



Grade 8

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.

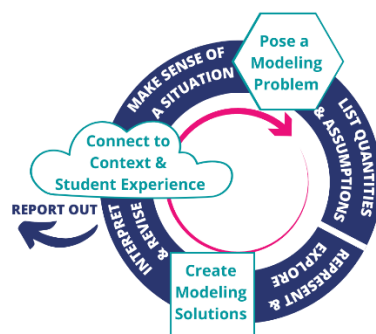
Standard for Mathematical Practice	What does it look like for middle school students?	How can middle school teachers support this practice?
Model with mathematics (SMP 4)	Students pose relational or “what if...?” questions (“What happens if the rate changes?”, “When will they be equal?”, “How long until...?”). 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 8 represents a culminating year in students' middle school numeracy development, as students consolidate prior quantitative reasoning and extend it into more formal algebraic, geometric, and statistical ways of representing and analyzing relationships. Across domains, students connect representations, reason about relationships among quantities, and interpret models in context, which prepares them for the transition to Integrated Algebra.

Within Number & Operation Sense, students reason about magnitude and scale by expressing very large and very small numbers using scientific notation. They apply properties of exponents to generate equivalent expressions and use rational approximations of irrational numbers to estimate values and judge reasonableness which strengthens numerical sense-making.

In Algebraic Thinking, students extend proportional reasoning into linear and functional representations. They model contexts using linear equations, systems, tables, graphs, and descriptions; solve systems by graphing and substitution; and interpret solutions in context. Students determine whether relationships are functions, identify rate of change and initial value, and write linear functions to model relationships. They also describe how nonlinear relationships differ from linear ones.

Geometric Reasoning and Measurement centers on the Pythagorean Theorem as a key relationship in right triangles. Students apply the theorem to find unknown side lengths in right triangles and connect geometric relationships to algebraic representations. They also use angle relationship classifications (supplementary, complementary, vertical, and adjacent) and the triangle angle-sum relationship to find missing angle measures and determine whether triangles can be formed from given conditions. This reinforces deductive reasoning about shape and structure.

In Reasoning with Data, Statistics, and Probability, students extend proportional and relative reasoning to analyze associations and likelihoods. They represent bivariate measurement data with scatter plots, use linear models to analyze associations and make predictions, and organize data from two categorical variables using two-way tables. Students also model sample spaces for compound events and determine probabilities, using relative comparisons to interpret results in context.

The developmental milestones identified in the [Numeracy Development Framework](#) for Grade 8 reflect an integration of numerical, algebraic, geometric, and statistical reasoning. This companion document highlights how these milestones align with Grade 8 standards and identifies the ideas most critical to monitor as students prepare for Integrated Algebra and more advanced mathematical study.

Number and Operation Sense (NOS)

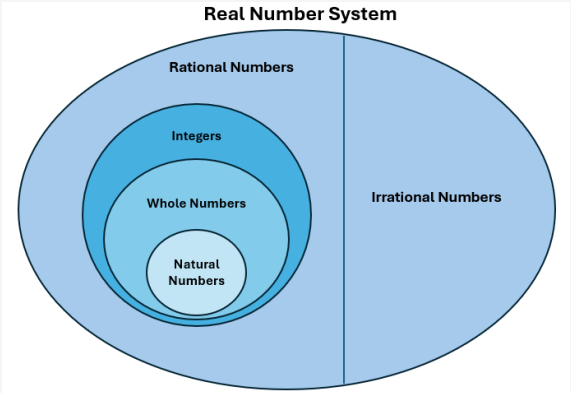
Number and Operation Sense (NOS) Clusters	Connections to the Numeracy Development Framework
8.NOS.A Reason with irrational numbers.	A standard within this cluster directly contributes* to a Grade 8 Number and Operation Sense milestone within the Estimation strand of the Numeracy Development Framework.
8.NOS.B Reason with exponents to express and interpret quantities.	Standards within this cluster directly contribute* to Grade 8 Number and Operation Sense milestones within the Numbers & Number Sets and Operations 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.

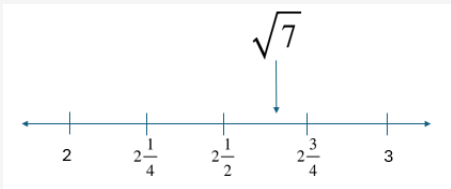
8.NOS.A REASON WITH IRRATIONAL NUMBERS.

8.NOS.A.1: Identify a number as irrational when its decimal expansion neither terminates nor repeats, and explain that irrational numbers cannot be expressed as the ratio of two integers.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Solve problems involving rational numbers in any form (7.NOS.A.3). - Apply formulas for area and circumference of circles (7.GR.B.3). Where are students going? - Expanding number systems to include complex numbers (IA2.NOS.B.2).	- This standard highlights the expansion of the Real Number system. Students should recognize that number systems in mathematics build on one another: whole numbers expand to integers, then to rational numbers. Irrational numbers are distinct from rational numbers, but together they complete the Real Number system. This progression illustrates a central feature of mathematics: new contexts often require expanding existing systems to encompass broader ideas.  - Students are not expected to write a repeating decimal as a fraction. - Avoid presenting irrational numbers only as “mystery numbers” like π, without showing that they arise naturally (e.g., from diagonal of a unit square).	- Participate in a conceptual proof of the existence of irrational numbers, such as using the diagonal of a unit square to show that its length is $\sqrt{2}$ and cannot be written as a ratio of integers (SMP 3). - Classify numbers within the Real Number System by placing them into the nested categories (see diagram) and explaining why each fits (SMP 6, SMP 7). - Critique misconceptions such as any non-termination (e.g., 0.3333...) is irrational, all square roots are irrational, irrational numbers are “rare” or “less important”, or not recognizing nesting of sets (e.g., integers are separate from rational numbers) (SMP 3, SMP 6).

Previously 8.NS.A.1

8.NOS.A.2: Use rational approximations of irrational numbers to estimate their locations on a number line, compare their size, and apply this understanding to estimate the value of expressions (e.g., π^2) in context.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Identify irrational numbers (8.NOS.A.1). Where are students going? - Use the Pythagorean Theorem to solve problems (8.GR.B.5). - Expanding number systems to include complex numbers (IA2.NOS.B.2).	- This standard builds on students' prior experience of locating numbers on a number line, and extends to show that both rational and irrational numbers are infinitely many and densely distributed along the line (i.e., between 2 and 4, the number 3 can be found; between 3.0 and 3.2, the number 3.13 can be found; between 3.13 and 3.14, the number 3.134 can be found, etc.). - Students are expected to recognize that irrational numbers cannot be expressed exactly so their placement on a number line is always estimated relative to rational benchmarks.  - For decimal approximations, the expectation of this standard is that students will compare irrational numbers to at least the hundredths place on a number line. - Avoid treating irrational approximations as exact value.(e.g., writing $\sqrt{2} = 1.41$)	- Order rational and irrational numbers together on a number line (SMP 6). - Participate in iterative narrowing of estimates for irrational numbers, and explain how repeated refinement increases precision but never reaches exactness (SMP 1, SMP 8). - Represent contexts mathematically where irrational approximations are needed (SMP 4). - Compare the impact of different approximations on computations to reason about precision, error, and appropriateness (SMP 6). - Engage with the concept of infinity and the density property (informally) by reasoning that between any two rational numbers there are infinitely many irrationals (and vice versa), and discussing what this means for the completeness of the number line (SMP 7). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Number & Operation Sense milestone in the Estimation strand of the Numeracy Development Framework.

