both quantities by the same factor. • Students develop flexibility in using and choosing representations. They learn to select representations strategically based on how they support reasoning about a situation. For example, in a music club, there are 5 students who play guitar for every 3 students who play drums. There are a total of 24 students in music club, how many guitarists and drummers are there?  • Connections across representations are essential for understanding. For example, a ratio table can be interpreted as a set of ordered pairs, a double number line shows the same pairs as aligned values, and a coordinate graph represents those pairs as points. (Continued on *next page*)	• Attend to precision in labeling quantities and units across representations so that relationships are clearly defined and accurately interpreted (SMP 6). • Engage in explicit use and comparison of multiple representations and discuss how each can represent the same relationship, identify common structures across them, and develop strategic awareness of which representations are most effective in different situations (SMP 2, SMP 5, SMP 7). • Discuss continuous and discrete representations of ratio relationships, particularly how double number lines and coordinate planes represent continuous scaling, while tables or tape diagrams *may* represent discrete values and how this affects interpretation and reasoning within context (SMP 2, SMP 4, SMP 7). • Analyze and critique reasoning involving representations, including identifying misuses such as applying additive reasoning within multiplicative structures (e.g., treating a 3:2 relationship

Content Progression	Examples and Clarifications	Students should have the opportunity to...
	  • Students should recognize that converting units involves the same multiplicative relationships as mentioned above and that conversion is not a new procedure but a familiar type of ratio relationship.	as "remove 1 from each" to find a unit rate) or misinterpreting how quantities are represented in diagrams (SMP 3, SMP 7). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Algebraic Thinking milestone in the Proportional Reasoning strand of the Numeracy Development Framework.**

Previously 6.RP.A.3

6.AT.A.4 Find a percent of a quantity in context as a rate per 100 (e.g., 30% of a quantity means $\frac{30}{100}$ times the quantity), including finding the whole given a part and the percent, by using tables, tape diagrams, and double number lines.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Interpret multiplication as scaling (5.NOS.D.14). • Use unit rates to solve problems (6.AT.A.2). **Where are students going?** • Solve ratio and percent problems (7.AT.A.4).	• Students connect percents directly to prior work with ratios and unit rates (e.g., 30% means 30 per 100). • Percent uses 100 as a common reference unit to standardize comparisons. Students can compare quantities from different contexts by expressing each as a percent (per 100), even when the original totals are not the same (e.g., Which class did better? 46 out of 53 OR 43 out of 51). • The percent symbol (%) represents a ratio per 100 but can "hide" that ratio, so instruction should make this relationship explicit to support understanding of percent as a multiplicative relationship rather than a standalone number. • Multiple representations support understanding of percent relationships. Tables help make multiplicative scaling visible, tape diagrams represent the part-whole structure, and double number lines represent how two quantities scale together continuously. • Finding the whole from a part and a percent involves reversing the scaling relationship. For example, if 35% of a quantity is 21, students reason about how 21 relates to 35 out of 100.  	• Build an intuitive sense of percent using benchmark percents and making fraction connections. They should be able to use these to estimate, reason about quantities, and check the reasonableness of results (SMP 2). • Connect percent reasoning to prior ratio and unit rate work by discussing percent as a specific application of multiplicative reasoning rather than a new or separate concept (SMP 7). • Analyze and critique reasoning about percent, including identifying misconceptions such as confusing the part and the whole in a situation, treating the percent as the whole quantity, or not distinguishing between the value of a percent and the quantity it describes (SMP 3). • Engage in a wide range of percent situations with a focus on understanding the relationship between quantities (e.g., part and whole) and how different representations can illuminate important aspects (SMP 2, SMP 4).

Adopted 2025

6.AT.B APPLY AND EXTEND PREVIOUS UNDERSTANDINGS OF ARITHMETIC TO ALGEBRAIC EXPRESSIONS.

6.AT.B.5 Write numerical expressions involving whole number exponents and positive rational number bases. Use technology to evaluate numerical expressions involving whole number exponents and positive rational number bases.

Content Progression	Examples and Clarifications	Students should have the opportunity to...

Where are students coming from?
• Understanding and using powers of 10 (5.NOS.A.2).
Where are students going?
• Apply the properties of integer exponents to generate equivalent numerical expressions (8.NOS.B.3).
	• Writing expressions in expanded form (e.g., 3 x 3 x 3 x 3 x 3) supports understanding and highlights the efficiency of exponential notation.
	• The base can be a positive rational number, not only a whole number (e.g., $\left(\frac{2}{3}\right)^3$).
	  • Parentheses are essential when the base is a fraction. Students should recognize that $\left(\frac{2}{3}\right)^3$ differs from $\frac{2}{3^2}$.
	• Exponential expressions arise naturally in mathematical contexts involving repeated structure. These may include:
	  • Place value, where powers of 10 represent repeated multiplication by 10.
	  • Area/surface area, where squared units (e.g., cm^2) represent two-dimensional structure.
	  • Volume, where cubed units (e.g., cm^3) represent three-dimensional structure.
	• Students use technology to efficiently evaluate expressions so that the focus remains on interpreting and writing exponential form in context, rather than on repeated multiplication.
		• Reason about when exponential notation is appropriate and when using it increases clarity in communication (SMP 2, SMP 3).
		• Analyze and critique reasoning about exponential expressions, including identifying misconceptions such as interpreting 3^4 as 3 x 4 or not recognizing the entire base when working with fractions (SMP 3, SMP 6).
		• Make and test conjectures (using technology) about how changing the base or exponent affects the value of an expression (SMP 2, SMP 7).
		• Attend to precision in notation and interpretation, including correctly using parentheses, identifying the base and exponent, and clearly communicating the meaning of an expression in context (SMP 6).

