Grade 7 Target B

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

Content Domain: The Number System
Target B [m]: 7.NS.A Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.
Standards included in Target A: 7.NS.A, 7.NS.A.1, 7.NS.A.2, 7.NS.A.3
Vertical Alignment
Achievement Level Descriptors
Evidence Required
Vocabulary
Response Types
Materials
Attributes
Claim 1: Concepts and Procedures (DOK 1, 2) Question Banks
Claim 2 Problem Solving Question Banks
Claim 3 Communicating Reasoning Question Banks
Claim 4 Modeling and Data Analysis Question Banks

Content Domain: The Number System

Target B [m]: 7.NS.A Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers.

Standards included in Target A: 7.NS.A, 7.NS.A.1, 7.NS.A.2, 7.NS.A.3

7.NS.A.1 Apply and extend previous understandings of addition and subtraction to add and subtract rational numbers; represent addition and subtraction on a horizontal or vertical number line diagram.

a. Describe situations in which opposite quantities combine to make 0. For example, a hydrogen atom has 0 charge because its two constituents are oppositely charged.
b. Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.
c. Understand subtraction of rational numbers as adding the additive inverse, p – q = p + (–q). Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.
d. Apply properties of operations as strategies to add and subtract rational numbers.

7.NS.A.2 Apply and extend previous understandings of multiplication and division and of

fractions to multiply and divide rational numbers.

a. Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

b. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with a non-zero divisor) is a rational number. If p and q are integers, then –(p/q) = (–p)/q = p/(–q). Interpret quotients of rational numbers by describing real-world contexts.

c. Apply properties of operations as strategies to multiply and divide rational numbers.

d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

Vertical Alignment

Related Grade 6 standards

6.NS.A Understand ratio concepts and use ratio reasoning to solve problems.

6.NS.A.1 Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?

6.NS.B Compute fluently with multi-digit numbers and find common factors and multiples.

6.NS.B.2 Fluently divide multi-digit numbers using the standard algorithm.

6.NS.B.3 Fluently add, subtract, multiply, and divide multi-digit decimals using the standard algorithm for each operation.

6.NS.B.4 Find the greatest common factor of two whole numbers less than or equal to 100 and the least common multiple of two whole numbers less than or equal to 12. Use the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor. For example, express 36 + 8 as 4 (9 + 2).

6.NS.C Apply and extend previous understandings of numbers to the system of rational numbers.

6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.

6.NS.C.6 Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

a. Recognize opposite signs of numbers as indicating locations on opposite sides of 0 on the number line; recognize that the opposite of the opposite of a number is the number itself, e.g., –(–3) = 3, and that 0 is its own opposite.

b. Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane; recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.

c. Find and position integers and other rational numbers on a horizontal or vertical number line diagram; find and position pairs of integers and other rational numbers on a coordinate plane.

6.NS.C.7 Understand ordering and absolute value of rational numbers.

a. Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. For example, interpret –3 > –7 as a statement that –3 is located to the right of –7 on a number line oriented from left to right.

b. Write, interpret, and explain statements of order for rational numbers in real-world contexts. For example, write –3°C > –7°C to express the fact that –3°C is warmer than –7°C.

c. Understand the absolute value of a rational number as its distance from 0 on the number line; interpret absolute value as magnitude for a positive or negative quantity in a real-world situation. For example, for an account balance of –30 dollars, write |–30| = 30 to describe the size of the debt in dollars.

d. Distinguish comparisons of absolute value from statements about order. For example, recognize that an account balance less than –30 dollars represents a debt greater than 30 dollars.

6.NS.C.8 Solve real-world and mathematical problems by graphing points in all four quadrants of the coordinate plane. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

Related Grade 8 Standards

8.NS.A Know that there are numbers that are not rational, and approximate them by rational numbers.

8.NS.A.1 Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal

expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

8.NS.A.2 Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., 2). For example, by truncating the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.

Achievement Level Descriptors

Level 1 Students should be able to add, subtract, multiply, and divide nonnegative rational numbers. They should be able to add, subtract, multiply, and divide rational numbers with a number line or other manipulative.