Previously 8.NS.A.2

8.NOS.B REASON WITH EXPONENTS TO EXPRESS AND INTERPRET QUANTITIES.**8.NOS.B.3: Know and apply the properties of integer exponents to generate equivalent numerical expressions.**

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Write expressions with whole-number exponents and positive rational bases (6.AT.B.5). Where are students going? - Use scientific notation to represent and compare very large or small numbers (8.NOS.B.5). - Rewrite exponential expressions to reveal key properties of relationships (IA1.AT.A.1).	- Students have been writing whole-number powers of 10 in exponential form since Grade 5, and they have seen the pattern that multiplying powers of 10 adds the exponents (i.e., $10^a \times 10^b = 10^{a+b}$). Extending this rule leads to the definition for zero and negative exponents. To keep $10^a \times 10^0 = 10^{a+0} = 10^a$, we must define $10^0 = 1$. Similarly, $10^{-1} = \frac{1}{10}$ follows from continuing the same pattern. $10^2 \times 10^{-5} = 10^{-3} = \frac{1}{10^3} = \frac{1}{1000}$ - Expressions should include exploration of base 10, but also extend to additional bases. Bases should be consistent within an expression and not mixed. (e.g., $2^4 \times 2^3 = 2^{4+3} = 2^7$) - Avoid skipping conceptual explorations and explanations for zero and negative exponents, which are often sources of misconception.	- Use technology to explore patterns with exponents, especially zero and negative exponents, to make conjectures before rules are formalized (SMP 5, SMP 8). - Explore contexts where exponent properties naturally arise. \$ - Critique misconceptions (e.g., “$a^0=0$” or “negative exponents make numbers negative”) and provide mathematically valid alternatives with explanation (SMP 3). - Connect multiple representations (e.g., algebraic rules, patterns in numerical examples, and contextual applications) to reinforce that the exponent properties are consistent, coherent, and broadly applicable (SMP 2, SMP 7). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Number & Operation Sense milestones in the Estimation strand of the Numeracy Development Framework.

Previously 8.EE.A.1

8.NOS.B.4: Use square and cube roots to represent solutions to equations and describe numbers.

- a. Use square and cube roots symbols to represent solutions to equations of the form $x^2=p$ and $x^3=p$, where p is a positive rational number.
- b. Evaluate square roots of perfect squares from 1 to 100 and cube roots of perfect cubes from 1 to 125 by inspection.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Write and solve one-step and two-step equations (6.AT.C.8; 7.AT.C.8). Where are students going? - Use Pythagorean Theorem to find unknown side lengths (8.GR.B.5). - Solve quadratic equations (IA2.AT.B.4).	- Students should understand that: - A square root of a positive number p is a value, when multiplied by itself, results in p, and that equations of the form $x^2=p$ have two solutions, positive and negative. - A cube root of a number p is a value, when multiplied by itself three times, results in p, and, and equations in the form $x^3=p$ have a single real solution, which may be negative. - Squaring and taking a square root are inverse operations, just as cubing and taking cube roots are inverse operations - If $x^2=36$, then $x=\sqrt{36}=6$ or $x=-\sqrt{36}=-6$ - Equations should include those with irrational number solutions (e.g., the solution for $x^2=14$ would include $x=\pm\sqrt{14}$)	- Find and analyze patterns in perfect squares and perfect cubes and note regularities in growth and structure (SMP 7, SMP 8). - Solve contextual/conceptual problems by connecting roots to geometry, such as finding the side length of square from its area or a cube from its volume. Explicit attention should be given to writing equations that represent these situations, explaining solution strategies, and discussing when solutions are rational or irrational (SMP 2, SMP 4, SMP 6). (Van de Walle, et al., 2019)

Previously 8.EE.A.2

8.NOS.B.5: Apply scientific notation to represent and compare very large and very small quantities in context, and use technology to compute with numbers in scientific notation.

- Express numbers as a single digit times an integer power of 10 to estimate and compare magnitudes.
- Use scientific notation to model and compute with real-world quantities, choose appropriate units, and interpret their meaning based on the context.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Multiply and divide by powers of 10 and use exponents (5.NOS.A.2). - Apply properties of exponents to rewrite expressions (8.NOS.B.3). Where are students going? - Students will apply scientific notation in fields like physics, astronomy, and chemistry, and in data-driven mathematics.	- The focus is on strengthening students' understanding of how exponents represent place value and scale in powers of 10, so that comparisons of very large or very small numbers are clearer and more meaningful. The population of one country is approximately 300,000,000 (or 3×10^8) and another country's population is approximately 300,000 (or 3×10^5). So the first country's population is $\frac{10^8}{10^5} = 10^3$ times larger. - The emphasis is on reasoning about what the numbers mean, not on carrying out calculations. Students use technology to compute with these numbers and interpret the results in context and make sense of units. A cell phone signal travels at approximately 3.0×10^8 meters per second. The signal reaches a tower in 2.4×10^{-3} seconds, how far does it go? Using technology, students compute: $(3.0 \times 10^8) \times (2.4 \times 10^{-3}) = 7.2 \times 10^5$ meters. They interpret the result as 720,000 meters, or 720 kilometers, and explain that kilometers are a more appropriate unit for describing long-distance signal transmission. - Avoid separating the use of scientific notation from contextual applications.	- Use contexts (e.g., astronomy, biology, technology) to interpret the scale and meaning of quantities expressed in scientific notation (SMP 4). - Justify when scientific notation is or is not appropriate to use when modeling and solving problems (SMP 1, SMP 3). - Use a variety of technology tools to compute with numbers in scientific notation and interpret results in context (SMP 5). - Explain how scientific notation can highlight scale more clearly than standard form (SMP 2). - Formulate questions that require scientific notation (e.g., "How many times could a piece of paper be folded before its thickness exceeds the height of a building?") and model them mathematically (SMP 4). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Number & Operation Sense milestones in the Number & Number Sets strand of the Numeracy Development Framework.

Previously 8.EE.A.3

Algebraic Thinking (AT)

Algebraic Thinking (AT) Clusters	Connections to the Numeracy Development Framework
8.AT.A Use proportional relationships to represent and reason about linear equations.	Standards within this cluster contribute** to the Grade 8 Algebraic Thinking milestones within the Proportional Reasoning strand of the Numeracy Development Framework.
8.AT.B Make sense of and solve equations, inequalities, and systems of equations.	Standards within this cluster directly contribute* to the Grade 8 Algebraic Thinking milestones within Creating Equations & Inequalities and Solving Equations & Inequalities strands of the Numeracy Development Framework.
8.AT.C Reason about functions.	Standards within this cluster directly contribute* to the Grade 8 Algebraic Thinking milestones within Functional Reasoning and Proportional Reasoning strands of the Numeracy Development Framework.
8.AT.D Model with functions.	A standard within this cluster directly contributes* to the Grade 8 Algebraic Thinking milestones within the Proportional 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.