Previously 6.EE.A.1

6.AT.B.6 Write, read, and evaluate expressions in which letters stand for numbers.

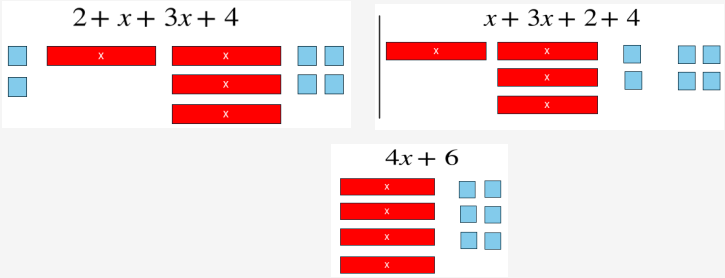
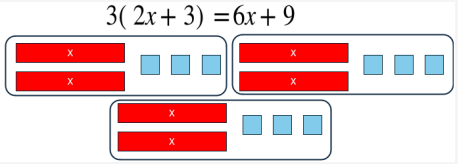
a. **Write expressions that record operations with numbers and with letters standing for numbers (e.g., express the calculation "Subtract y from 5" as 5 − y).**
b. **Identify parts of an expression using mathematical language (e.g., sum, term, product, factor, quotient, coefficient) and view one or more parts of an expression as a single unit (e.g., describe the expression 2(8 + 7) as a product of two factors; view (8 + 7) as both a single unit and a sum of two terms).**
c. **Evaluate expressions given specific values of their variables in context. Include expressions that involve arithmetic operations and whole number exponents.**

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Write, interpret, and evaluate numerical expressions involving all operations and grouping symbols (5.AT.A.1; 5.AT.A.2). • Use tables, ordered pairs, and graphs to represent the relationship between quantities (5.AT.B.3c). **Where are students going?** • Write equations to represent a relationship between quantities (7.AT.C.8a).	• Variables represent quantities that can vary within a context. Students develop the understanding that a letter stands for a value that depends on the situation, and that the same expression can represent many possible values. • The meaning of an expression depends on how the quantities are related; not just the operations and number presented. For example, if a $5 gift card is applied to a purchase costing y dollars, y – 5 represents how much is still owed for the purchase, while 5 – y represents how much of the gift card balance remains after paying for an item costing y dollars. • Seeing structure within expressions supports reasoning about relationships. For example, interpreting 2(8 + 7) as “two groups of a sum” connects to multiplicative reasoning and prepares students for later algebraic thinking. • Avoid overreliance on procedural rules (e.g., PEMDAS/GEMS) without accompanying reasoning about structure, which can lead students to treat expressions as steps to compute rather than as representations of quantities and relationships.	• Act out or physically represent situations to make sense of expressions by connecting actions (e.g., repeated groups, combining quantities) to the structure of an expression (SMP 2). • Draw diagrams or visual representations to support interpretation of expressions, such as grouping models or area representations, to make structure and relationship visible (SMP 2, SMP 7). • Engage in student-to-student discourse using precise mathematical language, where students describe expressions using vocabulary such as term, factor, product, and coefficient (SMP 3). • Analyze and compare different expressions that represent the same situation and discuss how structure affects meaning (e.g., comparing 2(x + 5) and 2x + 10 conceptually without formal expansion) (SMP 3, SMP 7). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Algebraic Thinking milestone in the Creating Equations & Inequalities strand of the Numeracy Development Framework.**

Previously 6.EE.A.2

6.AT.B.7 Apply the properties of operations (e.g., distributive, associative, commutative, etc.) to generate equivalent algebraic expressions and to identify when two expressions are equivalent (e.g., 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.)

Content Progression	Examples and Clarifications	Students should have the opportunity to...

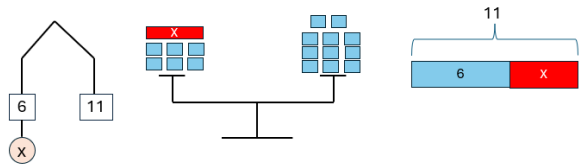
Where are students coming from?
• Write, interpret, and evaluate numerical expressions involving all operations and grouping symbols (5.AT.A.1; 5.AT.A.2).
• Identify common factors and multiples (6.NOS.B.4).
Where are students going?
• Rewrite expressions in different forms (7.AT.B.6).
• Rewrite linear and exponential expressions in different forms (IA1.AT.A.1).
	• Generating equivalent expressions means rewriting expressions so they represent the same quantity for all values of the variable(s).
	• When working with the distributive property, rewriting expressions should include both:
	  • Expanding (e.g., 4(x + 5) = 4x + 20) and
	  • Factoring (e.g., 12x + 8 = 4(3x + 2)) as connected and reversible processes.
	• The commutative and associative properties support combining like terms by allowing reordering and grouping:
	2 + x + 3x + 4 = x + 3x + 2 + 4 = 4x + 6
	Here, the commutative property allows terms to be reordered, and the associative property supports regrouping to combine like terms.
	• Equivalent expressions can be understood through representations:
	Example 1:
	 
