Claim 1: **Concepts and Procedures** Students can explain and apply mathematical concepts and interpret and carry out mathematical procedures with precision and fluency.	
Content Domain: **Algebra**	
Target G [m]: Create equations that describe numbers or relationships. (DOK 1,2) Tasks for this target will require students to create equations and inequalities in one variable to solve problems. Other tasks will require students to create and graph equations in two variables to represent relationships between quantities.	
Standards: A-CED.A, A-CED.A.1, A-CED.A.2	**A-CED.A Create equations that describe numbers or relationships.** **A-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. **A-CED.A.2** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
Related Below-Grade Standards for Purposes of Planning for Vertical Scaling: 8.EE.C, 8.EE.C.7a, 8.EE.C.7b 8.F.A, 8.F.A.1 8.F.B, 8.F.B.4, 8.F.B.5	**Related Grade 8 Standards** **8.EE.C Analyze and solve linear equations and pairs of simultaneous linear equations.** **8.EE.C.7** Solve linear equations in one variable. a. Give examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). b. Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. **8.F.A Define, evaluate, and compare functions.** **8.F.A.1** Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. **8.F.B Use functions to model relationships between quantities.** **8.F.B.4** Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models and in terms of its graph or a table of values. **8.F.B.5** 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 that has been described verbally.
DOK Levels:	1, 2
Achievement Levels Descriptors:	
RANGE Achievement Level Descriptors (Range ALD) Target G: Create equations that describe numbers or relationships.	**Level 1** Students should be able to create and use one-step linear equations in one variable to model a familiar situation and to solve a familiar problem.
	Level 2 Students should be able to create and use quadratic equations, linear equations, and linear inequalities in one and two variables to model a familiar situation and to solve a familiar problem. They should be able to graph a linear or a quadratic equation in two variables, and be able to rearrange a familiar formula or an unfamiliar linear formula in one or two variables for a particular given quantity.
	Level 3 Students should be able to create and use linear, quadratic, and rational equations and inequalities and exponential equations with an integer base and a polynomial exponent in multiple variables to model an unfamiliar situation and to solve an unfamiliar problem. They should be able to graph an equation in two variables and be able to rearrange a linear, a quadratic, an absolute value, a rational, or a cubic multi-variable formula for a particular given quantity.
	Level 4 Students should be able to rearrange polynomial, logarithmic, exponential, or trigonometric formulas with one or more variables to highlight a quantity of interest and be able to analyze in context to determine which quantity is of interest.
Evidence Required:	1. The student creates one variable equations arising from linear, quadratic, simple rational, and exponential functions in one variable. 2. The student creates one variable inequalities arising from linear, quadratic, simple rational, and exponential functions in one variable. 3. The student graphs equations or inequalities on coordinate axes with labels and scales to represent the solution to a contextual problem. 4. The student creates equations in two or more variables to represent relationships between quantities.
Allowable Item Types:	Equation/Numeric; Graphing
Allowable Stimulus Materials:	two-way table of values, graphs of linear equations or inequalities, graphs of quadratic equations or inequalities graphs of exponential equations or inequalities
Construct-Relevant Vocabulary:	Inequality, exponential, quadratic, linear, equation
Allowable Tools:	Calculator
Target-Specific Attributes:	Equations can be linear, quadratic, simple rational, or exponential.
Non-Targeted Constructs:	Linear function, quadratic function, exponential function, rational function

Accessibility Guidance:	Item writers should consider the following Language and Visual Element/Design guidelines[1] when developing items. Language Key Considerations: • Use simple, clear, and easy-to-understand language needed to assess the construct or aid in the understanding of the context • Avoid sentences with multiple clauses • Use vocabulary that is at or below grade level • Avoid ambiguous or obscure words, idioms, jargon, unusual names and references Visual Elements/Design Key Considerations: • Include visual elements only if the graphic is needed to assess the construct or it aids in the understanding of the context • Use the simplest graphic possible with the greatest degree of contrast, and include clear, concise labels where necessary • Avoid crowding of details and graphics Items are selected for a student's test according to the blueprint, which selects items based on Claims and targets, not task models. As such, careful consideration is given to making sure fully accessible items are available to cover the content of every Claim and target, even if some item formats are not fully accessible using current technology.[2]
Development Notes:	Equations are higher priority content than inequalities within this target, so item development plans should include more development for task models focused on equations.