Level 2 Students should be able to apply and extend previous understandings and properties of addition and subtraction to add and subtract with rational numbers; identify the absolute value of a rational number and understand when opposites combine to make 0; and convert between familiar fractions and decimals.

Level 3 Students should be able to solve mathematical problems using the four operations on rational numbers and convert from a fraction to a decimal. They should be able to extend previous understandings of subtraction to realize it is the same as adding the additive inverse. They should also be able to understand p + q as a number located |q| units from p on a number line in either direction depending on the sign of q. They should also know, understand, and use the rules for multiplying and dividing signed numbers.

Level 4 Students should be able to apply previous understandings of operations to solve real-world problems involving rational numbers with addition, multiplication, subtraction, and division.

Evidence Required

1. The student interprets rational number values on a number line, including modeling addition and subtraction expressions.

2. The student applies properties of operations as strategies to add and subtract rational numbers.

3. The student applies properties of operations as strategies to multiply and divide rational numbers.

4. The student converts from a fractional form of rational numbers to a decimal form of rational numbers.

5. The student solves real-world and mathematical problems involving the four operations with rational numbers.

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

Vocabulary
rational numbers, absolute value, positive, negative, additive inverse, sum, difference, terminating decimal, repeating decimal, integer

Response Types
Graphing; Equation/Numeric; Multiple Choice, multiple correct response; Matching Tables; Multiple Choice, single correct response; Drag and Drop

Materials
number lines, positive and negative rational numbers, tables

Attributes
This target emphasizes both the understanding of operations and the ability to do calculations with rational numbers.

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.NS.A.1b DOK Level 2

Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.

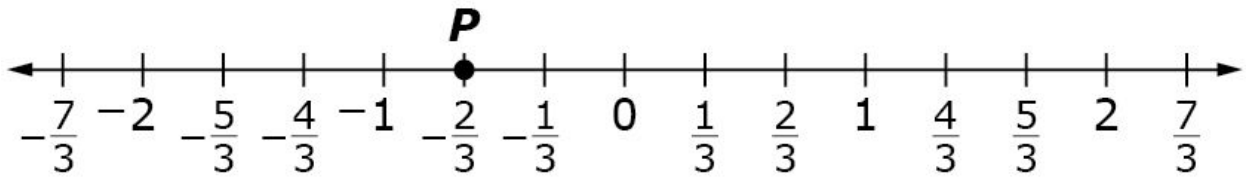
Evidence Required

The student interprets rational number values on a number line, including modeling addition and subtraction expressions.

Question Type 1: The student is presented with a number line with a labeled point at a rational number.

1. What numbers are located exactly $\frac{5}{3}$ units from point P on the number line?

Use the Add Point tool to plot the location of these numbers on the number line.



These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

Rubric: (1 point) The student enters the correct number (e.g., $\frac{1}{2}$).

Response Type: Equation/Numeric

Claim 1 7.NS.A.1b DOK Level 1

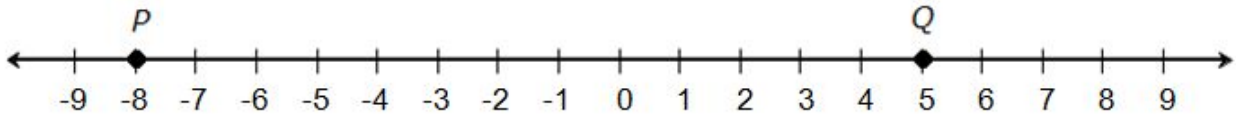
Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.

Evidence Required

The student interprets rational number values on a number line, including modeling addition and subtraction expressions.

Question Type 1: The student is presented with a number line with two labeled points at least 3 units apart.

1. Select all expressions that show the distance between P and Q.



A. 5 – (−8)
B. 5+|8|
C. |8+5|
D. 5 + (−8)

Answer Choices: Answer choices should involve using absolute value signs, such |5+8|. Distractors should include using a wrong operation, number, or sign(s).