	
	Example 2:
	 
	
		• Analyze an expression to determine whether expanding or factoring is more useful in a given context (e.g., recognizing a common factor vs. distributing to reveal total quantities) (SMP 1, SMP 7).
		• Engage in discourse, using precise mathematical language (e.g., factor, term, equivalent) that centers on why expressions are equivalent (SMP 3, SMP 6).
		• Move flexibly between symbolic and visual representations to verify and build meaning and deepen understanding of how properties operate across representations (SMP 2).
		• Analyze and critique incorrect rewrites of expressions (e.g., 3(x + 5) = 3x + 5 or combining unlike terms such as 2x + 3 = 5x), identify the misconception, and explain the correct reasoning using properties of operations and/or representations (SMP 3).
		• **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Algebraic Thinking milestone in Creating Equations & Inequalities strand of the Numeracy Development Framework.**

Previously 6.EE.A.3; 6.EE.A.4

6.AT.C REASON ABOUT AND SOLVE ONE-VARIABLE EQUATIONS AND INEQUALITIES

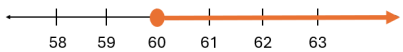
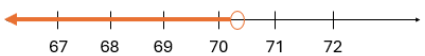
6.AT.C.8 Solve problems in context by writing and solving equations and interpreting the solutions in context.

a. **Explain that a variable can represent an unknown number and use substitution to determine whether a given number makes an equation true.**
b. **Write and solve one-step equations of the form $x+p=q$, $x-p=q$, $px=q$ and $\frac{x}{p}=q$ for cases in which p, q and x are all nonnegative rational numbers.**
c. **Represent solutions of such equations on a number line.**

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Perform operations with fractions (5.NOS.C.8; 5.NOS.D.11; 5.NOS.D.12). • Use variables to represent unknowns or values that can change (6.AT.B.6). **Where are students going?** • Write and solve equations in the form of $px+q=r$ and $p(x+q)=r$ (7.AT.C.8).	• Students should understand that a variable maintains a consistent value when presented in an *equation* (this is different than a variable in an expression) and that the equal sign represents a relationship of equality between two quantities (not a signal to compute), meaning the equation itself represents a balance between two quantities, not a sequence of operations. • Representations (e.g., hanger, balance, bar) make the structure of equations visible: $x+6=11$  • Representing the solution to an equation on a number line prepares students to see solutions as locations and sets of values and extend from a single point (e.g., x = 7) to intervals of solutions (e.g., x > 7). • Avoid treating procedures and visual models in isolation. Students should connect representations to algebraic reasoning.	• Before performing symbolic steps, use models to predict what must be done to maintain equality, then connect that reasoning to inverse operations (SMP 7). • Determine which equation from a set represents a given context, or create a context for a given equation, and explain how the structure of the equation reflects the relationship in the situation (SMP 2). • Use number lines to reason about how operations affect quantities (e.g., shifting or scaling values), not just to plot final answers (SMP 7). • Analyze and critique reasoning that misinterprets the equal sign or disrupts equality (e.g., applying an operation to only one side), and explain how maintaining equality preserves the relationship in the equation (SMP 3). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Algebraic Thinking milestone in the Solving Equations & Inequalities strand of the Numeracy Development Framework.**

Previously 6.EE.B.7

6.AT.C.9 Write an inequality of the form $x > c$ (using $\geq$, $>$, $\leq$, $<$) to represent a constraint or condition in context. Recognize that inequalities of this form have infinitely many solutions; represent solutions of such inequalities on number lines.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Order rational numbers on a number line (6.NOS.C.6; 6.NOS.C.7). **Where are students going?** • Write and solve inequalities (6.AT.C.10; 7.AT.C.8). • Determine whether an equation or inequality represents a situation (7.AT.C.7).	• A foundational understanding is that the variable in an *inequality* represents a value that can vary within a range of possible values, which is different than an *equation*. • Number lines are an essential visual representation of the range of values a variable can take in an inequality. Note that open circles indicate values not included (e.g., x > 5); closed circles indicate values included (e.g., $x \geq 5$); arrows represent that the solutions extend infinitely in one direction. Example: You must be at least 60 inches to ride. $h \geq 60$  Example: The temperature must be below 70.2°F. $x < 70.2$  • Avoid treating the inequality as a procedural cue (e.g., “shade right for >”) without connecting direction to the meaning of the relationship.	• Generate situations that match given inequalities and justify how the structure of the inequality captures the condition (SMP 2). • Consider whether the solution set extending infinitely in one direction makes sense in the context and discuss how real-world constraints might limit or refine the range of possible values (SMP 4). • Use substitution to test multiple values and demonstrate that more than one value makes an inequality true (SMP 2, SMP 8). • Zoom in and out of number lines to reason about the density of numbers and make sense of why there are infinitely many solutions (SMP 7). • Analyze and critique incorrect representations or interpretations (e.g., shading the wrong direction or including/excluding the boundary incorrectly) and explain how they misrepresent the condition (SMP 3). • Interpret and use multiple ways to describe inequality relationships (e.g., “less than”, “no more than”, “at most”) and discuss how language connects to symbols to build fluency with mathematical vocabulary (SMP 6). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Algebraic Thinking milestone in the Creating Equations & Inequalities strand of the Numeracy Development Framework.**

Previously 6.EE.B.8

6.AT.C.10 Solve problems in context by writing and solving inequalities and interpreting solution sets in context.