[1] For more information, refer to the General Accessibility Guidelines at: http://www.smarterbalanced.org/wordpress/wp-content/uploads/2012/05/TaskItemSpecifications/Guidelines/AccessibilityandAccommodations/GeneralAccessibilityGuidelines.pdf

[2] For more information about student accessibility resources and policies, refer to http://www.smarterbalanced.org/wordpress/wp-content/uploads/2014/08/SmarterBalanced_Guidelines.pdf

Task Model 1
 	
Response Type: Equation / Numeric
 	
DOK Level 2
 	
A-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.*
 	
Evidence Required:
1. The student creates one variable equations arising from linear, quadratic, simple rational, and exponential functions in one variable.
 	
Tools: Calculator
	Prompt Features: The student is prompted to create an equation in one variable that can be used to solve a given problem.
	
	Stimulus Guidelines:
	• The student is presented with a contextual situation familiar to 16- to 17-year-olds that can be modeled by an equation in two or more variables that correspond to quantities given in the problem context.
	  o The student may be given the equation and all but one of the values for the variables, or
	  o The student may be given the same information without an equation and asked to represent the relationship between the quantities whose values are known and the unknown quantity with an equation.
	  o The equations students are expected to enter are single-variable linear, quadratic, simple rational, or exponential equations.
	o Item difficulty can be adjusted via these example methods, but is not limited to these methods:
	  o The form of the equation being created:
	  ▪ is linear
	  ▪ is quadratic
	  ▪ is simple rational
	  ▪ is exponential
	  o The complexity of the contextual situation:
	  ▪ The unknown quantity corresponds to one of the variables.
	  ▪ The unknown quantity corresponds to an expression rather than a single variable in the anchoring multi-variable equation.
	
	TM1
	Stimulus: The student is presented with a contextual problem.
	
	Example Stem 1: Consider the given equation that models a train's distance from its departing station, where:
	• *y* represents the distance in miles,
	• *x* represents the speed of the train in miles per hour, and
	• *t* represents the time traveled from the departing station in hours.
	$y = xt$
	
	Enter an equation for which the solution is the speed of the train, in miles per hour, where the train's distance from the departing station is 162 miles and it has traveled for 3 hours.
	
	Rubric: (1 point) The student correctly enters an equation (e.g., 162=3*x* or any equation equivalent to $x = 54$).
	
	Response Type: Equation/Numeric

Task Model 1 **Response Type: Equation / Numeric** **DOK Level 2** **A-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.* **Evidence Required:** 1. The student creates one variable equations arising from linear, quadratic, simple rational, and exponential functions in one variable. **Tools:** Calculator	**Example Stem 2:** Consider the equation that gives the minimum stopping distance, *d*, in feet, for an automobile, where: • *v* represents the automobile speed, in feet per second, • *s* represents the driver's response time, in seconds, to apply the brakes, and • m represents the coefficient of friction between the tires and the road. $$d = vs + \frac{v^2}{64m}$$ Enter an equation for which the solution is the speed, in feet per second, of an automobile with a stopping distance of 200 feet, a driver's response time of 0.5 second, and a coefficient of friction equal to 0.8. **Rubric:** (1 point) The student correctly enters an equation (e.g., equation equivalent to $200 = 0.5v + \frac{v^2}{51.2}$). **Example Stem 3:** A sales clerk's daily earnings include $125 per day plus commission equal to *x* percent of his daily sales. Enter an equation that can be used to find the commission percentage (*x*), if the clerk's daily sales are $1375 and his total earnings for that day are $180. **Rubric:** (1 point) The student correctly enters an equation [e.g., $125 + \frac{x}{100} \cdot 1375 = 180$ or equivalent]. **Example Stem 4:** Jim can paint a house in 12 hours. Alex can paint the same house in 8 hours. Enter an equation that can be used to find the time in hours, *t*, it would take Alex and Jim to paint the house together assuming they both work at the rates they work when working alone. **Rubric:** (1 point) The student correctly enters an equation (e.g., $\frac{1}{12} + \frac{1}{8} = \frac{1}{t}$ or equivalent). **Response Type:** Equation/Numeric