Rubric: (1 point) Student selects all correct expressions and no incorrect expressions (e.g., A and B).

Response Type: Multiple Choice, multiple correct response

Claim 1 7.NS.A.1c DOK Level 2

Understand subtraction of rational numbers as adding the additive inverse, p – q = p + (–q). Show that the distance between two rational numbers on the number line is the absolute value of their difference, and apply this principle in real-world contexts.

Evidence Required

The student interprets rational number values on a number line, including modeling addition and subtraction expressions.

Question Type 1: The student is presented with an expression in the form p – q and asked to identify all equivalent expressions.

1. Select all expressions that equal -7 – (-12).
    A. 7+ (-12)
    B. -7 + (-12)
    C. -7 + 12
    D. 7+12

Rubric: (1 point) Student selects all correct expressions and no incorrect expressions (e.g., B and C).

Response Type: Multiple Choice, multiple correct response

Claim 1 7.NS.A.1d DOK Level 1

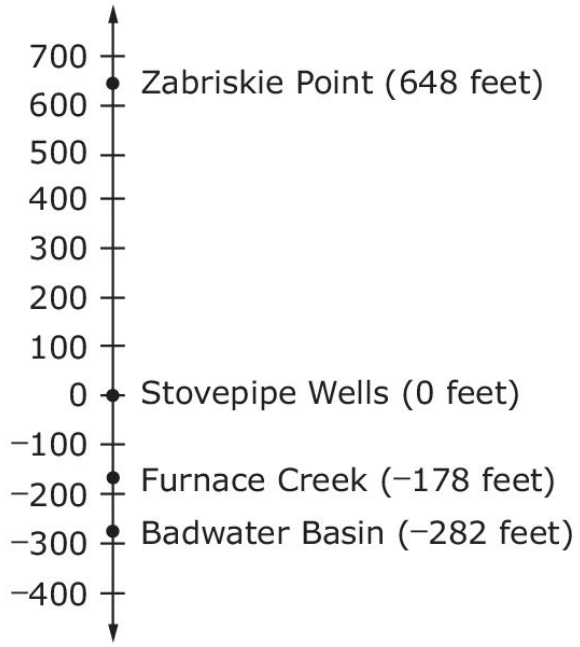
Apply properties of operations as strategies to add and subtract rational numbers.

Evidence Required

The student interprets rational number values on a number line, including modeling addition and subtraction expressions.

Question Type 1: The student is presented with a problem in a real-world context involving the addition or subtraction of rational numbers written in the same form on a number line.

1. The number line shows four elevations in Death Valley National Park.



Enter the difference, in feet, between the elevation at Zabriskie Point and Furnace Creek.

Rubric: (1 point) Correct answer will be a rational number (e.g., 826).

Response Type: Equation/Numeric

Question Type 2: The student is presented with an expression involving the sum or difference of rational numbers.

1. Enter the value of 14 + (-22) – 14 – 22.

2. Enter the value of 2.1 + (-3) – (-0.9).

Rubric: (1 point) Student accurately computes the value of the expression, which is a rational number (e.g., -44; 0).

Response Type: Equation/Numeric

Claim 1 7.NS.A.1b DOK Level 2

Understand p + q as the number located a distance |q| from p, in the positive or negative direction depending on whether q is positive or negative. Show that a number and its opposite have a sum of 0 (are additive inverses). Interpret sums of rational numbers by describing real-world contexts.

Evidence Required

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

The student interprets rational number values on a number line, including modeling addition and subtraction expressions.

Question Type 1: The student is presented with an expression of the form $\frac{p}{q}$ or $-\frac{p}{q}$ where p and q are integers, and q ≠ 0.

