NEW MEXICO
Public Education Department

HS: ALGEBRA – CREATING EQUATIONS

Cluster Statement: A: Create equations that describe numbers or relationships.
Widely Applicable as Prerequisite for a Range of College Majors, Postsecondary Programs and Careers.

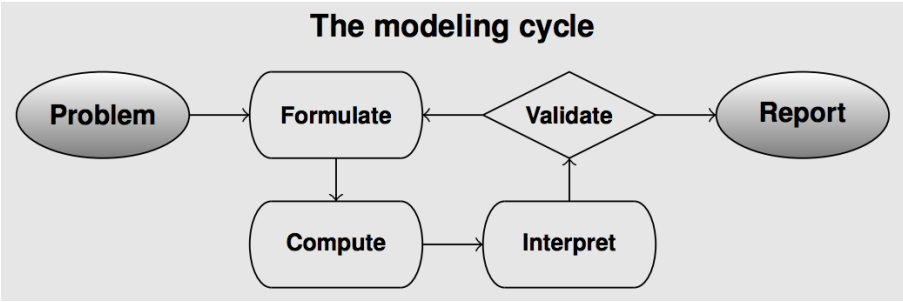
Standard Text	**Standard for Mathematical Practices**	**Students who demonstrate understanding can:**
HSA.CED.A.1: Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.* * *Note: Algebra 1 focuses on linear, quadratic, and exponential (integer inputs only)*	SMP 1: Students can make sense of problems and persevere in solving them by appropriately choosing from among linear, exponential and quadratic functions when creating an equation or inequalities in one variable to solve a problem. SMP 4: Students can model with mathematics by creating equations or inequalities with one variable when given a problem with context.	• Write a linear equation in one variable based on a given context and use their equation to solve problems. • Write quadratic equations in one variable based on a given context and use their equation to solve problems. • Write an exponential equation in one variable based on a given context and use their equation to solve problems. • Write inequalities in one variable based on a given context and use their inequality to list possible solutions for the problem. **Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Understand, Apply, Analyze
Standard Text	**Standard for Mathematical Practices**	**Students who demonstrate understanding can:**
HSA.CED.A.2: Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.* *Note: Algebra 1 focuses on linear, quadratic, and exponential (integer inputs only)*	SMP 1: Students can make sense of problems and persevere in solving them by appropriately choosing from among linear, exponential and quadratic functions when creating a system of equations or inequalities in two or more variables to solve a problem. SMP 4: Students can model with mathematics by creating a system equations or inequalities in two or more variable when given a problem with context.	• Write equations in two or more variables based on a given context. • Write equations in two or more variables combining linear, quadratic and/or exponential equations based on a given context. • Graph equations on coordinate axes with scales clearly labeling the axes, defining what the values on the axes represent and the unit of measure. • Select intervals for the scale that are appropriate for the context and display adequate information about the relationship.

		• Analyze points on and off a graph and interpret them in context. **Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Understand, Apply, Analyze
Standard Text **HSA.CED.A.3: Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.** *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods. ** *Note: Algebra 1 focuses on linear only*	**Standard for Mathematical Practices** SMP 2: Students can reason abstractly and quantitatively by contextually, analytically and graphically checking a solution set of inequalities to determine the viability of each solution. SMP 4: Students can model with mathematics by representing constraints using equations or inequalities and systems of equations and/or inequalities when given a problem with context.	**Students who demonstrate understanding can:** • Identify constraints of equations, inequalities, and systems of equations and inequalities given a context • Interpret solutions of equations, inequalities, and systems of equations and inequalities as viable or non-viable given a context. • Interpret solutions analytically and graphically to answer questions about the quantities in context. **Webb's Depth of Knowledge:** 1-3 **Bloom's Taxonomy:** Understand, Apply, Analyze, Evaluate
Standard Text **HSA.CED.A.4: Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's***	**Standard for Mathematical Practices** SMP 4: Students can model with mathematics by applying literal when given a problem in context. SMP 7: Students can reflect and recognize the various structures in mathematic formulas and use them	**Students who demonstrate understanding can:** • Make connections between solving equations and rearranging formulas. • Apply inverse operations to rearrange formulas for a specified variable.

law V = IR to highlight resistance R.* *Note: Algebra 1 focuses on linear, quadratic, and exponential (integer inputs only)*	when solving problems requiring those formulas.	**Webb's Depth of Knowledge:** 1-2 **Bloom's Taxonomy:** Understand, Apply
Previous Learning Connections • Connect to creating and solving equations in one variable. **(7.EE.4)** • Connect to reasoning with inequalities. **(7.EE.4)** • Connect to solving real-world problems involving two linear equations in two variables. **(8.EE.8)**	**Current Learning Connections** • Connect to graphing equations and inequalities. **(HSF.IF.7)** • Connect to graphing systems of equations and inequalities. **(HSA.REI.7)** • Connect to solving equations in one variable including those equations with coefficients represented by variables. **(HSA.REI.3-4)** • Connect to communicating relevant domain and range for linear, exponential and quadratic functions. **(HSF.IF.4)**	**Future Learning Connections** • Connect to extending knowledge to include additional types of functions such as trigonometric, rational, and polynomial. **(HSA.CED.1-4)** • Connect to communicating relevant domain and range for all types of functions. **(HSF.IF.4)**