a. **Explain that a variable can represent an unknown number in a set and use substitution to determine whether a given number in a set makes an inequality true.**
b. **Write and solve one-step inequalities of the form $x+p>q,\ x-p>q,\ px>q,\ and\ \frac{x}{p}>q$ (using ≥ , >, ≤ , <) where p and q are nonnegative rational numbers.**
c. **Represent solutions of such inequalities on a number line.**

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Writing and interpreting inequalities (6.AT.C.9). • Writing and solving equations (6.AT.C.8). **Where are students going?** • Write and solve inequalities of the form $px+q<r$ and $px+q>r$ (7.AT.C.8).	• This work extends and integrates students' understanding of one-step equations and simple inequalities. Students combine their ability to interpret and write inequalities from context and solving one-step equations to now write, solve, and interpret inequalities as solution sets. • In an inequality, a variable represents an unknown value within a set of possible values, and solving an inequality means identifying all values that satisfy the condition, not a single solution. • Solving one-step inequalities should be understood as maintaining the relationship between two quantities while isolating the variable, not treating it as the same as an equation. • Number line representations should emphasize the structure of solution sets. Students should understand that boundary points represent critical values where inclusion or exclusion must be reasoned. • Avoid treating solving inequalities as identical to solving equations which could lead students to focus on procedural steps without attending to how the inequality relationship is maintained and what the solution set represents.	• Leverage structure to anticipate solution sets before solving and reason about how operations (e.g., adding, multiplying) will affect the range of values that satisfy the inequality (SMP 1, SMP 7). • Model financial constraints (e.g., budgeting with limited funds) (SMP 4). • Use test values strategically around the boundary to determine and justify the solution set and explain how values just below and above the boundary confirm both the direction and inclusion of the interval (SMP 2). • Critique reasoning that misrepresents the inequality relationship, such as applying operations inconsistently or misinterpreting the boundary, and explain how these errors change the solution set (SMP 3, SMP 6). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Algebraic Thinking milestone in the Solving Equations & Inequalities strand of the Numeracy Development Framework.**

Adopted 2025

6.AT.D REPRESENT AND ANALYZE QUANTITATIVE RELATIONSHIPS BETWEEN DEPENDENT AND INDEPENDENT VARIABLES

6.AT.D.11 Use variables to represent two quantities in context that change in relationship to one another.

a. **Write an equation (one-step) to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable.**
b. **Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation (e.g., in a problem involving motion at constant speed, list and graph ordered pairs of distances and times and write the equation d = 65*t* to represent the relationship between distance and time).**

Content Progression	Examples and Clarifications	Students should have the opportunity to…

Where are students coming from?
• Generate and analyze two numerical patterns, form ordered pairs from corresponding terms, and represent them with tables and graphs (5.AT.B.3).
 	
Where are students going?
• Represent proportional relationships and explain what an ordered pair (x, y) represents (7.AT.A.3).
	• This is students' first formal experience with equations involving two variables, where variables represent quantities that vary in relation to one another, not just unknowns to be solved.
	• In Grade 6, relationships are limited to one-step structures, often reflecting an additive relationship (e.g., y = x + p) or multiplicative relationship (e.g., y = px).
	• Students should understand that identifying which variable is independent or dependent depends on the context and the question being asked, not on fixed rules (e.g., time is not always the independent variable).
	• Relationships should be understood across multiple connected representations. Students should connect these representations as describing the same independent/dependent relationship:
	  • Tables show specific pairs of related values
	  • Equations express the general/explicit rule
	  • The coordinate plane represents all ordered pairs that satisfy the relationship
	• Avoid focusing on graphing as only plotting points without interpreting the relationship.
		• Use ratio reasoning to explain relationships between quantities by connecting equivalent ratios to patterns in tables, straight-line graphs, and equations (SMP 2, SMP 7).
		• Analyze how changes in rate affect the relationship, and explain how those changes appear across tables, equations, and graphs (SMP 7, SMP 8).
		• Use representations to reason about values beyond those explicitly shown, including fractional or non-whole number inputs to reinforce that relationships apply continuously rather than only at listed points (SMP 2).
		• Develop and use precise language to describe how quantities vary, including repeated opportunities to articulate which quantity depends on the other (SMP 6).
		• **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Algebraic Thinking milestone in the Functional Reasoning strand of the Numeracy Development Framework.**

Previously 6.EE.C.9

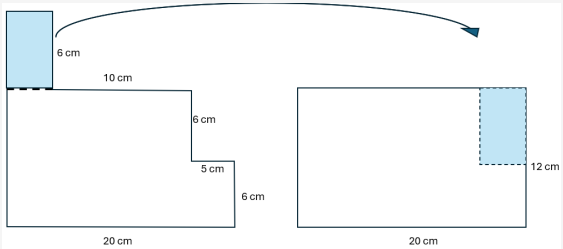
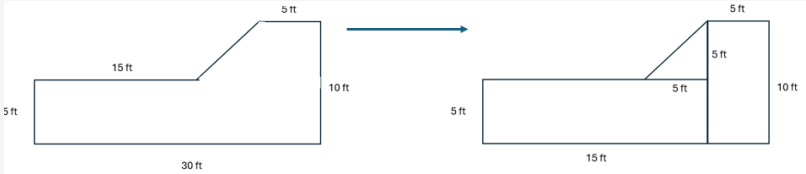
Geometric Reasoning and Measurement (GR)

Geometric Reasoning Clusters	Connections to the Numeracy Development Framework
6.GR.A Solve problems in context involving area, surface area, and volume.	Standards within this cluster **directly contribute*** to the Grade 6 Geometric Reasoning & Measurement milestones within **Reasoning with Geometric Structure** and **Spatial Reasoning strands** of the Numeracy Development Framework.