1. Select all values equal to $-\frac{4}{5}$.

A. $\frac{-4}{-5}$

B. $-\frac{-4}{-5}$

C. $\frac{-4}{5}$

D. $-\frac{-4}{5}$

E. $\frac{4}{-5}$

Answer Choices: Answer choices are rational numbers in the form of fractions. Distractors should include incorrect values which may be of the form

$$\frac{-p}{-q}, -\frac{-p}{q}, -\frac{p}{-q}, -\frac{-p}{-q}, \frac{-p}{q}, \frac{p}{-q}.$$

Rubric: (1 point) Student selects all the correct expressions (e.g., B, C, and E).

Response Type: Multiple Choice, multiple correct response

Claim 1 7.NS.A.2c DOK Level 1

Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. c. Apply properties of operations as strategies to multiply and divide rational numbers.

Evidence Required

The student applies properties of operations as strategies to multiply and divide rational numbers.

Question Type 1: The student is presented with an expression involving products or quotients of rational numbers.

1. Enter the value of $\frac{1}{2}$ (1.7).

2. Enter the value of (-8)(45)($\frac{1}{8}$).

3. Enter the value of (0.01)(-0.1)(10)(-100).

4. Enter the value of (0.45) ÷ $\frac{9}{10}$.

Rubric: (1 point) Student accurately calculates the product or quotient, which is a rational number (e.g., 0.85; -45; 1; 0.5 or equivalents).

Response Type: Equation/Numeric

Claim 1 7.NS.2a DOK Level 1

Understand that multiplication is extended from fractions to rational numbers by requiring that operations continue to satisfy the properties of operations, particularly the distributive property, leading to products such as (–1)(–1) = 1 and the rules for multiplying signed numbers. Interpret products of rational numbers by describing real-world contexts.

Evidence Required

The student applies properties of operations as strategies to multiply and divide rational numbers.

Question Type 1: The student is presented with a verbal description of a real-world situation with multiplication of rational numbers.

1. If a bank represents deposits with positive numbers and withdrawals as negative numbers, what could)20(5 •− represent?

A. Five deposits of $20.
B. Five withdrawals of $20.
C. A $5 deposit followed by a $20 withdrawal
D. A $5 withdrawal followed by a $20 deposit

Rubric: (1 point) The student selects the correct response (e.g., B).

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

Response Type: Multiple choice, single correct response

Claim 1 7.NS.A.2d DOK Level 1

Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. d. Convert a rational number to a decimal using long division; know that the decimal form of a rational number terminates in 0s or eventually repeats.

Evidence Required

The student converts from a fractional form of rational numbers to a decimal form of rational numbers.

Question Type 1: The student is presented with a rational number in fraction form.

1. Enter the decimal equivalent of $\frac{5}{8}$ **.**

Rubric: (1 point) Student gives the correct decimal equivalent (e.g., 0.625).

Interaction: Make sure student cannot enter a fraction in the response space.

Response Type: Equation/Numeric

Claim 1 7.NS.A.3 DOK Level 2

Solve real-world and mathematical problems involving the four operations with rational numbers.

Evidence Required

The student solves real-world and mathematical problems involving the four operations with rational numbers

Question Type 1: The student is presented with a mathematical expression involving a combination of addition/subtraction and multiplication/division with rational numbers.

1. Enter the value of $\frac{3}{8}$ [-8 + 16 - (2 $\frac{1}{2}$).

Rubric: (1 point) Student accurately calculates the value, which is a rational number (e.g., 3.9375 or 3 $\frac{15}{16}$).

Response Type: Equation/Numeric

Question Type 2: The student is presented with a one-step real-world problem involving addition, subtraction, multiplication, or division with rational numbers.

1. Mark buys a wooden board that is 7 feet long. The cost of the board is $0.50 per foot, including tax. What is the total cost, in dollars, of Mark's board?

Rubric: (1 point) Correct answer will be a single numeric value. (e.g., 3.75).

