

Grade 6 Mathematics Item Specification C1 TF

<p>Claim 1: Concepts and Procedures Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.</p>	
<p>Content Domain: Expressions and Equations</p>	
<p>Target F [m]: Reason about and solve one-variable equations and inequalities. (DOK Levels 1, 2)</p> <p>Tasks for this target will ask students to solve and write one-variable equations and inequalities, some of which provide substitution of given numbers as an entry point to a solution.</p> <p>Claim 3 tasks will tap into students' abilities to explain that there are infinitely many solutions to an inequality (some connecting the content of this target to 6.NS Target C).</p>	
<p>Standards: 6.EE.B, 6.EE.B.5, 6.EE.B.6, 6.EE.B.7, 6.EE.B.8</p>	<p>6.EE.B Reason about and solve one-variable equations and inequalities. 6.EE.B.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true. 6.EE.B.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. 6.EE.B.7 Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q, and x are all nonnegative rational numbers. 6.EE.B.8 Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.</p>
<p>Related Below-Grade and Above-Grade Standards for Purposes of Planning for Vertical Scaling: 5.OA.A, 5.OA.A.2 7.EE.B, 7.EE.B.3, 7.EE.B.4</p>	<p>Related Grade 5 Standards</p> <p>5.OA.A Write and interpret numerical expressions. 5.OA.A.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. <i>For example, express the calculation "add 8 and 7, then multiply by 2" as $2 \times (8 + 7)$. Recognize that $3 \times (18932 + 921)$ is three times as large as $18932 + 921$, without having to calculate the indicated sum or product.</i></p> <p>Related Grade 7 Standards</p> <p>7.EE.B Solve real-life and mathematical problems using numerical and algebraic expressions and equations. 7.EE.B.3 Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. <i>For example: If a woman making \$25 an hour gets a 10% raise, she will make an additional 1/10 of her salary an hour, or \$2.50, for a new salary of \$27.50. If you want to place a towel bar</i></p>

Grade 6 Mathematics Item Specification C1 TF

	<p><i>9 3/4 inches long in the center of a door that is 27 1/2 inches wide, you will need to place the bar about 9 inches from each edge; this estimate can be used as a check on the exact computation.</i></p> <p>7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities.</p> <p>a. Solve real-world problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers. Solve equations of these forms fluently. Compare an algebraic solution to an arithmetic solution, identifying the sequence of the operations used in each approach. <i>For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?</i></p> <p>b. Solve real-world problems leading to inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are specific rational numbers. Graph the solution set of the inequality and interpret it in the context of the problem. <i>For example: As a salesperson, you are paid \$50 per week plus \$3 per sale. This week you want your pay to be at least \$100. Write an inequality for the number of sales you need to make, and describe the solutions.</i></p>
DOK Levels:	1, 2
Achievement Level Descriptors:	
<p>RANGE Achievement Level Descriptor (Range ALD) Target F: Reason about and solve one-variable equations and inequalities.</p>	<p>Level 1 Students should be able to use substitution to determine when a given number makes an equation or inequality true.</p> <p>Level 2 Students should be able to solve one-variable equations and inequalities of the form $x + p = \leq/\geq/</> q$ or $px = \leq/\geq/</> q$, where p and q are nonnegative rational numbers. They should be able to identify and use variables when writing equations.</p> <p>Level 3 Students should be able to write one-variable equations and inequalities of the form $x + p = \leq/\geq/</> q$ or $px = \leq/\geq/</> q$, where p and q are nonnegative rational numbers. They should be able to reason about and solve equations and inequalities by writing and graphing their solutions on a number line.</p> <p>Level 4 Students should be able to solve equations and inequalities of the form $x + p = \leq/\geq/</> q$ or $px = \leq/\geq/</> q$, where p and q are rational numbers. They should be able to write and graph solutions on the number line.</p>
Evidence Required:	<ol style="list-style-type: none"> 1. The student uses substitution in one-variable equations and inequalities. 2. The student writes one-variable equations and inequalities and solves one-variable equations in real-world and mathematical problems. 3. The student represents solutions of inequalities in real-world and mathematical problems on a number line.
Allowable Response Types:	Multiple Choice, single correct response; Multiple Choice, multiple correct response; Drag and Drop; Equation/Numeric; Matching Tables
Allowable Stimulus Materials:	
Construct-Relevant Vocabulary:	variable, equation, inequality, solution, solution set