8.AT.A USE PROPORTIONAL RELATIONSHIPS TO REPRESENT AND REASON ABOUT LINEAR EQUATIONS.**8.AT.A.1 Analyze and compare proportional relationships using slope.**

- Graph proportional relationships and interpret the unit rate as the slope of the graph.**
- Compare proportional relationships represented in different forms (e.g., graphs, equations, and tables) by analyzing their slopes.**

Content Progression	Examples and Clarifications	Students should have the opportunity to...												
Where are students coming from? Identify and represent proportional relationships between quantities (7.AT.A.2; 7.AT.A.3)	- The focus is on building from prior work with proportional relationships and unit rates, and extending this to the graphical concept of slope; the bridge from ratios to formal work with linear equations. - Students should understand slope as the unit rate, constant of proportionality, and as the steepness of the graph. Three cars are traveling at a constant speed on a highway. Car B Time vs. Distance <table><thead><tr><th>Time (hours)</th><th>Distance (miles)</th></tr></thead><tbody><tr><td>0</td><td>0</td></tr><tr><td>1</td><td>45</td></tr><tr><td>2</td><td>90</td></tr><tr><td>3</td><td>135</td></tr><tr><td>4</td><td>180</td></tr></tbody></table> Car A: Distance vs. Time Car C: $d = 75t$	Time (hours)	Distance (miles)	0	0	1	45	2	90	3	135	4	180	- Discuss slope as a unifying idea that connects unit rate, constant of proportionality, and the steepness of a line across representations (SMP 2, SMP 7). - Formulate their own contextual problems and represent them with tables, graphs, and equations and interpret slope as the rate of change in the context with appropriate units (SMP 4). - Compare slopes from different representations of the same relationship and explain why they are consistent (SMP 8). - Critique misconceptions, such as thinking “steeper always means faster” without attending to units, or misidentifying non-origin lines as proportional (SMP 3, SMP 6).
Time (hours)	Distance (miles)													
0	0													
1	45													
2	90													
3	135													
4	180													
Where are students going? - Compare properties of two linear functions represented in different ways (8.AT.C.7). - Use slopes of segments and coordinates of vertices to solve problems involving polygons (IA1.GR.B.4; IA1.GR.B.5).	- Instruction should emphasize coherence across representations (tables, graphs, equations, contexts) when comparing relationships. - Avoid superficial statements such as “Line A is steeper” without interpreting what the steepness represents in the situation. Comparisons of slope should always be grounded in context.													

Previously 8.EE.B.5

8.AT.A.2 Use proportional reasoning to identify slope and represent linear relationships.

- a. Use proportional reasoning to explain why the slope m is the same between any two points on a non-vertical line by showing that the ratios of vertical change to horizontal change between points are equivalent.
- b. Use this relationship to write equations of lines in the form $y=mx$ for lines that pass through the origin, and in the form $y=mx+b$ for lines that include a vertical shift from the origin, where b represents the y-intercept.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Identify proportional relationships and constant rates and recognize that proportional graphs are straight lines through the origin (7.AT.A.2). Where are students going? - Students will model and solve contextual problems using linear and exponential equations (IA1.AT.B.4).	- The focus is on showing that, just as the constant of proportionality stays the same in proportional relationships, the slope remains the same between any two points on a line. This consistency translates to equations of lines: if the slope does not change, the only difference between lines is the starting value, represented by the y-intercept. 8.AT.A.2a: Students graph the points (2, 4), (4, 8), and (6, 12) on a coordinate plane and connect them with a straight line. They find that between any two points on the line, the ratio of vertical change to horizontal change is the same: 2. Students explain that because each segment on the line shows the same proportional change, the slope stays constant. This confirms that linear relationships have a constant rate of change represented by the same slope between any two points. 8.AT.A.2b: Students are told that a proportional relationship is represented by a line that passes through the origin and the point (4, 10). They calculate the slope as 2.5 and write the equation $y=2.5x$. Then, they are told another line with the same slope passes through (4, 12). They reason that this new line would have moved 2 units up and thus write the equation as $y=2.5x+2$	- Engage in discovery activities to conjecture about b representing the y-intercept and m representing the slope, then test and refine these ideas (SMP 3, SMP 8). - Write equations for lines given points, tables, or graphs, and justify the form (both $y=mx$ or $y=mx+b$) based on whether or not the line passes through the origin (SMP 1). - Describe and connect slope and y-intercept across representations, explaining how m and b appear in the graph (steepness, intercept) and in the equation (SMP 4). - Explain verbally and in writing how proportional relationships, lines through the origin ($y=mx$), and more general linear equations ($y=mx+b$) are related and different (SMP 2, SMP 7).

Previously 8.EE.B.6

8.AT.B MAKE SENSE OF AND SOLVE EQUATIONS, INEQUALITIES, AND SYSTEMS OF EQUATIONS**8.AT.B.3 Solve linear equations in one variable.**

- Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solution. Justify each example by showing how it can be rewritten in an equivalent equation in the form $x=a$, $a=a$, or $a=b$ (where a and b are different rational numbers) and explaining what this form reveals about the solution.
- Solve linear equations in one variable with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and combining like terms.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Create and solve equations of the form $px + q = r$ and $p(x + q) = r$ (7.AT.C.8). Where are students going? - Solve systems of linear equations by graphing and substitution (8.AT.B.5).	- This standard establishes the foundation for future work with linear equations by extending prior learning to include equations with variables on both sides of the equation. 8.AT.B.3a: Without solving, analyze the structure of each equation and determine whether each has one solution, no solution, or infinitely many solutions: A: $2(3x + 4) - 5 = 6x + 3$ B: $5(2x - 1) - 3 = 10x - 8$ C: $4(2x + 3) - 2x = 2(4x + 6)$ 8.AT.B.3b: Students need repeated exposure to equations that involve the distributive property and negative integers (e.g., $-2(-x - 4) = 10$) since misconceptions often arise in these cases. - Instruction should highlight why the solution makes sense and consistently connect algebraic steps back to the principle of maintaining equality. - Avoid focusing on procedural steps without connecting them back to equality and solution meaning, or presenting a single “right way” to solve.	- Engage in error analysis, especially with equations involving negatives or the distributive property, by diagnosing mistakes, explaining why they occur, and providing corrected reasoning (SMP 3). - Explore and classify equations that result in one solution, no solution, or infinitely many solutions in collaborative groups and share observed patterns through discourse (SMP 3, SMP 7, SMP 8). - Use manipulatives or visual models to represent combining like terms and applying the distributive property (SMP 5). - Explain their solving process with precise mathematical language and reasoning about why the solution makes sense (SMP 1, SMP 3). - Formulate equations with specific solution types (e.g., “Write a linear equation that has no solution”) and test them (SMP 4). - Compare and contrast multiple solving strategies to develop fluency in solving linear equations (SMP 2, SMP 7).

Previously 8.EE.C.7

8.AT.B.4 Solve linear inequalities in one variable.

- a. Solve inequalities including those requiring the use of the distributive property and combining like terms.
- b. Represent the solution set on a number line and describe the set of possible values in the context of the problem.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Create and solve inequalities of the form $px + q < r$ and $px + q > r$ (7.AT.C.9). Where are students going? - Solve absolute value inequalities (IA1.AT.B.3). - Create linear inequalities in two variables and graph solution set as half-plane (IA1.AT.B.6).	- This standard extends earlier work with two-step inequalities to include more complex expressions. - Students have already reasoned about why multiplying or dividing by a negative number reverses the inequality; this idea should be reinforced as connected reasoning, not introduce as a new procedure. - In context, students should reason about feasible solution sets, which lays the groundwork for future work with systems of inequalities and optimization. - A theme park charges \$50 for a student group ticket. Chaperones must buy individual tickets, also at \$50 each. A school is bringing g groups and 5 chaperones, and the total cost must stay under \$700. The following inequality is used to represent this: $50(g + 5) < 700$ Method 1: $g + 5 < 14$; $g < 9$ Method 2: $50g + 250 < 700$; $50g < 450$; $g < 9$  Interpretation: The school can bring at most 8 groups along with the 5 chaperones. In other words, they could bring {1, 2, 3, 4, 5, 6, 7, 8} groups.	- Engage in error analysis of common mistakes, such as forgetting to reverse the inequality when dividing a negative or misrepresenting the solution set on a number line (SMP 3, SMP 6). - Compare and contrast multiple strategies for solving inequalities (e.g., distributing first vs. dividing first) and discuss efficiency and clarity (SMP 1, SMP 7). - Reason about feasible solution sets in real-world contexts by interpreting what the inequality means and which values make sense (SMP 4). - Compare and connect multiple representations (e.g., verbal description, algebraic solution, number line, set of possible solutions) so they see them as equivalent ways of expressing the same set of solutions (SMP 2).