Clarification Statement

- HSA.CED.A.1: The repertoire of **functions** that is acquired during high school allows students to create more **complex equations**, including equations arising from **linear** and **quadratic expressions**, and **simple rational** and **exponential expressions**.
- HSA.CED.A.2: [Students use complex equations—including equations arising from linear and quadratic expressions, and simple rational and exponential expressions—to model] relationships between **quantities** with **equations in two variables**.
- HSA.CED.A.3: All the standards in the Creating Equations group carry a modeling star, denoting their connection with the Modeling category in high school. This connotes not only an increase in the complexity of the equations studied, but an upgrade of the student's ability in every part of the modeling cycle.



- HSA.CED.A.4: There are situations where an equation is used to describe the **relationship** between a number of different quantities. For example, Ohm's Law V = IR relates the voltage, current, and resistance of an electrical circuit. An equation used in this way is sometimes called a **formula**. It is perhaps best to avoid using the terms "**variable**", "**parameter**", or "**constant**" when working with this formula, because there are six different ways it can be viewed as defining one quantity as a **function** of the other with a third held constant.

Common Misconceptions

- Choosing the correct form of the equation can often be difficult when first introducing exponential and quadratic equations to students. They will often try to make everything linear.
- Students tend to struggle without the benefit of having numbers involved. They will often forget how algebra works while working through problems with this standard.

Multi-Layered System of Supports (MLSS)/Suggested Instructional Strategies

Pre-Teach

Pre-teach (targeted): *What pre-teaching will prepare students to productively struggle with the mathematics for this cluster within your HQIM?*

- For example, some learners may benefit from targeted pre-teaching that previews new contexts for tasks within the unit (e.g., cell phone plans) when studying creating equations that describe numbers or relationships because doing so allows students to better understand that writing expressions, equations, or inequalities to represent data is a highly useful tool that can be used in a variety of different scenarios and when wielded by them, will allow for a broader application of the concepts they are learning.

Pre-teach (intensive): *What critical understandings will prepare students to access the mathematics for this cluster?*

- 6.EE.A.2: This standard provides a foundation for work with creating equations that describe numbers or relationships because this is the first time that students are being asked to read, write, and evaluate expressions in which letters stand for numbers and many students have trouble making this transition. If students have unfinished learning within this standard, based on assessment data, consider ways to provide intensive pre-teaching support prior to the start of the unit to ensure students are ready to access grade level instruction and assignments.

Core Instruction

Access

Perception: *How will the learning for students provide multiple formats to reduce barriers to learning, such as providing the same information through different modalities (e.g., through vision, hearing, or touch) and providing information in a format that will allow for adjustability by the user?*

- For example, learners engaging with creating equations that describe numbers or relationships benefit when learning experiences ensure information is accessible to learners with sensory and perceptual disabilities, but also easier to access and comprehend for many others such as displaying information in a flexible format to vary perceptual features such as creating equations, graphs, tables, and verbal models because students comprehend information in a variety of ways that can be illustrated with the various ways of displaying the information to highlight different aspects of the model.

Build

Effort and Persistence: How will the learning for students provide options for sustaining effort and persistence?

- For example, learners engaging with creating equations that describe numbers or relationships benefit when learning experiences attend to students attention and affect to support sustained effort and concentration such as generating relevant examples with students that connect to their cultural background and interests because equations that model the students' real lives and have relevance to them

will encourage them to engage more deeply with the content since they will be able to connect it to a future career path or current situation.

Language and Symbols: *How will the learning for students provide alternative representations to ensure accessibility, clarity and comprehensibility for all learners? (e.g., a graph illustrating the relationship between two variables may be informative to one learner and inaccessible or puzzling to another; picture or image may carry very different meanings for learners from differing cultural or familial backgrounds)*

- For example, learners engaging with creating equations that describe numbers or relationships benefit when learning experiences attend to the linguistic and nonlinguistic representations of mathematics to ensure clarity and comprehensibility for all learners such as making explicit links between information provided in texts and any accompanying representation of that information in illustrations, equations, charts, or diagrams because the language of mathematics is more than just one way of representing the information and all of the different ways need to be included and explained in order for students to fully understand the content.

Expression and Communication: *How will the learning provide multiple modalities for students to easily express knowledge, ideas, and concepts in the learning environment?*

- For example, learners engaging with creating equations that describe numbers or relationships benefit when learning experiences attend to the multiple ways students can express knowledge, ideas, and concepts such as providing scaffolds that can be gradually released with increasing independence and skills (e.g., embedded into digital programs) because students who are able to be successful in creating their own equations that represent their real world and can do so in a way that there is a safety net to help them are more likely to want to interact with the information in a variety of ways.

