Grade 7 Target D

Domain, Target, Standards, DOK, Vertical Alignments, Achievement Levels, Evidence Required, Vocabulary, Response Types, Materials, Attributes, Question Types, and Question Banks (Examples)

Content Domain: Expressions and Equations

Target D [m]: 7.EE.B Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

Standards included in Target D: 7.EE.B, 7.EE.B.3, 7.EE.B.4

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. 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 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.

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.

a. Solve word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$,

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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. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

b. Solve word 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. 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. Give an inequality for the number of sales you need to make, and describe the solutions.

Vertical Alignment

Related Grade 6 standards

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 give 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 Give 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.

6.EE.C Represent and analyze quantitative relationships between dependent and independent variables.

6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; give an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and give the equation $d = 65t$ to represent the relationship between distance and time.

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.

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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.EE.C.8 Analyze and solve pairs of simultaneous linear equations.

a. Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.
b. Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection. For example, 3x + 2y = 5 and 3x + 2y = 6 have no solution because 3x + 2y cannot simultaneously be 5 and 6.
c. Solve real-world and mathematical problems leading to two linear equations in two variables. For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.

Achievement Level Descriptors

Level 1 Students should be able to solve multi-step problems with integers or common fractions with denominators of 2 through 10, 25, 50, or 100 and decimals to the hundredths place; solve equations in the form of px + q = r, where p, q, and r are integers; and distinguish between inequalities and equations with integer coefficients with or without real-world context.

Level 2 Students should be able to solve multi-step problems with rational numbers and solve equations in the form of px + q = r or p(x + q) = r, where p, q, and r are rational numbers. Students should be able to use variables to represent quantities in familiar real-world and mathematical situations. They should also be able to create equations with variables to solve familiar problems with a high degree of scaffolding.

Level 3 Students should be able to solve and graph solution sets to inequalities with one variable. They should be able to use variables to represent and reason with quantities in real-world and mathematical situations with minimal scaffolding. They should also be able to construct equations with variables to solve problems.

Level 4 Students should be able to use variables to represent and reason with quantities in real-world and mathematical situations with no scaffolding. They should be able to construct inequalities with more than one variable to solve problems.

Evidence Required

1. The student identifies equivalency between two rational numbers.

2. The student applies properties of operations to evaluate numeric expressions, including

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converting between different forms of rational numbers.

3. The student solves word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers.

4. The student solves word problems leading to inequalities of the form $px + q > r$ and $px + q < r$, where p, q, and r are specific rational numbers.

5. The student graphs the solution set of an inequality on a number line.

Vocabulary

rational number, equation, numeric expression, inequality, variable, constant, solution, solution set, distributive property of multiplication over addition, commutative property of addition/multiplication, associative property of addition/multiplication, additive/multiplicative identity, additive/multiplicative inverse

Response Types

Multiple Choice, single correct response; Equation/Numeric; Multiple Choice, multiple correct response; Drag and Drop

Materials

number lines, tables

Attributes

Only multi-step problems may be assessed. “Greater/less than or equal to” may be assessed.

Claim 1: Concepts and Procedures (DOK 1, 2) Question Banks

Students can explain and apply mathematical concepts and carry out mathematical procedures with precision and fluency.

Claim 1 7.EE.B.3 DOK Level 1

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.

Evidence Required

The student identifies equivalency between two rational numbers.

Question Type 1: The student is presented with a multi-step numerical expression involving rational numbers in at least two of these three forms: fraction, decimal, whole number.

1. Select all expressions equivalent to 2.3 • (1 8 1 + 0.125) – 9.

A. 2.3 • (1.25) – 9

B. 9 – 2.3 • (1.125 + $\frac{1}{8}$)

C. –9 + 2.3 • (1.125 + $\frac{1}{8}$)

D. 2.3 • (9 – 1.25)

Answer Choices: Each answer choice is an expression following the same stimulus guidelines. Distractors include expressions with misapplication of properties of operations, sign mistakes, or computation errors.

Rubric: (1 point) The student selects all the appropriate expressions (e.g., A and C).

Response Type: Multiple Choice, multiple correct response

Claim 1 7.EE.B.3 DOK Level 1

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.

Evidence Required

The student applies properties of operations to evaluate numeric expressions, including converting between different forms of rational numbers.

Question Type 1: The student is presented a multi-step numerical expression involving rational numbers in at least two of these three forms: fraction, decimal, or whole number.