Adopted 2025

8.AT.B.5 Analyze and solve systems of two linear equations in two variables.

- Interpret the solution to a system of two linear equations as the point where their graphs intersect and verify that the coordinates of the intersection satisfy both equations.
- Solve systems of two linear equations by graphing and substitution. When using graphing, find an approximate or exact solution depending on the precision of the graph. Select a method strategically based on the structure of the system or the context of the problem and explain why the method is appropriate.
- Use structure to determine when a system has no solution, one solution, or infinitely many solutions and justify the conclusion.
- Model and solve contextual problems using systems of two linear equations.

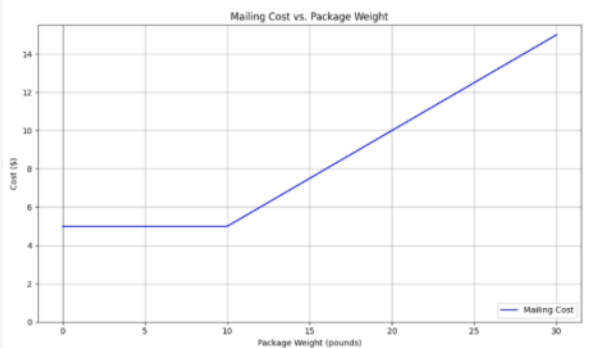
Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Graph proportional relationships and describe ordered pairs (7.AT.A.3). - Solve linear equations (8.AT.B.3). Where are students going? - Solve systems of equations by graphing, substitution, and elimination/linear combination (IA1.AT.B.5).	8.AT.B.5a: This is the entry point into systems of equations and should be a discovery opportunity that extends into using graphing as a method for solving. This should also be used as instructional space to discuss what graphs would look like if there were no or infinite solutions. 8.AT.B.5b: Students are <i>not</i> using elimination/linear combination yet. Graphing helps build conceptual understanding while substitution emphasizes algebraic structure. Strategic method choice is important (e.g., graphing when slope-intercept form/approximation is appropriate, substitution when a variable is already isolated). 8.AT.B.5c: Students should be provided with simple cases. A simple example is, "$3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6." - Avoid decontextualizing systems entirely. Be sure that students have opportunity to interpret the solution in context rather than leaving it as "just a point"	- Model real-world contexts by formulating systems of equations, solving with multiple methods, and interpreting the solution in context (SMP 4). - Connect and compare representations (e.g., tables, graphs, equations) especially when classifying systems as having one, none, or infinitely many solutions (SMP 2, SMP 7). - Evaluate efficiency of strategies based on the system's structure, and discuss the utility of checking a solution with another method for confirmation (SMP 1). - Use technology to graph systems and explore intersections, parallel lines, and coinciding line (SMP 5). - Engage in targeted error analysis, such as forgetting to find both variables or solving algebraically but not interpreting the result in context (SMP 3, SMP 6). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes key Grade 8 Algebraic Thinking milestones in the Creating Equations & Inequalities and Solving Equations & Inequalities strands of the Numeracy Development Framework

Previously 8.EE.C.8

8.AT.C REASON ABOUT FUNCTIONS

8.AT.C.6 Determine whether a relationship is a function by analyzing whether each input is assigned to exactly one output.

- Given a clearly defined set of input-output pairs in a table, mapping, or real-world description, determine whether the relationship is a function and explain why.
- Given a graph, identify input-output pairs and determine whether the graph represents a function.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Determine whether two quantities are in a proportional relationship (7.A.T.A.2). Where are students going? - Compare functions (8.A.T.C.7; 8.A.T.D.11). - Reason about functions in terms of their domain and range (1A.1.A.T.C.10).	- Use of function notation is not required in Grade 8. - Algebraic reasoning should guide determinations. Students should <i>not</i> rely on surface “tricks” (e.g., vertical line test) without understanding why it works or simply checking for repeating x-values in a table. - Reasoning across representations (tables, mappings, ordered pairs, contexts) is essential. - Precise vocabulary use should be modeled and expected: <i>function</i>, <i>input</i>, <i>output</i>. - Use the following graph of Mailing Cost vs. Package Weight to write input-output pairs and describe their meaning in context. Does the graph represent a function? Explain your reasoning. 	- Generate and analyze contexts that illustrate both examples and non-examples of functions (SMP 2, SMP 4). - Engage in a discussion about the purpose of functions. Students should reason about <i>why it matters</i> if a relationship is a function (e.g., predictability, ability to model situations, efficiency in using formulas) (SMP 3). \$ - Work with functions expressed in words, not just symbolic form (e.g., “every person has exactly one birth date”) to bridge natural language with formal representation (SMP 2). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Algebraic Thinking milestone in the Functional Reasoning strand of the Numeracy Development Framework.

Previously 8.F.A.1

8.AT.C.7 Compare the properties (i.e., rate of change, intercepts) of two linear functions each represented in a different way (algebraically, graphically, numerically in tables, or by narrative descriptions).

Content Progression	Examples and Clarifications	Students should have the opportunity to...								
Where are students coming from? - Identify the constant of proportionality in tables, graphs, equations, and descriptions (7.AT.C.8). - Reason about slope and y-intercept in linear relationships (8.AT.A.2).	- This standard builds a foundation for later work with families of functions. - Instruction should begin with comparisons within the same representation before moving into cross-representation comparisons. - Three friends shared their tomato plant’s growth with the following representations. Compare the properties of two of the tomato plants, including rate of change and intercepts. What conclusions can you make about the tomato plants based on the information provided? Mya’s Tomato Plant Growth $y = x + 3$ Where x represents the number of weeks since June 1 and y represents the plant height (in inches) Bailey’s Tomato Plant Growth <table><tr><th>Number of weeks since June 1st</th><th>Plant height (inches)</th></tr><tr><td>0</td><td>2</td></tr><tr><td>2</td><td>4</td></tr><tr><td>4</td><td>6</td></tr></table> Alivia’s Tomato Plant Growth	Number of weeks since June 1st	Plant height (inches)	0	2	2	4	4	6	- Attend to precision by labeling graphs, tables, and equations clearly and by interpreting the meaning of slope and intercepts within the given context (SMP 6). - Make explicit cross-representation connections (e.g., explain how the constant difference in a table, the steepness of a line on a graph, and the coefficient of x in an equation all describe the rate of change) (SMP 7). - Use narrative descriptions as valid representations (e.g., “The water tank starts with 125 gallons and drains 3 gallons per minute” can be compared to a graph of a different tank’s drainage) (SMP 2, SMP 4). - Discuss efficiency of representation as they consider which representation makes a property easiest to identify (SMP 5).
Number of weeks since June 1st	Plant height (inches)									
0	2									
2	4									
4	6									
Where are students going? - Compare properties of linear and exponential functions represented in different ways (IA1.AT.C.12). - Compare properties of quadratic functions represented in different ways (IA2.AT.C.10).										