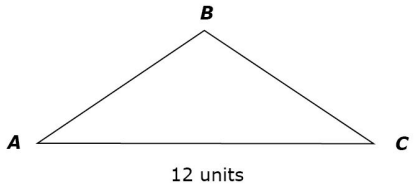
Response Type: Equation/Numeric

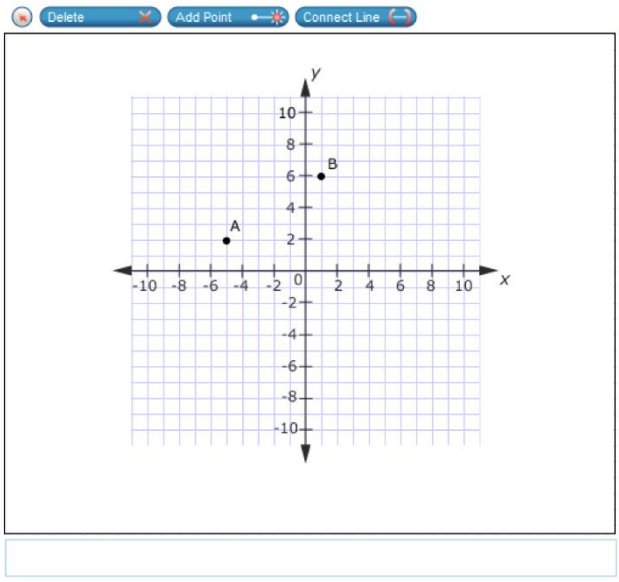
Claim 2 Problem Solving Question Banks

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





Complete the sketch of triangle ABC in the coordinate plane.

- Point A is plotted at (-5, 2)
- Point B is plotted at (1, 6)
- Side AC is parallel to the x-axis and is 12 units long

Use the Add Point and Connect Line Tool to plot C in the coordinate plane and connect the three points.

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

Rubric: (1 point). The student plots point C in the coordinate plane and draws the three line segments. (C is plotted at (7, 2); segments AB, AC, and BC are created)

Response Type: Graphing

Example 2

The weather report predicted that the low temperature would be -8 degrees Fahrenheit. The radio announcer said,

"The low temperature was 5 degrees colder than predicted!"

What was the low temperature, in degrees Fahrenheit?

Enter your answer in the response box.

Rubric: (1 point). The student enters the correct temperature in the response box (e.g., -13).

Response Type: Equation/Numeric

Example 3

Determine whether each expression has a value that is positive, negative, or zero.
Select the correct comparison for each expression.

Rubric: (1 point) The student selects the correct sign for each expression, as shown below.

Expression	Positive	Zero	Negative
$\left(1\frac{2}{3}\right)+\left(-\frac{4}{3}\right)$			
$\frac{23}{56}-0.42$			
$(-0.025)\cdot\left(\frac{9}{16}\right)$			
$\left(-\frac{21}{5}\right)\div\left(-\frac{21}{5}\right)$			

Rubric: (1 point) The student selects the correct sign for each expression, as shown below.

Expression	Positive	Zero	Negative
$\left(1\frac{2}{3}\right)+\left(-\frac{4}{3}\right)$	✓		
$\frac{23}{56}-0.42$			✓
$(-0.025)\cdot\left(\frac{9}{16}\right)$			✓
$\left(-\frac{21}{5}\right)\div\left(-\frac{21}{5}\right)$	✓		

Example 4

This table shows the monthly change in Sara's bank account balance for each month listed. For example, the account balance change of -30 means that Sara's balance decreased by $30 from the beginning to the end of the month of February.

Month	Account Balance Change (Dollars)
January	+38
February	−30
March	−19
April	+49

Determine whether each statement about Sara's bank account balance is true or false, based on the information in the table.

Select True or False for each statement.

Statement	True	False
Sara has less money in her account at the end of February than at the end of any other month.		
Sara's account balance is the same at the end of April as it is at the end of January.		
Sara has more money in her account at the end of April than she had at the **beginning** of January.		

Rubric: (1 point) The student correctly selects true or false for all three statements (e.g., FTT).

Response Type: Matching Tables

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

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

When you divide 100 by a positive whole number, the result is always less than or equal to 100. This is not always true when you divide by a positive fraction.

Give an example of a fraction $\frac{a}{b}$ where $100 \div \frac{a}{b} < 100$

Enter your fraction in the first response box.