1. Enter the value of 21 4 • (4 + 12).

2. What is the mean of -15, -12, 8, and 9?

Rubric: (1 point) The student accurately calculates the value (e.g., 36; -2.5).

Response Type: Equation/Numeric

Question Type 2: The student is presented with a contextual problem that requires converting between different forms of rational numbers.

1. Javier's fuel tank holds $12\frac{3}{4}$ gallons of gasoline when completely full. He had some gas in the tank and added 10.3 gallons of gasoline to fill it completely.

How many gallons of gasoline were in the tank before Javier added some?

Rubric: (1 point) Student enters a correct value (2.45 or equivalent).

Response Type: Equation/Numeric

Claim 1 7.EE.B.4a DOK Level 2

Solve word 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. For example, the perimeter of a rectangle is 54 cm. Its length is 6 cm. What is its width?

Evidence Required

The student solves word problems leading to equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers.

Question Type 1: The student is presented with a real-world situation that leads to an equation of the form $px + q = r$ or $p(x + q) = r$, where p, q, and r are rational numbers.

1. A coach buys a uniform and a basketball for each of the 15 players on the team. Each basketball costs $9.40. The coach spends a total of $420 for uniforms and basketballs.

Enter an equation that models the situation with u, the cost of one uniform.

2. A coach buys a uniform and a basketball for each of the 15 players on the team. Each basketball costs $9. The coach spends a total of $420 for uniforms and basketballs.

Enter the cost, in dollars, of 1 uniform.

Rubric: (1 point) Student enters a correct equation or value (e.g., $15u + 15 \bullet 9.4 = 420$; 19).

Response Type: Equation/Numeric

Claim 1 7.EE.B.4b DOK Level 2

Solve word 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.

Evidence Required

The student solves word problems leading to inequalities of the form $px + q > r$ and $px + q < r$, where p, q, and r are specific rational numbers.

Question Type 1: The student is presented with a real-world situation that leads to an inequality in the form of $px + q > r$ or $px + q < r$, where p, q, and r are rational numbers.

1. Linda has $26. She wants to buy a ski pass for $80. She can earn $6 per hour to babysit.

Enter an inequality that represents the number of hours (h) Linda could babysit to earn at least enough money to buy the ski pass.

Rubric: (1 point) The student enters a correct inequality (e.g., $6h + 26 \geq 80$).

Response Type: Equation/Numeric

Claim 1 7.EE.B.4b DOK Level 2

Solve word 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.

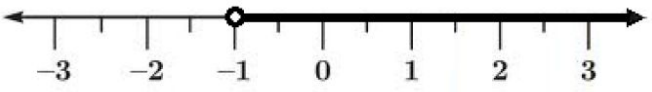
Evidence Required

The student graphs the solution set of an inequality on a number line.

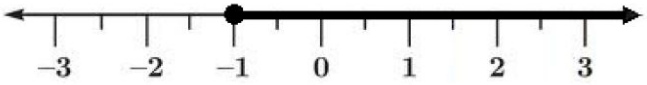
Question Type 1: The student is presented with an inequality of the form $px + q > r$ or $px + q < r$, where p, q, and r are rational numbers.

1. Which number line shows the solution to the inequality $-3x - 5 < -2$?

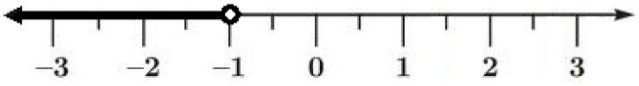
A.



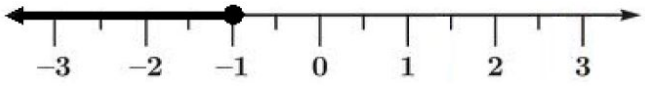
B.



C.



D.



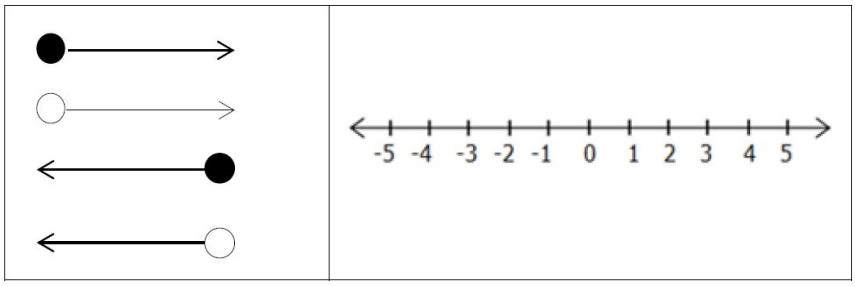
Answer Choices: The answer choices will be horizontal lines, each showing a graph of an inequality. Distractors will include common mistakes made when graphing inequalities such as a ray pointing the wrong direction, rays with closed and/or open circles, incorrect solution to the inequality by not performing the correct operation to both sides of the inequality, and forgetting to switch the inequality symbol when dividing/multiplying by a negative number.