Previously 8.F.A.2

8.AT.C.8 Identify whether a function is linear or non-linear given equations, graphs, or input-output pairs, and provide a justification using reasoning about the constant rate of change and its relationship to proportional reasoning.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Determine whether two quantities are in a proportional relationship (7.AT.A.2). - Write equations of lines as $y=mx$ that pass through the origin and as $y=mx+b$ when they include a vertical shift (8.AT.A.2). Where are students going? - Model relationships with linear functions (8.AT.D.10). - Distinguish between situations that can be modeled with linear or exponential functions (IA1.AT.D.15).	- Identifying whether a function is linear requires examining whether the change in outputs is proportional to the change in inputs. - Students should connect their earlier understanding of proportional relationships to a fuller view of linear functions; work in 8.AT.A.2 introduced equations of the form $y=mx+b$ and $y=mx$ and this standard extends that by explicitly defining them as linear functions. - A linear function has a constant rate of change, which is visible as: a constant difference in a table; a slope in an equation $y=mx+b$; a straight line in a graph. - Avoid only relying on visual cues like “the graph is a straight line.”	- Analyze and compare multiple representations of functions to identify patterns and develop criteria for linearity before being formally directed (SMP 7). - Use geometric relationships (e.g., comparing how the perimeter of a square changes with side length (linear) versus how the area changes (non-linear)) to explain that linear functions have a constant rate of change while non-linear functions do not (SMP 4). - Engage in mathematical discourse to justify whether a function is linear or non-linear using precise reasoning about constant versus changing rates of change when interpreting equations, graphs, tables, or input-output pairs (SMP 3). - Explore a variety of graphs, such as time–distance and time–velocity graphs, to determine linearity (SMP 4). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Algebraic Thinking milestone in the Proportional Reasoning strand of the Numeracy Development Framework.

Previously 8.F.A.3

8.AT.D MODEL WITH FUNCTIONS.**8.AT.D.9 Interpret the graph of a linear function in the form $y = mx + b$**

- a. Given the graph of a linear function, identify the slope and y-intercept.
- b. Match a linear equation in the form $y = mx + b$ to its graph.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Reason about slope and y-intercept in linear relationships (8.AT.A.2). Where are students going? - Compare key properties of functions represented in different ways (IA1.AT.C.12).	- When matching algebraic representations of linear functions to their graphs, students should interpret the parameters m and b in $y = mx + b$ as defining the function's behavior (i.e., whether it increases or decreases, the rate at which it changes, and the vertical position of the line) rather than relying only on isolated points or visual matching. - Avoid interpreting linear functions as a set of disconnected points or procedural steps. Do not reduce analysis to counting rise and run or locating intercepts without connecting these features to how slope and intercept represent quantities in context, describe the relationship between variables, and determine how one quantity changes in relation to another across the domain.	- Predict how changes in slope or intercept will affect the graph before seeing the graph and explain their reasoning (SMP 1). - Describe how a linear function behaves across its entire domain, using precise language such as rate of change, growth or decline, and value when the input is zero (SMP 4).

Adopted 2025

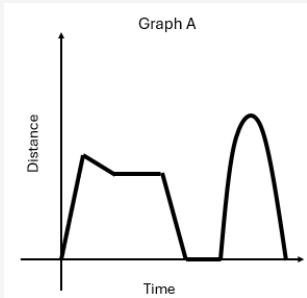
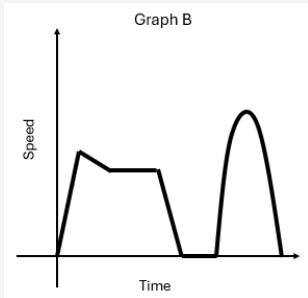
8.AT.D.10 Construct and interpret a linear function to model a relationship between two quantities.

- Given two input-output pairs, a graph, a table, or a description of a relationship, determine the rate of change and initial value and write the linear equation that models the situation.
- Interpret the rate of change and initial value in the context of the problem.

Content Progression	Examples and Clarifications	Students should have the opportunity to...										
Where are students coming from? - Represent proportional relationships using equations (7.AT.A.3). Where are students going? - Determine whether a relationship is linear or exponential and write functions that models it (IA1.AT.D.15).	- A plant is growing at a constant rate. After 2 weeks, the plant is 11 centimeters tall. After 6 weeks, the plant is 23 centimeters tall. - What students do: Determine the rate of change: $\text{slope} = \frac{23 - 11}{6 - 2} = \frac{12}{4} = 3$ The plant grows 3 centimeters per week. Since it was 11 centimeters after 2 weeks: $11 - 3(2) = 5$; or <table border="1"><thead><tr><th>Weeks of Growing</th><th>Height (cm)</th></tr></thead><tbody><tr><td>0</td><td>5</td></tr><tr><td>1</td><td>8</td></tr><tr><td>2</td><td>11</td></tr><tr><td>6</td><td>23</td></tr></tbody></table> The plant was 5 centimeters tall at the start. If x is weeks since the plant started growing and y is the height in centimeters, the function is: $y = 3x + 5$	Weeks of Growing	Height (cm)	0	5	1	8	2	11	6	23	- Construct linear functions to model real-world contexts and explain how the function represents the relationship between the quantities involved (SMP 4). - Analyze and refine linear models by evaluating whether the rate of change and initial value accurately represent the situation, using reasonableness checks or error analysis to justify adjustments (SMP 3). - Predict and explain how changing the rate of change or initial value in a linear function would affect the behavior of the model and the relationship between the quantities involved in the context (SMP 1; SMP 2). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Algebraic Thinking milestone in the Proportional Reasoning strand of the Numeracy Development Framework.
Weeks of Growing	Height (cm)											
0	5											
1	8											
2	11											
6	23											

Previously 8.F.B.4

8.AT.D.11 Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function based on a narrative description.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Compare functions represented in different forms and identify features such as rate of change from descriptions (8.AT.C.7). Where are students going? - Interpret key features of functions in context (IA1.AT.D.14). - Distinguish between situations that can be modeled with linear functions and with exponential functions (IA1.AT.D.15).	- This standard focuses on qualitative analysis—describing how one quantity changes in relation to another by interpreting broad features of a graph (e.g., increasing, decreasing, constant, linear, nonlinear, steady vs. rapid change). Students are not expected to compute exact values or rates but to interpret overall behavior. - The two graphs have similar shapes, but they represent different quantities over time. Graph A shows a person's distance from home as time passes. Graph B shows a person's traveling speed as time passes. Describe what an observer would see in each situation based on the qualitative features of the graphs. Graph A  Graph B 	- Describe how two quantities change together by explaining what they notice about how the output responds when the input increases, decreases, or moves through different intervals (SMP 2). - Create narrative descriptions of how two quantities change together for classmates to sketch—and sketch graphs for classmates to describe—to promote creativity, collaboration, and flexible thinking across representations (SMP 3, SMP 6).