***Directly contribute to milestones**: The cluster includes content and practices that are *explicitly named within* an NDF milestone, meaning student proficiency with this cluster demonstrates attainment of that milestone.
****Contribute to milestones**: The cluster builds prerequisite knowledge, skills, or ways of reasoning that *support progress toward* a milestone in the NDF, even if the milestone itself is not fully realized at this stage.

6.GR.A SOLVE PROBLEMS IN CONTEXT INVOLVING AREA, SURFACE AREA, AND VOLUME.

6.GR.A.1: Find the area of triangles, quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and quadrilaterals to solve problems.

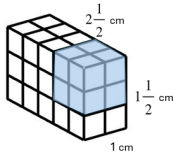
Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Find the area of rectangles (4.GR.A.3). • Relate the area of a triangle to the area of a rectangle (4.GR.A.4). • Multiple a fraction or whole number by a fraction (5.NOS.D.11). **Where are students going?** • Solve problems involving scale drawings of geometric figures (7.GR.A.1). • Solve problems involving area and surface area of polygonal figures (7.GR.B.4a).	• Area is understood as the measure of space inside a two-dimensional figure and should be developed through reasoning about composition and decomposition, **not applying formulas**. • Finding area by composing (emphasizing transforming a figure into a known shape):  • Finding area by decomposing (emphasizing breaking a figure into manageable pieces):  • Decomposition should be flexible and strategic, with multiple valid ways to break apart a figure depending on what is most efficient or meaningful.	• Choose between composing and decomposing based on the structure of the figure and explain why a specific approach was taken (SMP 1, SMP 3). • Compare and contrast multiple ways of composing or decomposing the same figure and use these comparisons to develop flexible ways of seeing and reasoning about polygons (SMP 3, SMP 7). • Extend prior understanding of area across shapes, using known areas to reason about more complex polygons (SMP 8). • Reason about base and height by identifying and justifying appropriate base-height pairs and explaining how different choices impact the decomposition or composition strategy (SMP 6). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Geometric Reasoning & Measurement milestone in the Reasoning with Geometric Structure strand of the Numeracy Development Framework.**

Previously 6.G.A.1

6.GR.A.2: Find the volume of a right rectangular prism with fractional edge lengths.

a. **By packing prisms with unit cubes and using estimation to show that the volume can be found by multiplying the edge lengths of the prism.**
b. **Apply the formulas $V=lwh$ and $V=B\cdot h$ (B is the area of the base) to find the volumes of right rectangular prisms with fractional edge lengths in context.**

Content Progression	Examples and Clarifications	Students should have the opportunity to...

Where are students coming from?
• Find the volume of right rectangular prisms with whole-number side lengths (5.GR.C.5).
Where are students going?
• Solve problems involving the volume of both polyhedral solids and solids with curved surfaces (7.GR.B.4).
	• Volume is understood as the measure of space inside a three-dimensional figure and should be developed through reasoning about units and structure, not formulas.
	• Students build on prior work with whole-number dimensions by extending to fractional edge lengths, while still grounding their reasoning in unit cubes.
	For example: A prism with a length such $2\frac{1}{2}$ units can be viewed as being filled with unit cubes that have edge length $\frac{1}{2}$. Each of these cubes represents a fraction of a cubic unit, while the total volume is still measured in cubic units.
	 
	
	• The formulas $V=lwh$ and $V=B\cdot h$ should be understood as generalizations of this structure:
	  • $V=lwh$: counting cubes across three dimensions
	  • $V=B\cdot h$: viewing volume as layers of area stacked vertically
	• Students should interpret volume in context, including what the units represent (cubic units) and how the dimensions relate to the space being filled.
		• Repartition a prism in multiple ways, compare the resulting counts, and explain how changing the size of the cubes (e.g., halves vs. wholes) changes the count but not the total volume (SMP 7).
		• Model and interpret volume in real-world spaces (e.g., containers, rooms) and explain how the volume represents the space being filled (SMP 4).
		• Use benchmark volumes to bound and justify results through reasoning that a prism must have a volume between two known values (e.g., between volumes of nearby whole-number prisms) (SMP 1, SMP 6).
		• Critique and refine reasoning about units, including identifying when reasoning incorrectly treats linear units as cubic units or misinterprets what a "unit cube" represents (SMP 3).