Task Model 2
 	
Response Type: Equation / Numeric
 	
DOK Level 2
 	
A-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.*
 	
Evidence Required:
2. The student creates one variable inequalities arising from linear, quadratic, simple rational, and exponential functions in one variable.
 	
Tools: Calculator
	Prompt Features: The student is prompted to create a one-variable inequality that can be used to solve a given problem.
	
	Stimulus Guidelines:
	• The student is presented with a contextual situation familiar to 16- to 17-year-olds that can be modeled by an inequality in two or more variables that correspond to quantities given in the problem context.
	  o The student may be given the inequality and all but one of the values for the variables, or
	  o The student may be given the same information without an inequality and asked to represent the relationship between the quantities whose values are known and the unknown quantity with an inequality.
	  o The inequalities students are expected to enter are single-variable linear, quadratic, or simple rational equations.
	• Item difficulty can be adjusted via these example methods, but is not limited to these methods:
	  o The form of the inequality being created:
	  ▪ is linear
	  ▪ is quadratic
	  ▪ is simple rational
	  o The complexity of the contextual situation:
	  ▪ The unknown quantity corresponds to one of the variables.
	  ▪ The unknown quantity corresponds to an expression rather than a single variable in the anchoring multi-variable inequality.
	TM2
	Stimulus: The student is presented with a contextual situation that can be represented by an inequality.
	
	Example Stem 1: A clerk earns $125 per day, plus a commission equal to 10% of her sales, *s*. The clerk earns less than $180 on Monday.
	
	Enter an inequality that represents all possible values for the clerk's sales, *s*, on Monday.
	
	Rubric: (1 point) The student correctly enters the inequality (e.g., inequality equivalent to $0.1s + 125 < 180$).
	
	Example Stem 2: A rectangular garden measuring 13 meters by 15 meters is to have a gravel pathway of constant width built all around it. There is enough gravel to cover 80 square meters or less.
	
	Enter an inequality that represents all possible widths (w), in meters, of the pathway.
	
	Rubric:
	(1 point) The student correctly enters an inequality equivalent to $(13 + 2w)(15 + 2w) - 13(15) \leq 80$.
	
	Response Type: Equation/Numeric

Task Model 3

Response Type: Graphing

DOK Level 2

A-CED.A.2
Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

Evidence Required:

3. The student graphs equations on the coordinate axes with labels and scales to represent the solution to a contextual problem.

Tools: Calculator

Accessibility Note: Graphing items are not currently able to be Brailled. Minimize the number of items developed to this TM.

Prompt Features: The student is prompted to create a graph of an equation in two variables from a contextual situation.

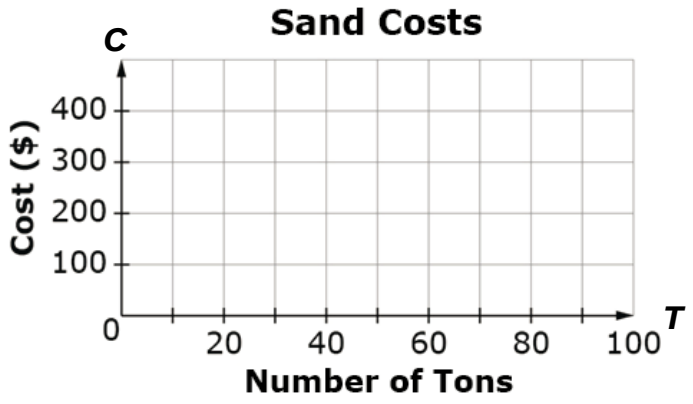
Stimulus Guidelines:

- The student is presented with a contextual situation familiar to 16- to 17-year-olds that can be modeled by an equation in two or more variables that correspond to quantities given in the problem context.
  - The student may be given the equation and all but two of the values for the variables, or
  - The student may be given the same information without an equation and asked to represent the relationship between the quantities whose values are known and the unknown quantities with an equation.
  - The student is asked to sketch the graph of the equation.
- Item difficulty can be adjusted via these example methods, but is not limited to these methods:
  - The form of the equation being created:
    - is linear
    - is quadratic
    - is simple rational
    - is exponential

TM3
Stimulus: The student is presented with a contextual situation and a labeled coordinate grid.

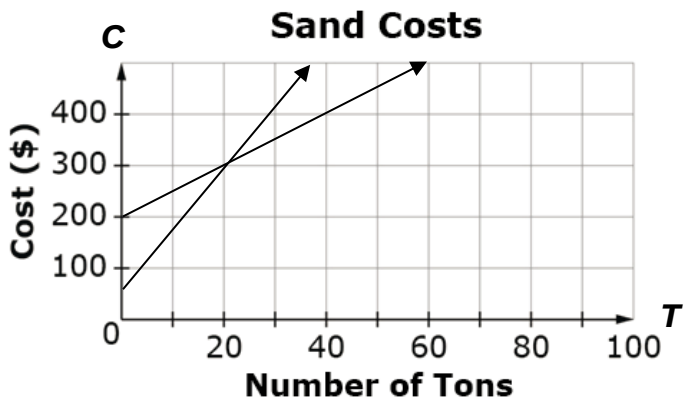
Example Stem: An elementary school is having sand delivered for the playground. Sadie's Sand charges $5.00 per ton of sand plus a delivery fee of $200. Greg's Sand Pit charges $12.00 per ton of sand plus a delivery fee of $50.

Use the Add Arrow tool to represent functions that show the cost *C* of buying *T* tons of sand from each company.



Interaction: The student uses the Add arrow tool to graph the functions represented in the context.

Rubric:
(1 point) The student correctly graphs the functions.

	 **Response Type:** Graphing

Task Model 4
 	
Response Type: Equation / Numeric
 	
DOK Level 1
 	
A-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.
 	
Evidence Required:
4. The student creates equations in two or more variables to represent relationships between quantities.
 	
Tools: Calculator
 	
Version 3 Update:
Retired TM4 example stem 2
	Prompt Features: The student is prompted to create an equation in two or more variables that can be used to solve a given problem.
	
	Stimulus Guidelines:
	• The student is presented with a contextual situation familiar to 16- to 17-year-olds that can be modeled by an equation in two or more variables that correspond to quantities given in the problem context.
	  o The student may be given the equation and all but two of the values for the variables, or
	  o The student may be given the same information without an equation and asked to represent the relationship between the quantities whose values are known and the unknown quantities with an equation.
	o Item difficulty can be adjusted via these example methods, but is not limited to these methods:
	  o The form of the equation being created:
	  ▪ is linear
	  ▪ is quadratic
	  ▪ is simple rational
	  ▪ is exponential
	  o The number of variables in the equation
	
	TM4
	Stimulus: The student is presented with a contextual situation.
	
	Example Stem: Malik and Nora are playing a video game.
	
	• Malik starts with *m* points and Nora starts *n* points.
	• Then Malik gets 150 more points, while Nora loses 50 points.
	• Finally, Nora gets a bonus and her score is doubled.
	• Nora now has 50 more points than Malik.
	
	Enter an equation that represents the relationship between *m* and *n* given the information above.
	
	Rubric: (1 point) The student correctly enters the equation (e.g., equation equivalent to $2(n-50)=(m+150)+50$).
	
	Response Type: Equation/Numeric