Previously 8.F.B.5

Geometric Reasoning (GR)

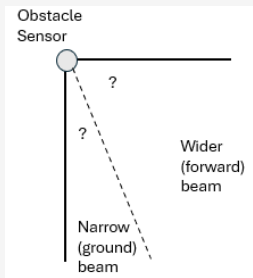
Geometric Reasoning Clusters	Connections to the Numeracy Development Framework
8.GR.A Make conjectures about and verify geometric relationships.	Standards within this cluster directly contribute* to the Grade 8 Geometric Reasoning & Measurement milestones within the Classifying Figures, Spatial Reasoning , and Reasoning with Geometric Structure strands of the Numeracy Development Framework.
8.GR.B Apply the Pythagorean Theorem to reason about right triangles.	A standard within this cluster directly contributes* to the Grade 8 Geometric Reasoning & Measurement milestones within the Reasoning with Geometric Structure 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.

8.GR.A MAKE CONJECTURES ABOUT AND VERIFY GEOMETRIC RELATIONSHIPS.

8.GR.A.1: Use the relationships between supplementary, complementary, vertical, and adjacent angles to write and solve equations for an unknown angle.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Use angle decomposition and angle-addition equations to determine unknown angles (4.GR.B.7). Where are students going? - Use theorems about angle pairs created by parallel lines and a transversal (IA1.GR.B.4).	- Students translate the structural facts of supplementary, complementary, vertical, and adjacent angle relationships into equations rather than relying on formal definitions. They use these developed symbolic definitions to solve missing value problems. - Avoid overemphasizing equation solving at the expense of understanding the angle relationship, including creating algebraic expressions for angles that are not realistic or meaningful. - A robotics team is programming an obstacle sensor mount that must split a complementary angle into two beams. The ground beam must cover a narrow detection zone, while the other covers a wider zone that is three times as large.  - Students recognize that since they are complementary, their measures sum to 90°. They translate this structural fact into an equation that reflects both the complementary relationship and the 3-to-1 size condition: $x + 3x = 90$ - They solve to determine the angle to program to each beam.	- Understand why these angle relationships are named—they capture consistent angle structures that arise whenever lines meet or intersect in real and geometric contexts, making them essential for interpreting angle situations (SMP 7). - Explain how an equation models the angle situation and connect each term in the equation back to the structure of the diagram (SMP 3). - Use angle relationships in contextual or design-based scenarios, interpreting the meaning of the angles and evaluating whether the results make sense within the situation (SMP 4). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Geometric Reasoning & Measurement milestone in the Classifying Figures strand of the Numeracy Development Framework.

Previously 7.G.B.5

8.GR.A.2: Draw or build triangles using tools (ruler, protractor, technology, or physical manipulatives) given three measures of angles or sides. Determine whether the given conditions result in a unique triangle, more than one triangle, or no triangle.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Identify right triangles (4.GR.C.9). Where are students going? - Apply triangle congruence theorems to verify congruence and solve problems (IA1.GR.B.3).	- Students should understand that: - Three sides lengths may determine one triangle or none (e.g., violating the triangle inequality). - Three angles may allow infinitely many triangles. - Certain combinations of angles and sides (e.g., two angles and a side) lead to only one possible triangle, while others allow more than one possible triangle based on how the conditions constrain the shape. - Avoid introducing formal congruence theorems (e.g., SSS, SAS, ASA); instead, support students in making and testing conjectures about when given measures determine one triangle, multiple triangles, or no triangle.	- Conjecture whether a unique triangle, more than one triangle, or no triangle is possible given a set of measures before drawing or building, then test and refine those conjectures through construction (SMP 1, SMP 3). - Explain why certain sets of measures lead to different outcomes based on what they observe during construction. For example, recognizing when sides cannot meet, or when a vertex can “move” while conditions stay fixed (SMP 7). - Use dynamic geometry software to explore many examples in a condensed time (SMP 5). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Geometric Reasoning & Measurement milestone in the Spatial Reasoning strand of the Numeracy Development Framework.

Previously 7.G.A.2

8.GR.A.3: Use informal arguments to verify that the sum of the interior angles of a triangle is 180 degrees and why an exterior angle equals the sum of the two remote interior angles.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Use angle relationships to find unknown angles (8.GR.A.1). - Determine whether given conditions result in a triangle (8.GR.A.2). Where are students going? - Justify angle relationships formed by parallel lines cut by a transversal (IA1.GR.B.4.a) - Find unknown measures in congruent triangles (IA1.GR.B.3).	- This standard focuses on informal reasoning—students use drawings, dynamic tools, or hands-on exploration to justify why triangle interior angles sum to 180° and why an exterior angle equals the sum of the two remote interior angles. The emphasis is on insight into geometric structure, <i>not formal proof</i>. - Students should use this knowledge to find unknown interior angles in triangles. - Angle sum example: Students may fold or “tear and rearrange” paper copies of a triangle so the three angles form a straight line. - When a side of a triangle is extended, the adjacent interior angle and the exterior angle form a straight 180° angle. Since the three interior angles of a triangle also sum to 180°, students reason that the exterior angle must equal the sum of the two remote interior angles. Rearranging or comparing those interior angles helps confirm this relationship visually.	- Explore multiple informal arguments (including physical rearrangements or dynamic geometry software) to collaboratively justify and confirm the interior angles of a triangle sum 180° (SMP 5, SMP 7). - Compare triangles of different types (scalene, isosceles, right, obtuse) to confirm that these angle relationships hold for all triangles (SMP 8). - Use triangle and exterior-angle relationships to reason through applied or modeling situations, drawing on these structures to make sense of constraints or interpret relationships in a context (SMP 4). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Geometric Reasoning & Measurement milestone in the Reasoning with Geometric Structure strand of the Numeracy Development Framework.

Previously 8.G.A.5

8.GR.B APPLY THE PYTHAGOREAN THEOREM TO REASON ABOUT RIGHT TRIANGLES.**8.GR.B.4: Understand and reason about the Pythagorean Theorem and its extensions.**

- a. Use diagrams, examples, or informal reasoning to explain the Pythagorean Theorem and why it applies to all right triangles.
- b. Use the converse of the Pythagorean Theorem to determine whether a set of three side lengths forms a right triangle, and extend this reasoning to identify whether a triangle is acute or obtuse using Pythagorean inequalities.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Work with area, surface area, and volume of polygonal figures, including triangles, where shapes are defined by edges and flat faces. (7.GR.B.4). Where are students going? - Apply the Pythagorean Theorem (8.GR.B.5). - Justify side length ratios in special right triangles (IA2.GR.B.6).	- Students use area models (e.g., constructing and rearranging squares on the sides of a right triangle) and dynamic geometry tools to reason that, although the side lengths of a right triangle may change, the relationship between the squared lengths of the legs and the hypotenuse remains consistent across all right triangles. - Students reason dynamically about side-length relationships by comparing the sum of the squares of the two shorter sides to the square of the longest side. When these quantities are equal, students conclude the triangle is right; as the angle opposite the longest side increases beyond 90°, the longest side grows larger and c^2 exceeds $a^2 + b^2$, and when that angle decreases below 90°, c^2 becomes smaller than $a^2 + b^2$. - This perspective emphasizes understanding how changes in angle measure affect side-length relationships, rather than memorizing inequality cases.	- Collaboratively explore and test conjectures about how side-length relationships determine whether a triangle is right, acute, or obtuse, using examples and counterexamples to refine their reasoning (SMP 1, SMP 3). - Use dynamic models to investigate how changing one angle affects side lengths, and notice how equality corresponds to a right triangle and how inequalities emerge as the angle opens or closes (SMP 7).

Previously 8.G.B.6

8.GR.B.5: Apply the Pythagorean Theorem to solve problems in context.