Give an example of a fraction $\frac{c}{d}$ where $100 \div \frac{c}{d} > 100$

Enter your fraction in the second response box.

Rubric: (1 point) The student enters appropriate fractions in the response boxes ($\frac{a}{b} > 1$ and $\frac{c}{d} < 1$)

Response Type: Equation/Numeric

Example 2

A perfect square is a number s that is the product of an integer, n, and itself, so that s = n2.

Examples of perfect squares include 25 because it is equal to 52 and 81 because it is equal 92.

Can a perfect square be negative?

A. Yes; an example is −25.
B. No; a square of any integer is always positive.
C. Sometimes Yes, sometimes No; it depends on the value of n.
D. There is not enough information to tell.

Rubric: (1 point) The student selects the correct statement (B).

Response Type: Multiple Choice, single correct response

Example 3

Given x and y are rational numbers, when is |x + y| = |x| + |y| true?

A. This is never true.
B. This is always true.
C. This is true when x and y have opposite signs.
D. This is true when x and y have the same sign.

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

Rubric: (1 point) The student selects the correct statement (D).

Response Type: Multiple Choice, single correct response

Example 4

Clyde and Lily were solve the equation $\frac{8}{9} \div \frac{1}{2} = x$.

Clyde said, "I can think of this division problem as a multiplication problem." Then he wrote:		Lily said, "You need to invert and multiply." Then she wrote:	
Step 1.	$\frac{8}{9} \div \frac{1}{2} = x$	Step 1.	$\frac{8}{9} \div \frac{1}{2} = x$
Step 2.	$\frac{1}{2}x = \frac{8}{9}$	Step 2.	$\frac{8}{9} = 2 \cdot x$
Step 3.	$2\left(\frac{1}{2}x\right) = 2\left(\frac{8}{9}\right)$	Step 3.	$\frac{1}{2}(2x) = \left(\frac{1}{2}\right) \cdot \left(\frac{8}{9}\right)$
Step 4.	$x = \frac{16}{9}$	Step 4.	$x = \frac{8}{18}$

Who solved the problem correctly?

A. Only Clyde solved the equation correctly.
B. Only Lily solved the equation correctly.
C. They both solved the equation correctly.
D. Neither one solved the equation correctly.

Rubric: (1 point) The student selects the correct characterization of these two approaches (A).

Response Type: Multiple choice, single correct response

Example 5

P and T are numbers and P + T = 0.

Select all of the statements about P and Q that could be true.

A. P = 0 and T = 0
B. P = 0 or T = 0, but not both.
C. P can be any positive number and T can be any negative number.
D. P and T are on opposite sides of zero and equally distant from zero on the number line.

Rubric: (1 point) The student selects the correct statements (A, D).

Response Type: Multiple Choice, multiple correct response

These pages were adapted from open source documents available on the Smarter Balanced Website: http://www.smarterbalanced.org/assessments/development/ August 2016

Claim 4 Modeling and Data Analysis Question Banks

Claim Descriptors and Targets

Students can analyze complex, real-world scenarios and can construct and use mathematical models to interpret and solve problems.

Example 1

Alice, Raul, and Maria are baking cookies together.

They need $\frac{3}{4}$ cup of flour and $\frac{1}{3}$ cup of butter to make one batch of cookies.

They each brought the ingredients they had at home.

- Alice brought 2 cups of flour and $\frac{1}{4}$ cup of butter
- Raul brought 1 cup of flour and $\frac{1}{2}$ cup of butter
- Maria brought 1 $\frac{1}{4}$ cups of flour and $\frac{3}{4}$ cups of butter.

Assume the students have plenty of the other ingredients (sugar, salt, baking soda, etc.) they need to make the cookies.

What is the maximum number of whole batches of cookies they can make with the ingredients they brought from home?

Enter your answer in the second response box.

Response Type: Equation/Numeric

Commentary: Difficulty and grade level can be varied by varying the complexity of the numbers used. Item aligns with 4D because students must choose which fraction division limits the number of batches that can be made.