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), Algebra 2 focuses on equations using all available types of expressions, including simple root functions.*	SMP 1: Students can make sense of problems and persevere in solving them by appropriately choosing a function type 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.	• Create equations and inequalities in one variable and use them to solve problems. • Write equations in one variable and use them to solve problems. • Write inequalities in one variable and use them to solve problems **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), Algebra 2 focuses on equations using all available types of expressions, including simple root functions.*	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.	• Create equations in two or more variables based on a given context. • Write equations in two or more variables 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

<table>
<tr><td></td><td></td><td>Bloom's Taxonomy:
Understand, Apply,Analyze</td></tr>
<tr><td rowspan="3">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, quadratic, and exponential (integer inputs only), Algebra 2 focuses on equations using all available types of expressions, including simple root functions.</td><td rowspan="3">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.</td><td>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.</td></tr>
<tr><td>Webb's Depth of Knowledge: 1-3</td></tr>
<tr><td>Bloom's Taxonomy:
Understand, Apply, Analyze, Evaluate</td></tr>
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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 law V = IR to highlight resistance R.

Note: Algebra 1 focuses on linear, quadratic, and exponential (integer inputs only), Algebra 2 focuses on equations using all available types of expressions, including simple root functions.</td><td rowspan="3">Standard for Mathematical Practices

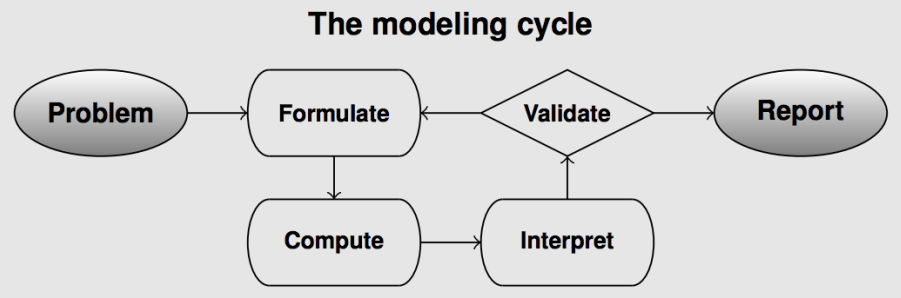
SMP 4: Students can model with mathematics by applying literal when given a problem in context.

SMP 7: Students can reflect and recognize the various structures in mathematic formulas and use them when solving problems requiring those formulas.</td><td>Students who demonstrate understanding can:
• Solve for a specified variable in a literal equation.
• Solve formulas for a specified variable of interest.</td></tr>
<tr><td>Webb's Depth of Knowledge: 1-2</td></tr>
<tr><td>Bloom's Taxonomy:
Understand, Apply</td></tr>
<tr><td><u>Previous Learning Connections</u>
• Connect to the work of Algebra 1 around linear, quadratic, and exponential (integer inputs only) with this cluster. (HSA.CED.A)
• Connect to graphing systems of equations and inequalities.(HSA.REI.7)</td><td><u>Current Learning Connections</u>
• Connect to communicating relevant domain and range for linear, exponential and quadratic functions.(HSF.IF.4)
• Connect to graphing equations and inequalities.(HSF.IF.7)</td><td><u>Future Learning Connections</u>
• 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</td></tr>
</table>

• Connect to solving equations in one variable including those equations with coefficients represented by variables.**(HSA.REI.3-4)**		for all types of functions. **(HSF.IF.4)**

Clarification Statement

- Equations and inequalities can be created to represent and solve real world and mathematical problems.
- Students check their solutions to real-world problems which can be found by modeling them with equations and graphs.
- Constraints are necessary to balance a mathematical model with real-world context. Variable quantities may be able to take on only certain values and expressing these restrictions, or constraints, algebraically in an important part of modeling with mathematics.
- Formulas are equations with specific meaning that show the relationship between two or more quantities and are written in the same way literal equations are solved for a given variable, by isolating the desired variable on one side of the equation.
- 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.



Common Misconceptions

- Student may believe only linear and quadratic expressions can be used within inequalities.
- Students may believe that ellipses and hyperbolas are the same, but are reversed on the axis
- Students may believe absolute value cannot be inverted and struggle when there is more than one term inside absolute value
- Students may believe that mid-term and distance are the same thing and confuse the formulas.

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 rehearses prior learning when studying creating equations that describe numbers or relationships because this cluster requires students to create equations they have already studied from relationships and contexts. A recap of the key features of the families of functions studied can help students more easily apply their prior learnings to these problems.

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

- 8.F.B.4: This standard provides a foundation for work with creating equations that describe numbers or relationships because this standard called on students to specifically write linear equations from a given relationship and explain the parts of

the equation in context of a scenario. 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

Interest: *How will the learning for students provide multiple options for recruiting student interest?*

- For example, learners engaging with creating equations that describe numbers or relationships benefit when learning experiences include ways to recruit interest such as providing contextualized examples to their lives because this selecting relevant and/or recognizable topics can ease the stress of students in discussing the mathematics and engaging with the material.