- a. Determine unknown side lengths in right triangles.
- b. Find the distance between two points in a coordinate system using the Pythagorean Theorem.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Understand the Pythagorean Theorem (8.GR.B.4). - Represent points on the plane with positive and negative coordinates (6.NOS.C.7). Where are students going? - Use trigonometric ratios, Pythagorean Theorem, and special right triangles to solve right triangles (IA2.GR.B.7). - Represent real-world objects and solve design problems by modeling with geometric figures (IA2.GR.D.10).	- Students apply the Pythagorean relationship to determine missing side lengths in right triangles that arise in real or modeled situations. Students should attend to which side is the hypotenuse and interpret the resulting length in context. - Students build on earlier experiences finding distances between points that share the same x- or y-coordinate (purely horizontal or vertical distance). This standard extends that reasoning to situations where points differ in both coordinates, and requires students to recognize and construct a right triangle whose legs represent the horizontal and vertical changes and whose hypotenuse represents the distance between the points. - Students are not expected to use the distance formula; instead, they should reason geometrically by constructing or visualizing the right triangle formed by the horizontal and vertical differences.	- Recognize (without being directed) when a situation can be represented by a right triangle and explain why the Pythagorean relationship is appropriate for modeling the situation (SMP 4, SMP 7). - Anticipate and evaluate what a reasonable result should be in context by using estimation or comparison (e.g., recognizing that a diagonal must be longer than either side of a rectangle) before computing an exact distance (SMP 1). - Encounter situations in the coordinate plane where finding distance cannot be done by counting or subtracting along the grid, thus creating a need to extend the Pythagorean relationship to determine straight-line distance between points (SMP 1, SMP 4). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Geometric Reasoning & Measurement milestone in the Reasoning with Geometric Structure strand of the Numeracy Development Framework.

Previously 8.G.B.7; 8.G.B.8

Reasoning with Data, Statistics, and Probability (DS)

Reasoning with Data and Statistics Clusters	Connections to the Numeracy Development Framework
8.DS.A Make sense of statistical inquiry.	Standards within this cluster contribute* to the Grade 8 Reasoning with Data, Statistics, and Probability milestones within the Collecting & Representing Data strand of the Numeracy Development Framework.
8.DS.B Describe, analyze, and compare data using visual and numerical representations to model situations and draw inferences.	Standards within this cluster directly contribute* to the Grade 8 Reasoning with Data, Statistics, and Probability milestones within the Collecting & Representing Data and Interpreting & Analyzing Data strands of the Numeracy Development Framework.
8.DS.C Model and analyze probability to interpret chance events and make predictions.	Standards within this cluster directly contribute* to the Grade 8 Reasoning with Data, Statistics, and Probability milestones within the Collecting & Representing Data and Reasoning about Probability 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.

8.DS.A MAKE SENSE OF STATISTICAL INQUIRY.**8.DS.A.1: Evaluate predictions and conclusions drawn from bivariate data.**

- a. Determine whether observed associations in sample data justify generalizations about a broader population.
- b. Identify limitations or potential bias in data collection or interpretation when analyzing trends in scatter plots.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Use and read coordinate plane (6.NOS.C.7). - Evaluate when generalizations from single-variable data are appropriate (7.DS.A.1). Where are students going? - Distinguish between correlation and causation (IA1.DS.A.1). - Analyze the representativeness of a sample and its implications for making inferences about the population (IA1.DS.A.2).	- Students may observe a trend in a scatter plot (e.g., a positive association between hours studied and test scores) and then reason about whether the data justify a broader claim, such as predicting outcomes for all students. This reasoning should consider factors such as how the data were collected, how representative the sample is, and how much variability is present in the data. - Students identify features of data collection or interpretation that could limit conclusions, such as: - Data collected from a limited or non-representative group - Missing or incomplete information - Data covering only a narrow range of values - Individual data points that have a strong influence on the overall pattern - Avoid discussing observed associations as if one variable directly causes the other; students should be guided to interpret trends as relationships that may have multiple explanations. For example, a scatter plot shows hours of video game play per week and math test scores. Students observe a negative association but rather than concluding that playing video games causes lower test scores, students discuss other possible explanations (e.g., time spent studying, sleep) and state that the graph shows a relationship; not a proof of causation.	- Compare multiple data sets or scenarios that show similar patterns but differ in sampling or context to reason about which conclusions are more or less justified (SMP 1, SMP 7). - Identify what additional information or data would strengthen or weaken a conclusion and explain why (SMP 3, SMP 6). - Discuss alternative explanations for an observed association and reason about how other variables or contextual factors might influence the relationship (SMP 3, SMP 4).

Adopted 2025

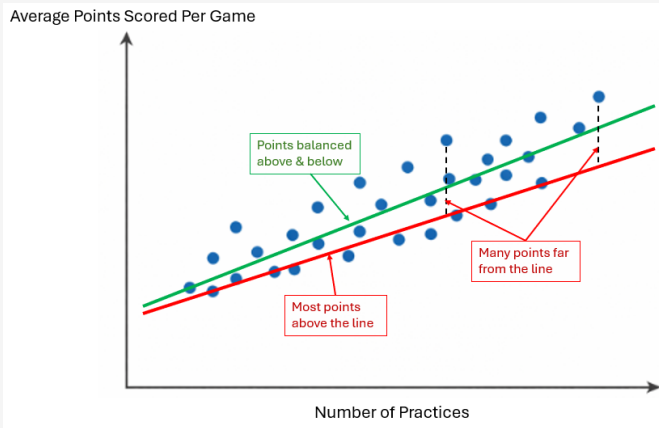
8.DS.B DESCRIBE, ANALYZE, AND COMPARE DATA USING VISUAL AND NUMERICAL REPRESENTATIONS TO MODEL SITUATIONS AND DRAW INFERENCES.

8.DS.B.2: Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Solve contextual problems involving the coordinate plane (6.NOS.C.9). Where are students going? - Represent data on a scatter plot and describe how the variables are related (IA1.DS.B.7).	- Students are not expected to fit equations or calculate correlation coefficients. Descriptions should remain qualitative, grounded in visual evidence and contextual understanding. - The focus is on describing patterns in scatter plots by attending to the <i>overall tendency</i> of the data rather than individual points. - Students examine how points cluster in certain regions to suggest common/typical values, how tightly or loosely the data are grouped to indicate variability, and how individual points may fall outside of the overall pattern. - Students distinguish between roughly linear and nonlinear relationships and use context to reason about why that pattern exists.	- Make deliberate choices about scale and labels when constructing scatter plots from data sets (SMP 5, SMP 6). - Compare patterns of association across multiple scatter plots and explain how these patterns shape interpretation of the relationship (SMP 2, SMP 7). - Collaboratively discuss how individual data points influence interpretation of the overall pattern, including when an outlier noticeably affects the apparent pattern and when the overall association remains clear (SMP 3). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Reasoning with Data, Statistics, & Probability milestone in the Collecting & Representing Data strand of the Numeracy Development Framework.

Previously 8.SP.A.1

8.DS.B.3: Compare the fit of different linear models shown on scatter plots of the same data by describing the overall pattern and the closeness of data points to each line.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Describe patterns in bivariate data such as positive/negative and linear/non-linear association (8.DS.B.2). Where are students going? - Informally assess the fit of a linear or exponential function to data (IA1.DS.B.7).	- Students are not expected to calculate residuals or statistical measures of fit. Judgements should be based on visual comparison and attention to patterns. - Students focus on how well each line captures the <i>trend</i> in the data rather than trying to pass the line through every point. - For example, in a scatter plot relating the number of practices to average points scored per game, one linear model may pass through several data points but lie below most of the data. Students may reason that, because the line consistently underestimates performance across much of the data, it does not capture the overall trend in the data as well as another model (even if it intersects a fair number of points). 	- Develop criteria for what “better fit” means by discussing and debating which features matter most before any formal criteria are introduced (SMP 3, SMP 7) - Use context to reason about model choice, connecting features such as slope to the context being modeled (SMP 2, SMP 4). - Reflect on the limits of linear model by discussing when a linear model captures the general trend but still leaves variability unexplained (SMP 2). - Justify model choices to others by explaining why one linear model better represents the data and responding to questions or alternative interpretations from peers (SMP 3).