Grade 6 Mathematics Item Specification C1 TF

Allowable Tools:	None
Target-Specific Attributes:	p , q , and x must all represent nonnegative rational numbers when solving equations of the form $x + p = q$ and $px = q$
Non-Targeted Constructs:	Parentheses when the student is applying the use of real-world problems. Properties of addition and multiplication.
Accessibility Guidance:	<p>Item writers should consider the following Language and Visual Element/Design guidelines¹ when developing items.</p> <p>Language Key Considerations:</p> <ul style="list-style-type: none"> • 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 <p>Visual Elements/Design Key Considerations:</p> <ul style="list-style-type: none"> • 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 <p>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</p>
Development Notes:	Claim 3 tasks will tap into a student's ability to explain inequalities as a set of infinitely many solutions (some connecting the content of this target to 6.NS Target C).

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

<p>Task Model 1</p> <p>Response Type: Multiple Choice, multiple correct response</p> <p>DOK Level 1</p> <p>6.EE.B.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.</p> <p>Evidence Statement: 1. The student uses substitution in one-variable equations and inequalities.</p> <p>Tools: None</p>	<p>Prompt Features: The student is prompted to identify equations that have a given solution.</p> <p>Stimulus Guidelines: The student is presented with a solution and one equation per answer choice.</p> <ul style="list-style-type: none"> • Equations are one-step equations in the form $x + p = q$ or $px = q$ in which p, q, and x must all represent nonnegative rational numbers. • Item difficulty can be adjusted via these example methods: <ul style="list-style-type: none"> ○ p and q are whole numbers. ○ At least one number is a decimal to the hundredths. ○ At least one number is a fraction or mixed number. <p>TM1a</p> <p>Example Stem: Select all equations that have $x = 3$ as a solution.</p> <p>A. $x + 7 = 10$ B. $3 + x = 3$ C. $x \bullet 3 = 1$ D. $4 \bullet x = 12$</p> <p>Answer Choices: Answer choices will be equations in the form $x + p = q$ or $px = q$, in which p and q must represent nonnegative rational numbers. Distractors will include confusing addition, subtraction, multiplication, or division, computation errors, and/or incorrect substitution. At least two equations must be correct.</p> <p>Rubric: (1 point) Student selects all the correct equations (e.g., A and D).</p> <p>Response Type: Multiple Choice, multiple correct response</p>
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<p>Task Model 1</p> <p>Response Type: Multiple Choice, multiple correct response</p> <p>DOK Level 2</p> <p>6.EE.B.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.</p> <p>Evidence Statement: 1. The student uses substitution in one-variable equations and inequalities.</p> <p>Tools: None</p> <p>Version 3 Update: Revised TM1a example stem 1 and added new example stem 2. Revised TM1c.</p>	<p>Prompt Features: The student is prompted to use substitution to identify a solution set for an inequality.