Previously 6.G.A.2

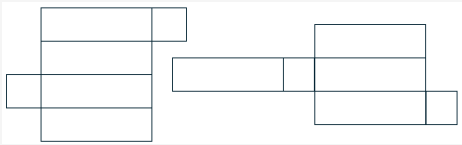
6.GR.A.3: Draw polygons in the Coordinate Plane given coordinates for the vertices; use coordinates to find the length of a side joining endpoints with the same first coordinate or the same second coordinate. Apply these techniques in context.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Represent contexts by plotting points in the first quadrant of the coordinate plane (5.GR.D.7). • Calculate vertical and horizontal length in the coordinate plane (6.NOS.C.9). **Where are students going?** • Use the Pythagorean Theorem to find the distance between two points in the coordinate plane (8.GR.B.5b). • Describe the effects of dilations on two-dimensional figures using coordinates (IA2.GR.A.1).	• This work builds on understanding of the coordinate plane as a representation of numerical relationship, and where movement along axes corresponds to changes in values. • Distance is understood as the absolute difference between coordinates, not just subtraction (i.e., length must be positive and represent magnitude). • Horizontal and vertical distances are determined by isolating change in a single coordinate which reinforces that horizontal change depends only on change in x and vertical change depends only on change in y. • The order in which vertices are connected matters, as it determines the shape being formed.	• Anticipate distances and the structure of a shape before plotting by reasoning from the coordinates to predict horizontal and vertical side lengths and how the polygon will be formed (SMP 1). • Reconstruct missing vertices of a polygon given partial information by using coordinate relationships (same x or same y) and known side lengths to determine unknown points (SMP 2, SMP 7). • Use coordinate reasoning to design a polygon that meets given conditions, such as specified side lengths, and justify how the coordinates satisfy those constraints (SMP 3, SMP 4). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Geometric Reasoning & Measurement milestone in the Spatial Reasoning strand of the Numeracy Development Framework.**

Previously 6.G.A.3

6.GR.A.4: Represent three-dimensional figures (triangular prism, rectangular prism, pyramid) using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures to solve problems.

Content Progression	Examples and Clarifications	Students should have the opportunity to...

Where are students coming from?
• Find areas through composition and decomposition (6.GR.A.1).
Where are students going?
• Solve problems involving surface area of polygonal figures (7.GR.B.4a).
	• Surface area is understood as the total area of all faces of a three-dimensional figure and is developed through reasoning about how a solid can be unfolded into a net.
	• Nets represent a two-dimensional decomposition of a three-dimensional figure, where each face of the solid corresponds to a region in the plane:
	  • Rectangular prisms → rectangles
	  • Triangular prisms → rectangles and triangles
	  • Pyramids → a base and triangular faces
	• Students should use visual and physical models of nets (e.g., drawings, manipulatives, digital tools) to reason about how solids' surfaces are structured.
	• Students should attend to the structure of the solid, including the number and types of faces, and how edges connect faces, so nets accurately represent the solid and all surfaces are accounted for.
	• Avoid teaching nets as having only one correct arrangement, without acknowledging that while some figures may have limited options, many solids can be represented by multiple valid nets.
	 
		• Compare valid and invalid nets and explain why some arrangements do or do not form the intended solid (SMP 3).
		• Analyze how changes to a net (e.g., rearranging faces, altering dimensions) impact the resulting solid or its surface area by connecting two-dimensional changes to three-dimensional structure (SMP 7, SMP 8).
		• Design a net to meet given constraints (e.g., surface area or face dimensions) and justify how it will form the intended solid (SMP 4).
		• Apply nets and surface area to contexts involving covering, designing, or constructing three-dimensional objects. Students should determine which faces are included and use the net to justify how much material is needed (SMP 1, SMP 4).
		• **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Geometric Reasoning & Measurement milestone in the Reasoning with Geometric Structure strand of the Numeracy Development Framework.**

Previously 6.G.A.4

Reasoning with Data, Statistics, and Probability (DS)

Reasoning with Data and Statistics Clusters	Connections to the Numeracy Development Framework
6.DS.A Extend understanding of statistical variability.	Standards within this cluster **directly contribute*** to the Grade 6 Reasoning with Data, Statistics, and Probability milestones within the **Collecting & Representing Data** and **Reasoning with Probability strands** of the Numeracy Development Framework. They **contribute**** to the Grade 6 Reasoning with Data, Statistics, and Probability milestones within the **Collecting & Representing Data** and **Interpreting & Analyzing Data strands** of the Numeracy Development Framework.
6.DS.B Summarize and describe distributions.	Standards within this cluster **directly contribute*** to the Grade 6 Reasoning with Data, Statistics, and Probability milestones within the **Collecting & Representing Data** and **Interpreting & Analyzing Data strands** of the Numeracy Development Framework.

***Directly contribute to milestones**: The cluster includes content and practices that are *explicitly named within* an NDF milestone, meaning student proficiency with this cluster demonstrates attainment of that milestone.
****Contribute to milestones**: The cluster builds prerequisite knowledge, skills, or ways of reasoning that *support progress toward* a milestone in the NDF, even if the milestone itself is not fully realized at this stage.

6.DS.A EXTEND UNDERSTANDING OF STATISTICAL VARIABILITY.

6.DS.A.1: Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answers (e.g., "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).

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? • Summarize data and evaluate accuracy of data visualizations (5.DS.A.1) **Where are students going?** • Decide whether a sample is representative of a population (7.DS.A.1a).	• A statistical question is defined not just by involving a group, but by producing a set of values that vary and must be interpreted collectively. • Variability is not just that values are different, but that the question is designed to capture and make sense of those differences. • Students should recognize that statistical questions eventually require interpretation of patterns in the data, not just reporting results. • Avoid framing statistical questions in a way that still leads to a single expected answer (e.g., “What is the average height of students in this class?” vs. “How do the heights of students in this class vary?”), which undermines the need to analyze variation and can cause students to treat statistical inquiry as answer-getting rather than sense-making.	• Compare questions within the same context to identify how small changes in wording shift a question from non-statistical to statistical by focusing on how variability is introduced (SMP 3, SMP 6). • Revise questions to intentionally introduce or remove variability and explain how changes in scope or population impact whether the question is statistical (SMP 2, SMP 6). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Reasoning with Data, Statistics, & Probability milestone in the Collecting & Representing Data strand of the Numeracy Development Framework.**

Previously 6.SP.A.1

6.DS.A.2: Use the language of probability (e.g., likely, unlikely, certain, impossible) to describe the likelihood of possible outcomes and to anticipate variability in data collected from statistical questions. Explain how the likelihood of outcomes helps predict which responses may be more or less common in the data and justify predictions using probability terms.