Previously 8.SP.A.2

8.DS.B.4: Use a provided linear model to make predictions based on bivariate measurement data. Interpret the meaning of the slope and y-intercept in context.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Identify the unit rate in graphs and equations (7.A.T.A.2). - Interpreting scatter plots and evaluating linear models of bivariate data sets (8.DS.B.2; 8.DS.B.3). Where are students going? - Analyze and interpret key components of linear and exponential models of bivariate data sets (IA.DS.B.8).	- The emphasis is on using a linear model as a summary of a relationship, not as an exact rule. Students interpret the model as an approximation that captures an overall trend in the data and supports reasonable predictions within the context. - Students recognize that individual data points may not lie on the line and that predictions represent typical or average behavior suggested by the data. Deviations from the model are expected based on the inherent variability in real-world data.  $y = 1.5x + 15$ - For the above data and linear model, students would explain that the slope of 1.5 represents an average increase of about 1.5 points per game for each additional practice, rather than as an exact or guaranteed change. - Students explain that the y-intercept of 15 represents the number of points if the team has no (zero) practices and consider whether this value is meaningful in context. They may, for example, say that the y-intercept suggests that a team might score about 15 points per game with very few practices and then discuss whether this is an appropriate extrapolation.	- Discuss how far a linear model can reasonably be used to make predictions by considering how close or far an input value is from the data used to create the model and explaining when predictions begin to feel less reliable (SMP 2, SMP 4). - Use context to judge the reasonableness of predictions and identify when a numerical prediction makes sense in the situation and when it may be unrealistic even if it follows from the model (SMP 1). - Examine cases where the model does not match individual data points and discuss why variability is expected and why predictions describe average behavior rather than exact outcomes (SMP 6). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Reasoning with Data, Statistics, & Probability milestone in the Interpreting & Analyzing Data strand of the Numeracy Development Framework.

Previously 8.SP.A.3

8.DS.C MODEL AND ANALYZE PROBABILITY TO INTERPRET CHANCE EVENTS AND MAKE PREDICTIONS

8.DS.C.5: Construct a two-way table to organize data on two categorical variables collected from the same subjects. Calculate and interpret relative frequencies for rows and/or columns and use them to describe possible associations between the variables.

Content Progression	Examples and Clarifications	Students should have the opportunity to...																				
Where are students coming from? - Collect and organize categorical data (5.DS.A.1). Where are students going? - Use two-way frequency tables to find joint and marginal probabilities (IA1.DS.B.6). - Use two-way frequency tables to approximate conditional probabilities (IA2.DS.B.3).	- Students move beyond describing totals to comparing how one category is distributed <i>within</i> another. Relative frequencies allow students to reason proportionally. For example, comparing the percentage of students who participate in an activity across different groups rather than comparing raw numbers. <table><tr><th>Grade Level</th><th>Participates in a Club</th><th>Does Not Participate in a Club</th><th>Total</th></tr><tr><td>Grade 6</td><td>11</td><td>45</td><td>56</td></tr><tr><td>Grade 7</td><td>30</td><td>30</td><td>60</td></tr><tr><td>Grade 8</td><td>24</td><td>41</td><td>65</td></tr><tr><td>Total</td><td>65</td><td>116</td><td>181</td></tr></table> - Students calculate relative frequencies within each grade and observe that, although Grade 7 has the greatest number of students participating in a club, Grade 8 has the highest proportion its students who participate. - This perspective answers the question, “<i>Within each grade, how common is participation?</i>” If students instead look across grades among students who participate, they answer a different question (e.g., which grade contributes the largest share of club participants overall/what is that proportion). Educators should emphasize that different perspectives highlight different aspects of the data.	Grade Level	Participates in a Club	Does Not Participate in a Club	Total	Grade 6	11	45	56	Grade 7	30	30	60	Grade 8	24	41	65	Total	65	116	181	- Select and justify appropriate comparisons for a given question and discuss how different perspectives on the same two-way table can support different conclusions and align with different questions (SMP 2, SMP 3, SMP 7). - Use proportional reasoning to reconcile seemingly conflicting conclusions, such as when one group has the highest count while another has the highest proportion, and explain why both statements can be true (SMP 2). - Critique informal claims made from categorical data by identifying when conclusions are based on raw counts rather than relative comparisons and suggest how the data could be interpreted more appropriately (SMP 3). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes a key Grade 8 Reasoning with Data, Statistics, & Probability milestone in the Collecting & Representing Data strand of the Numeracy Development Framework.
Grade Level	Participates in a Club	Does Not Participate in a Club	Total																			
Grade 6	11	45	56																			
Grade 7	30	30	60																			
Grade 8	24	41	65																			
Total	65	116	181																			

Previously 8.SP.A.4

8.DS.C.6: Find probabilities of compound events by representing or simulating the sample space or simulating events.

- a. Represent the sample space for a compound event using organized lists, tables, or tree diagrams. Given an event described in everyday language, identify the outcomes in the sample space that make up the event.
- b. Determine the probability of a compound event as a fraction of outcomes in the sample space that result in the event.

Content Progression	Examples and Clarifications	Students should have the opportunity to...
Where are students coming from? - Develop and use probability models (7.DS.C.6). - Solve ratio and percent problems by applying proportional reasoning (7.A.T.A.4). Where are students going? - Determine event independence and approximate conditional probability (IA1.DS.B.6; IA2.DS.B.3).	- Students are not expected to use formal probability rules. All reasoning should remain grounded in representations of the same space and equal likelihood of outcomes. - This standard emphasizes that probabilities of compound events come from identifying all possible outcomes and determining which outcomes satisfy the event being described. - Representations (i.e., lists, tables, or tree diagrams) are used to make the full sample space visible and support students' clear reasoning about compound events. They are essential in this standard. - Simulation supports reasoning about compound events by helping students visualize likelihood and test expectations, but conclusions about probability should ultimately be grounded in the structure of the same space.	- Choose representations based on the structure of the situation and explain why one representation makes the sample space easier to reason about than another (SMP 5, SMP 7). - Collaboratively reason about completeness by checking one another's representations to ensure all possible outcomes are accounted for and that none are repeated or omitted (SMP 3). - Discuss how different interpretations of the same narrative description of an event can lead to different sample spaces and probabilities (SMP 6). - For example, "Two coins are flipped. What is the probability of getting one head and one tail?" One student lists outcomes {HH, HT, TH, TT} and finds $\frac{2}{4} = \frac{1}{2}$. Another lists {two heads, one of each, two tails} and answers $\frac{1}{3}$. Students explain why $\frac{1}{3}$ is incorrect (i.e., the three categories are not equally likely). Students must have multiple opportunities and varied ways to demonstrate mastery, as this standard constitutes key Grade 8 Reasoning with Data, Statistics, & Probability milestones in the Reasoning about Probability strand of the Numeracy Development Framework.

Previously 7.SP.C.8

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.