</p> <p>Stimulus Guidelines:</p> <ul style="list-style-type: none"> • Inequalities should be in the form $x > c$ or $x < c$ where c must represent a rational number. • Item difficulty can be adjusted via these example methods: <ul style="list-style-type: none"> ○ c is an integer. ○ c is a decimal to the hundredths. ○ c is a fraction or mixed number. <p>TM1b Stimulus: The student is presented with a solution set and one inequality per answer choice.</p> <p>Example Stem 1: Select all inequalities that include 0 in the solution set.</p> <p style="margin-left: 40px;">A. $x > -4.24$ B. $x < -5.5$ C. $x > -5.13$ D. $x < 4.5$</p> <p>Example Stem 2: Select all inequalities that include all numbers less than -6 in the solution set.</p> <p style="margin-left: 40px;">A. $x > -4.24$ B. $x < -5.5$ C. $x > -5.13$ D. $x < 4.5$</p> <p>Answer Choices: Answer choices will be inequalities in the form $x > c$ or $x < c$. Distractors will include misinterpreting the inequality symbols and/or not all the values in a given set satisfy the inequality. At least two inequalities must be correct.</p> <p>Rubric: (1 point) Student selects all the correct inequalities (e.g., A,C,D; B,D).</p> <p>TM1c Stimulus: The student is presented with a one-variable inequality.</p> <p>Example Stem: Select all the values that satisfy the inequality $x < 7\frac{1}{2}$.</p> <p style="margin-left: 40px;">A. $x = -8$ B. $x = -7$ C. $x = 7$ D. $x = 8$</p> <p>Rubric: (1 point) Student selects all the correct sets of numbers (e.g., A, B and C).</p> <p>Response Type: Multiple Choice, multiple correct response</p>
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<p>Task Model 1</p> <p>Response Type: Matching Tables</p> <p>DOK Level 2</p> <p>6.EE.B.5 Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine whether a given number in a specified set makes an equation or inequality true.</p> <p>Evidence Statement: 1. The student uses substitution in one-variable equations and inequalities.</p> <p>Tools: None</p>	<p>Prompt Features: The student is prompted to use substitution to identify multiple solutions to one-variable inequalities.</p> <p>Stimulus Guidelines: The student is presented with a one-variable inequality.</p> <ul style="list-style-type: none"> • Inequalities should be in the form $x > c$ or $x < c$ in which c must represent a rational number. • The table may include four to five values. • Item difficulty can be adjusted by varying the types of numbers used as values in the table (e.g., positive and negative integers, fractions, decimals). <p>TM1d Example Stem: Consider the inequality $x > 7$.</p> <p>Determine whether each value of x makes this inequality true. Select Yes or No for each value.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>Yes</th> <th>No</th> </tr> </thead> <tbody> <tr> <td>22</td> <td></td> <td></td> </tr> <tr> <td>-7</td> <td></td> <td></td> </tr> <tr> <td>13</td> <td></td> <td></td> </tr> <tr> <td>5</td> <td></td> <td></td> </tr> <tr> <td>-39</td> <td></td> <td></td> </tr> </tbody> </table> <p>Rubric: (1 point) Student correctly determines whether all five values make the inequality true (e.g., Y, N, Y, N, N).</p> <p>Response Type: Matching Tables</p>	x	Yes	No	22			-7			13			5			-39		
x	Yes	No																	
22																			
-7																			
13																			
5																			
-39																			