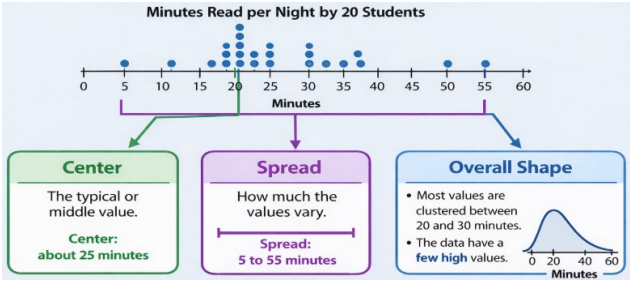
Content Progression	Examples and Clarifications	Students should have the opportunity to...

Where are students coming from?
• Interpret data visualizations and key features (e.g., mode, range) to draw conclusions, determine whether statements about what typically occurs or how often outcomes occur are reasonable (5.DS.A.1).
Where are students going?
• Interpret probabilities on a 0-1 scale, where 0 indicates impossible and 1 indicates certain (7.DS.C.4).
	• This work continues developing the connection between probability and statistics informally started in prior grades by using the language of probability to more formally anticipate variability in data.
	• Probability is about reasoned expectations, not certainty:
	  • Likelihood describes what tends to happen across many outcomes, not what will happen in a single case.
	  • Even unlikely events can occur, and likely events may not occur in small samples.
	• Predictions must be grounded in context and knowledge of the situation.
	• Avoid using probability language without connecting it to expected patterns in data which could lead students to treat terms like “likely” or “unlikely” as subjective opinions rather than reasoned predictions about how outcomes will occur across many responses.
		• Use probability language to make and justify predictions about which outcomes will be more or less likely for a posed statistical question before collecting data (SMP 2).
		• Use probability language to compare multiple predictions and evaluate which are more reasonable (SMP 3).
		• **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Reasoning with Data, Statistics, & Probability milestone in the Reasoning with Probability strand of the Numeracy Development Framework.**

Adopted 2025

6.DS.A.3: Explain how a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

Content Progression	Examples and Clarifications	Students should have the opportunity to...

Where are students coming from?
• Summarize data presented in visualizations using mode, range, and gaps in data (5.DS.A.1b).
Where are students going?
• Interpret and summarize numerical data sets (6.DS.B.5; 6.DS.B.6).
	• A set of data collected to answer a statistical question forms a distribution, meaning the data should be viewed as a whole set of values with patterns, not just individual points.
	• Distributions can be described by:
	  • Center: a typical or representative value
	  • Spread: how much the values vary
	  • Overall shape: how the values are arranged (e.g., clustered, spread out, gaps)
	 
	
	• Students should understand that different data sets can have similar centers but different spreads or shapes and that the usefulness of a summary depends on how well it represents the distribution.
	• This work lays the foundation for more formal measures without requiring full formalization at this stage.
	• Avoid using informal descriptions of shape (e.g., “looks like a hill”) without connecting them to what the arrangement of values means in context.
		• Describe how center, spread, and overall shape work *together* to characterize a data set and explain why no single feature alone is sufficient to understand the distribution (SMP 2).
		• Match data sets to descriptions and justify how features like clustering, gaps, and range align with center, spread, and overall shape (SMP 2, SMP 4).
		• Reason about how adding, removing, or changing values affects the distribution (SMP 2).

Previously 6.SP.A.2

6.DS.A.4: Recognize that a measure of center (median and/or mean) for a numerical data set summarizes all the values with a single number, while a measure of variation describes how its values vary with a single number.

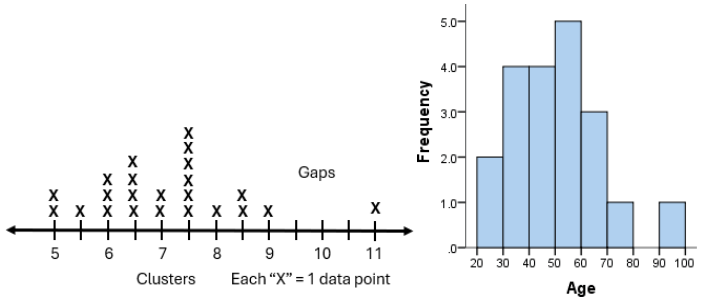
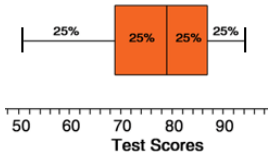
Content Progression	Examples and Clarifications	Students should have the opportunity to...