Rubric: (1 point) The student selects the correct number line (e.g., A).

Response Type: Multiple Choice, single correct response

Question Type 2: The student is presented with an inequality of the form $px + q > r$ or $px + q < r$, where p, q, and r are rational numbers, or a situation that can be modeled with an inequality.

1, Drag the correct arrow to the number line to represent the solution of the inequality $3x + 7 > 13$.



Interaction: The student will drag an arrow from a set of preset images to a number line to represent the solution of an inequality. Snap-to feature should be used at each tick mark.

Rubric: (1 point) The student graphs the inequality by placing an arrow on the number line.

Response Type: Drag and Drop

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Claim 2 Problem Solving Question Banks

Claim Descriptors and Targets

Students can solve a range of complex well-posed problems in pure and applied mathematics, making productive use of knowledge and problem-solving strategies.

Example 1

The marching band has 85 members. There are 15 more girls than boys in the band. How many boys are in the marching band?

Enter your answer in the response box.

Rubric: (1 point) The student enters the correct number of boys in the response box (e.g., 35).

Response Type: Equation/Numeric

Item Commentary: Notice that although the equation is simple, the item is a disguised 2-step problem, which prevents extracting the equation through simple keyword analysis. Indeed, keyword analysis might lead to the wrong equation.

Example 2

The students in Mr. Sanchez's class are converting distances measured in miles (m) to kilometers (km).

Abby and Renato use the following methods to convert miles to kilometers.

- Abby takes the number of miles, doubles it, and then subtracts 20% of the result.
- Renato first divides the number of miles by 5, then multiplies the result by 8.

Which equation correctly shows why both their methods produce the same result?

A. $2m - 0.20 = \frac{m}{5} \cdot 8$

B. $2m - 0.20(2m) = \frac{m}{5} \cdot 8$

C. $2m - 2.20m = \frac{m}{5} + 8\left(\frac{m}{5}\right)$

D. $0.20(2m) - 2m = \frac{m}{5} + 8\left(\frac{m}{5}\right)$

Rubric: (1 point) The student selects the correct equation (e.g., B).
Response Type: Multiple Choice, single correct response

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Example 3

A mail-order company sells jars of spices.

- An empty jar has a mass of 200 grams.
- A full jar contains 110 grams of a spice.
- The company sells n jars filled with spices.

Select the best interpretation of the expression (200 +110)n.

A. The cost to ship 1 full jar
B. The cost to ship n full jars
C. The mass of 1 full jar
D. The mass of n full jars

Rubric: (1 point) The student selects the correct interpretation (e.g., D).

Response Type: Multiple Choice, single correct response

Example 4

A mail-order company sells jars of spices.

- An empty jar has a mass of 200 grams.
- A full jar contains 110 grams of a spice.
- The company sells n jars filled with spices.

Select the best interpretation of the expression (200 +110)n.

A. The cost to ship 1 full jar
B. The cost to ship n full jars
C. The mass of 1 full jar
D. The mass of n full jars

Rubric: (1 point) The student selects the correct interpretation (e.g., D).

Response Type: Multiple Choice, single correct response

Claim 3 Communicating Reasoning Question Banks

Claim Descriptors and Targets

Students can clearly and precisely construct viable arguments to support their own reasoning and to critique the reasoning of others.

Example 1

In February, the price of a gallon of gasoline increased by 23% from the price in January. In March, the price decreased by 11% from the price in February. In March, gas cost $2.63 per gallon.

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How much did a gallon of gasoline cost in January, in dollars? Round your answer to the nearest cent. Enter your answer in the response box.

Which equation shown can be solved to find x, the cost of gas in January?

A. (0.11)(0.23)x = 2.63
B. (1.11)(1.23)x = 2.63
C. (0.89)(1.23)x = 2.63
D. (1.11)(0.77)x = 2.63

Rubric: (2 points) The student enters the correct cost of a gallon of gas (2.40) and selects the correct equation (C).
(1 point) The student does one of these parts correctly.

Response Type: Equation/numeric and multiple choice, single correct response