<p>Task Model 2</p> <p>Response Type: Multiple Choice, single correct response</p> <p>DOK Level 1</p> <p>6.EE.B.8 Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.</p> <p>Evidence Statement: 2. The student writes one-variable equations and inequalities and solves one-variable equations in real-world and mathematical problems.</p> <p>Tools: None</p>	<p>Prompt Features: The student is prompted to identify one-variable inequalities in real-world and mathematical problems.</p> <p>Stimulus Guidelines: The student is presented with verbal constraints in a real-world or mathematical problem involving one-variable inequalities.</p> <ul style="list-style-type: none"> • Inequalities should be in the form $x > c$, $x < c$, $c > x$, or $c < x$ in which c must represent a rational number. • Context should be familiar to students 11 to 13 years old. • Item difficulty can be adjusted by varying the types of numbers used as values (e.g., positive and negative integers, fractions, decimals). <p>TM2a Example Stem: John is planning to put a rectangular pool in his backyard. The length (l) of the pool must be greater than 24 feet and the width (w) must be less than 14 feet.</p> <p>Select the pair of inequalities that models the possible measurements for each dimension.</p> <p style="margin-left: 40px;">A. $l > 14$ and $w < 24$ B. $l > 24$ and $w < 14$ C. $24 > l$ and $14 > w$ D. $24 < l$ and $14 < w$</p> <p>Answer Choices: Each answer choice will be two inequalities in the form $x > c$, $x < c$, $c > x$, or $c < x$. Distractors will include misinterpreting the inequality symbols and/or incorrect placement of variable and numerical terms.</p> <p>Rubric: (1 point) Student selects the correct inequality pair (e.g., B).</p> <p>Response Type: Multiple Choice, single correct response</p>
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<p>Task Model 2</p> <p>Response Type: Equation/Numeric</p> <p>DOK Level 2</p> <p>6.EE.B.7 Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.</p> <p>Evidence Statement: 2. The student writes one-variable equations and inequalities and solves one-variable equations in real-world and mathematical problems.</p> <p>Tools: None</p>	<p>Prompt Features: The student is prompted to solve one-variable equations in mathematical and real-world contexts.</p> <p>Stimulus Guidelines: The student is presented with a one-variable equation of the form $x + p = q$ or $px = q$ in context.</p> <ul style="list-style-type: none"> • p and q must represent nonnegative rational numbers • If used, context should be familiar to students 11 to 13 years old. • Item difficulty can be adjusted by varying the types of numbers used as values (e.g., positive and negative integers, fractions, decimals). <p>TM2b</p> <p>Example Stem: Julia has some peaches. She gathers 6 more peaches. She now has 58 peaches.</p> <p>Part A: In the first box, enter an equation to represent the number of peaches, p, that Julia has before she gathers 6 more peaches.</p> <p>Part B: In the second box, enter the number of peaches represented by p in this situation.</p> <p>Rubric: (2 points) Student enters the correct equation (e.g., $p + 6 = 58$) and the correct solution (e.g., 52). (1 point) Student enters the correct equation or the correct solution.</p> <p>Response Type: Equation/Numeric (2 response boxes)</p>
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<p>Task Model 2</p> <p>Response Type: Equation/Numeric</p> <p>DOK Level 1</p> <p>6.EE.B.7 Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.</p> <p>Evidence Statement: 2. The student writes one-variable equations and inequalities and solves one-variable equations in real-world and mathematical problems.</p> <p>Tools: None</p>	<p>Prompt Features: The student is prompted to write or solve one-variable equations in mathematical and real-world contexts.</p> <p>Stimulus Guidelines:</p> <ul style="list-style-type: none"> Equations should be in the form $x + p = q$ or $px = q$, where p and q must represent nonnegative rational numbers. If used, context should be familiar to students 11 to 13 years old. Item difficulty can be adjusted by varying the types of numbers used as values (e.g., positive and negative integers, fractions, decimals). <p>TM2c Stimulus: The student is presented with an equation in a mathematical context.</p> <p>Example Stem: The sum of 32 and n is equal to 59.13.</p> <p>Enter the equation described in the sentence.</p> <p>Rubric: (1 point) Student enters a correct equation (e.g., $32 + n = 59.13$ or equivalent).</p> <p>Response Type: Equation/Numeric</p> <p>TM2d Stimulus: The student is presented with an equation containing an unknown variable.</p> <p>Example Stem: Enter the value of y that makes the given equation true.</p> $y + 3\frac{2}{9} = 5\frac{5}{6}.$ <p>Rubric: (1 point) Student enters the correct value (e.g., $2\frac{11}{18}$).</p> <p>Response Type: Equation/Numeric</p>
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Task Model 3