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 encouraging and supporting opportunities for peer interactions and supports (e.g., peer-tutors) because students may each pick out different important features in a given problem and, through sharing their findings, can help each other move to the next step in a problem solving process. Consider structures such as think-write-pair share where all students have time to consider the problem, write what they recognize as important or write a question they have about the problem and then share with a partner or group. Structures like this give all students support in engaging with the content and in discussing the mathematics.

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 can comprehensibility for all learners such as making relationships between elements explicit (constant change is linear, half-life/doubling is exponential, “at least” and “no more than” create inequalities, etc.) because identifying these key terms in a word problem are the key to understanding which equation to create. Providing support in translating from context to equation can help students guide themselves through a problem.

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 multiple examples of ways to solve a problem (i.e. examples that demonstrate the same outcomes but use differing approaches,

strategies, skills, etc.) because students may be able to reason using a table, graph or by analyzing keywords in descriptions. Each of these techniques can illuminate new pathways to solutions and can show students a variety of ways to approach a problem.

Internalize

Self-Regulation: *How will the design of the learning strategically support students to effectively cope and engage with the environment?*

- For example, learners engaging with creating equations that describe numbers or relationships benefit when learning experiences set personal goals that increase ownership of learning goals and support healthy responses and interactions (e.g., learning from mistakes), such as supporting students with metacognitive approaches to frustration when working on mathematics because this cluster requires students to consider a context, extract the important information that reveals features of a specific family of functions and then model the scenario with an equation. There are many steps where students may feel lost or stuck. Providing students with prompting questions they can ask themselves like "what information is given?" or "is the change constant?" may help them to progress through the problems.

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 students may see problems as having one specific solution when infinitely many solutions are appropriate. Students may benefit from revisiting contexts with inequalities and discussing many potential solutions and why they each make sense in context of the problem. Further, students may benefit from discussing why a solution can be found mathematically but why it may not make sense in context of a problem.

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 students must have a firm grasp of the features of equations and inequalities before they can model scenarios with them. Students may require support in conceptualizing the different families of functions and/or the difference between an equation and an inequality.

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 open-ended tasks linking multiple disciplines when studying creating equations that describe numbers or relationships because once students are fluent in applying equations to contexts, they can be challenged by selecting their own problems relating to specific careers or interests.

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?

Building Procedural Fluency from Conceptual Understanding: Instruction should build from conceptual understanding to allow students opportunities to make meaning of mathematics before focusing on procedures. When new learning begins with procedures it privileges those with strong prior familiarity with school mathematics procedures for solving problems and does not allow learning to build for more methods for solving tasks that occur outside of school mathematics. For example, when studying HS.CED.A: Create equations that describe numbers or relationships cluster the types of mathematical tasks are critical because fluency in Algebra is akin to becoming fluent in a spoken or written language. Fluency is essential to obtaining a deep understanding of the function and meaning of any language. Algebra is no different.

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

Question ID 19489

Assessment	Test	Cross-Test and Subscore	Difficulty	Primary Dimension	Secondary Dimension	Tertiary Dimension	Calculator
SAT	Math	Heart of Algebra	■□□	Heart of Algebra	Linear inequalities in one or two variables	1. Create and use linear inequalities in one or two variables to solve problems in a variety of contexts.	Calculator

19489

Wyatt can husk at least 12 dozen ears of corn per hour and at most 18 dozen ears of corn per hour. Based on this information, what is a possible amount of time, in hours, that it could take Wyatt to husk 72 dozen ears of corn?

Rationale
The correct answer is any number between 4 and 6, inclusive. Since Wyatt can husk at least 12 dozen ears of corn per hour, it will take him no more than $\frac{72}{12} = 6$ hours to husk 72 dozen ears of corn. On the other hand, since Wyatt can husk at most 18 dozen ears of corn per hour, it will take him at least $\frac{72}{18} = 4$ hours to husk 72 dozen ears of corn.
Therefore, the possible times it could take Wyatt to husk 72 dozen ears of corn are 4 hours to 6 hours, inclusive. Any number between 4 and 6, inclusive, can be gridded as the correct answer.

Relevance to families and communities:
During a unit focused on HS.CED.A: Create equations that describe numbers or relationships cluster, 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, how statistics are used to describe how the risk of different cultural and ethnic groups for developing breast cancer and how this might affect medical breast cancer screening frequency recommendations.
Example 1: During a unit focused on creating equations in two variables, consider options for

Cross-Curricular Connections:

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

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, exploring how changing the structure for an equation is similar to how a sentence can be re-structured to convey different meanings depending on the structure of the words.	students must rearrange the same formulas in multiple ways to highlight different quantities of interest.