Where are students coming from?
• Use center, spread, and overall shape to describe a data set (6.DS.A.3).
Where are students going?
• Summarize data sets using measures of center (6.DS.B.6c; 7.DS.B.3b).
	• Students should understand that these measures allow data to be communicated more efficiently in a standardized way.
	• A measure of center answers: "What is a typical value?"
	• A measure of variation answers: "How much do the values vary?"
	• No single number can fully describe a data set. Students should consider that considering center and variation together improves their interpretation of a data set.
	• This work builds conceptual understanding of these measures before formal computation and emphasizes their purpose and meaning in context.
	Example:
	  • Center only: Two classes have an average test score of 80.
	  • Adding variation: one class has scores tightly clustered near 80, while the other has scores ranging from 50 to 100 (same center, different variation).
	  • Interpretations: "A typical value is about 80, but the scores vary widely" and "Scores are consistently around 80"
		• Distinguish between describing center and describing variation, and explain how each provides different information about the same data set (SMP 2).
		• Compare data sets using descriptions of center and variation and explain how similar summaries can still represent very different situations (SMP 7).
		• Analyze data reports or claims and determine whether the information provided (e.g., only average) is sufficient to understand the data and what additional information is needed (SMP 3).
		• Identify misconceptions about "typical value," such as assuming all values are close to the center, and explain how variation affects what "typical" actually means (SMP 6).

Previously 6.SP.A.3

6.DS.B SUMMARIZE AND DESCRIBE DISTRIBUTIONS

6.DS.B.5: Interpret numerical data in plots on a number line, including line plots, histograms, and box plots.

Content Progression	Examples and Clarifications	Students should have the opportunity to…
Where are students coming from? • Interpret bar graphs, circle graphs, line plots, and line graphs (5.DS.A.1). **Where are students going?** • Use histograms and other data visualizations to compare two numerical data distributions (7.DS.B.3a).	• Student focus on interpreting data displays rather than constructing them. • Each type of display highlights different aspects of the data: Line plots show individual data values in smaller data sets and their frequency; Histograms group larger data sets into intervals (bins) and show how many values fall within ranges  Box plots summarize data using quartiles and divide the data set into four equal groups  • Interpretation should focus on center, spread, clusters, gaps, and concentrations of data. • Students should be able to connect a data set to an appropriate representation and recognize how the same data appears differently across displays.	• Match data sets to their corresponding representations (SMP 4). • Interpret how grouping data into intervals changes what is visible and explain how histograms highlight patterns in ways that are more effective for larger data sets (SMP 2). • Reason about equal groups in box plots and explain that each section represents the same number of data points even when the visual lengths differ (SMP 2, SMP 6). • Identify and critique common misinterpretations (e.g., treating histogram bars as individual values, interpreting box plot sections by length instead of proportion) (SMP 3, SMP 6). • Connect multiple representations of the same data set and explain how key features appear in a line plot, histogram, and box plot, and what each representation makes more or less visible (SMP 2). • **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Reasoning with Data, Statistics, & Probability milestone in the Collecting & Representing Data strand of the Numeracy Development Framework.**

Previously 6.SP.B.4

6.DS.B.6: Summarize numerical data sets in relation to their context.

a. **Report the number of observations.**
b. **Describe the nature of the attribute under investigation, including how it was measured and its units of measurement.**
c. **Give quantitative measures of center (median and/or mean) and variability (interquartile range), as well as describing outliers with reference to the context in which the data were gathered.**
d. **Relate the choice of measures of center and variability to the shape of the data distribution and the context in which the data were gathered.**

Content Progression	Examples and Clarifications	Students should have the opportunity to…

Where are students coming from?
• Summarize data sets using mode, range, and gaps (5.DS.A.1b).
Where are students going?
• Use mean/median and range/interquartile range to compare two data sets (7.DS.B.3b).
	• Summary interpretations of data should *integrate:* number of operations; attribute and measurement; center; variability; outliers.
	• The mean reflects a "fair share" or balance point while the median reflects the middle value and is less affected by extreme values (i.e., outliers).
	• Students should recognize that the choice of measure (mean vs. median) depends on the shape of the distribution and/or the presence of outliers.
	• Outliers should be:
	  • Identified and described in context
	  • Potentially removed (depending on interpretation), but always considered when interpreting the data
	  • Formal calculations rules can be introduced informally through Interquartile Range (IQR), but emphasis should remain on interpretation rather than procedure
	• Students should connect numerical summaries to representations (e.g., box plots, histograms), using technology to generate visualizations and explaining how the representation supports their interpretation.
		• Analyze how outliers influence measures of center and variability and make connections to how data sets are interpreted (SMP 2).
		• Use technology to generate and interpret data displays to support summaries (SMP 5).
		• Engage in discourse to compare and refine interpretations of the same data set by using evidence (e.g., center, variability, outliers, context) to support claims and respond to differing conclusions about what the data shows (SMP 3, SMP 6).
		• **Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 6 Reasoning with Data, Statistics, & Probability milestone in the Interpreting & Analyzing Data strand of the Numeracy Development Framework.**

Previously 6.SP.B.5

Provide Feedback

Your feedback is essential in helping us understand how these resources are being used, their effectiveness in supporting instruction, and how they can be improved to better serve educators, students, and stakeholders across the state. If you are interested in providing feedback, please completed the Feedback: PreK-8 Mathematics Standards Companion Guide survey.

The survey includes general questions about your overall impressions of the companion guides, as well as opportunities to provide grade-level specific feedback. Your responses will inform future revisions and professional learning efforts to ensure the guides are clear, useful, and aligned with the needs of Maryland's diverse learning communities.