Response Type:
Multiple Choice,
single correct
response

DOK Level 1

6.EE.B.8

Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

Evidence Statement:

3. The student represents solutions of inequalities in real-world and mathematical problems on a number line.

Tools: None

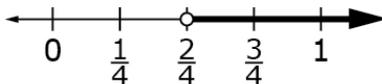
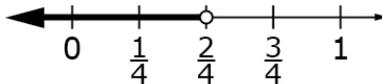
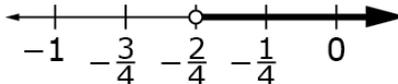
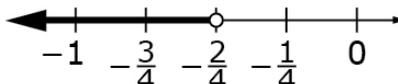
Prompt Features: The student is prompted to identify a number line that represents the solution to a one-variable inequality presented in a mathematical or real-world context.

Stimulus Guidelines: The student is presented with a one-variable inequality in a mathematical or real-world context.

- Inequalities should be in the form $x > c$ or $x < c$ in which c must represent a rational number.
- Number lines should have evenly spaced tick marks.
- If used, context should be familiar to students 11 to 13 years old.
- Item difficulty can be adjusted via these example methods, but are not limited to these methods:
 - c is a whole number; number line has integers labeled.
 - c is an integer; number line has integers labeled.
 - c is a fraction.
 - c is a decimal.

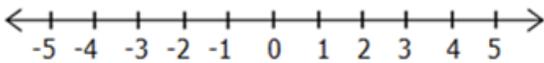
TM3a

Example Stem: Select the number line that represents all solutions of $x < -\frac{2}{4}$.

- A. 
- B. 
- C. 
- D. 

Rubric: (1 point) Student selects the correct number line (e.g., D).

Response Type: Multiple Choice, single correct response

<p>Task Model 3</p> <p>Response Type: Drag and Drop</p> <p>DOK Level 2</p> <p>6.EE.B.8 Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in a real-world or mathematical problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.</p> <p>Evidence Statement: 3. The student represents solutions of inequalities in real-world and mathematical problems on a number line.</p> <p>Tools: None</p> <p>Accessibility Note: Drag and Drop items are not currently able to be Brailled. Minimize the number of items developed to this TM</p>	<p>Prompt Features: The student is prompted to create and represent, on a number line, a one-variable inequality that corresponds to a verbal constraint in a mathematical or real-world problem.</p> <p>Stimulus Guidelines: The student is presented with a verbal constraint in a mathematical or real-world problem.</p> <ul style="list-style-type: none"> • Inequalities should be in the form $x > c$ or $x < c$ in which c must represent a rational number. • Drag elements should include: an arrow going to the left with an open circle, an arrow going to the right with an open circle, $<$, and $>$. • Number lines should have evenly spaced tick marks. Each tick mark should have snap-to regions that can fit the circles and arrows. • Context should be familiar to students 11 to 13 years old. • Item difficulty can be adjusted via these example methods, but are not limited to these methods: <ul style="list-style-type: none"> ◦ c is a whole number; number line has whole numbers labeled. ◦ c is an integer; number line has integers labeled. ◦ c is a decimal; number line is appropriately labeled. ◦ c is a fraction; number line is appropriately labeled. <p>TM3b Example Stem: The freezing point of water is 0 degrees Celsius.</p> <div data-bbox="505 1066 1286 1512" style="border: 1px solid black; padding: 10px;"> <div style="display: flex; justify-content: space-between;"> <div style="width: 30%;"> <p style="text-align: center;">$<$</p> <p style="text-align: center;">$>$</p> <p style="text-align: center;">○ →</p> <p style="text-align: center;">← ○</p> </div> <div style="width: 65%;"> <p>Part A All temperatures below freezing.</p> <p style="text-align: center;">$t \square 0$</p> <p>Part B</p>  </div> </div> </div> <p>Part A: Drag the correct symbol into the box to create an inequality that describes all temperatures (t) below freezing.</p> <p>Part B: Drag the correct ray to the number line to represent all temperatures, t, that are below freezing, in degrees Celsius.</p> <p>Interaction: Students given Delete tool as well as the following:</p> <p>Part A</p> <ul style="list-style-type: none"> • Students use the drag-and-drop tool to place an inequality symbol in the open box. <p>Part B</p> <ul style="list-style-type: none"> • Students use the drag-and-drop tool to place a ray on the
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Grade 6 Mathematics Item Specification C1 TF

	<p>number line.</p> <ul style="list-style-type: none">• Snap-to feature used at each tick mark on the number line. <p>Rubric: (1 point) Student places the correct inequality symbol in the box and places the correct ray at the proper location on the number line.</p> <p>Response Type: Drag and Drop</p>
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