Internalize

Comprehension: *How will the learning for students support transforming accessible information into usable knowledge, knowledge that is accessible for future learning and decision-making?*

- For example, learners engaging with creating equations that describe numbers or relationships benefit when learning experiences attend to students by intentionally building connections to prior understandings and experiences; relating important information to the learning goals; providing a process for meaning making of new learning; and, applying learning to new contexts such as providing explicit, supported opportunities to generalize learning to new situations (e.g., different types of problems that can be solved with linear equations) because numbers and relationships are a foundational topic in algebra and providing the connections and context for how using the relationships that you can create in order to solve problems given different parameters will allow students to have a more flexible way of approaching problems in the future.

Re-teach

Re-teach (targeted): *What formative assessment data (e.g., tasks, exit tickets, observations) will help identify content needing to be revisiting during a unit?*

- For example, students may benefit from re-engaging with content during a unit on creating equations that describe numbers or relationships by clarifying mathematical ideas and/or concepts through a short mini-lesson because creating equations has such a broad level of application, from linear and proportional to exponential, quadratic, logarithmic, and trigonometric meaning that this has the opportunity to

be studied from many different perspectives and the better that is understood about one type of problem, the better it will be understood for the others.

Re-teach (intensive): *What assessment data will help identify content needing to be revisited for intensive interventions?*

- For example, some students may benefit from intensive extra time during and after a unit creating equations that describe numbers or relationships by addressing conceptual understanding because creating equations is best done in the context of a real-world problem and understanding the underlying relationships of why a particular equation is preferred over another will allow students to more readily choose the appropriate type of equation in the future. ...

Extension

What type of extension will offer additional challenges to 'broaden' your student's knowledge of the mathematics developed within your HQIM?

- For example, some learners may benefit from an extension such as the opportunity to explore links between various topics when studying creating equations that describe numbers or relationships because it would allow them to build the context of why they are building equations and the purposes of what using the equations would allow them to do. For example, they could explore the link between how building an equation to model the cost of a project based on the material costs and size constraints can help when calculating costs in manufacturing and construction.

Culturally and Linguistically Responsive Instruction:

Validate/Affirm: How can you design your mathematics classroom to intentionally and purposefully legitimize the home culture and languages of students and reverse the negative stereotypes regarding the mathematical abilities of students of marginalized cultures and languages?
Build/Bridge: How can you create connections between the cultural and linguistic behaviors of your students' home culture and language the culture and language of school mathematics to support students in creating mathematical identities as capable mathematicians that can use mathematics within school and society?

Using and Connecting Mathematical Representations: The standard for mathematical practice, use appropriate tools strategically, provides a strong foundation to validate and bridge for students. Mathematical representations are mathematical tools. The linguistic and cultural experiences of students provide different and varied types of representations for solving mathematical problems. By explicitly encouraging students to use multiple mathematical representations students can draw on their "mathematical, social, and cultural competence". By valuing these representations and discussing them we can connect student representations to the representations of school mathematics and build a bridge for students to position them as competent and capable mathematicians. For example, when studying creating equations that describe numbers or relationships the use of mathematical representations within the classroom is critical because creating equations is a skill that focuses on transforming the world around us into numbers and symbols and in doing so, care needs to be taken to emphasize that this stripping down of the world is not a discarding of the cultural aspects of the situation. Making the connections between the math that is being used and the thing it is being used to analyze is imperative in this context.

Standards Aligned Instructionally Embedded Formative Assessment Resources:
Source: https://satsuitequestionbank.collegeboard.org/

Question ID 1054727

Assessment	Test	Cross-Test and Subscore	Difficulty	Primary Dimension	Secondary Dimension	Tertiary Dimension	Calculator
SAT	Math	Heart of Algebra	■■□	Heart of Algebra	Linear functions	4. Make connections between verbal, tabular, algebraic, and graphical representations of a linear function, by a. deriving one representation from the other;	No Calculator

1054727

The graph in the xy-plane of the linear function f contains the point $(3,4)$. For every increase of 5 units in x, $f(x)$ increases by 3 units. Which of the following equations defines the function?

A. $f(x) = -\frac{5}{3}x + 9$

B. $f(x) = -\frac{3}{5}x + \frac{29}{5}$

C. $f(x) = \frac{3}{5}x + \frac{11}{5}$

D. $f(x) = \frac{5}{3}x - 1$

Cash box
http://tasks.illustrativemathematics.org/content-standards/HSA/CED/A/tasks/462

Relevance to families and communities:	**Cross-Curricular Connections:**
During a unit focused on creating equations that describe numbers or relationships, consider options for learning from your families and communities the cultural and linguistic ways this mathematics exists outside of school to create stronger home to school connections for students, for example, this could be looking at the utility bills for someone in the neighborhood and seeing how the rates are calculated using the unit rate of energy or water.	Economics: Linear programming with a system of inequalities is often used to model the constraint of resources for production. Consider providing a connection where students are starting their own business and must maximize profit or production with the possible solutions of the system. Science: There are many formulas in science such as Ohm's Law and the Doppler formulas that may require isolating and solving for a specific variable given certain conditions. Consider providing a connection where students must rearrange the same formulas in multiple ways to highlight different quantities of interest.