

Grade 6 Mathematics Item Specification C1 TB

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| <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: The Number System</p> | |
| <p>Target B [m]: Apply and extend previous understandings of multiplication and division to divide fractions by fractions. (DOK Levels 1, 2)</p> <p>Tasks for this target will ask students to divide fractions by fractions, including using this as a strategy to solve one-step contextual problems.</p> | |
| <p>Standards: 6.NS.A, 6.NS.A.1</p> | <p>6.NS.A Apply and extend previous understanding of multiplication and division to divide fractions by fractions. 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. <i>For example, create a story context for $(2/3) \div (3/4)$ and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that $(2/3) \div (3/4) = 8/9$ because $3/4$ of $8/9$ is $2/3$. (In general, $(a/b) \div (c/d) = ac/bd$.) 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?</i></p> |
| <p>Related Below-Grade and Above-Grade Standards for Purposes of Planning for Vertical Scaling: 5.NF.B, 5.NF.B.7 7.NS.A, 7.NS.A.2</p> | <p>Related Grade 5 Standards</p> <p>5.NF.B Apply and extend previous understandings of multiplication and division to multiply and divide fractions. 5.NF.B.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.</p> <ol style="list-style-type: none"> Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. <i>For example, create a story context for $(1/3) \div 4$, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain the $(1/3) \div 4 = 1/12$ because $1/12 \times 4 = 1/3$.</i> Interpret division of a whole number by a unit fraction, and compute such quotients. <i>For example, create a story context for $4 \div 1/5$, and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that $4 \div 1/5 = 20$ because $20 \times (1/5) = 4$.</i> Solve real-world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. <i>For example, how much chocolate will each person get if 3 people share $1/2$ lb of chocolate equally? How many $1/3$-cup servings are in 2 cups of raisins?</i> <p>Related Grade 7 Standards</p> <p>7.NS.A Apply and extend previous understandings of operations with fractions to add, subtract, multiply, and divide rational numbers. 7.NS.A.2 Apply and extend previous understandings of multiplication and division of fractions to multiply and divide rational</p> |

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| | <p>numbers.</p> <ol style="list-style-type: none"> Understand that multiplication is extended from fractions to rational numbers by requiring the 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. Understand that integers can be divided, provided that the divisor is not zero, and every quotient of integers (with 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. Apply properties of operations as strategies to multiply and divide rational numbers. 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. |
| DOK Levels: | 1, 2 |
| Achievement Level Descriptors: | |
| <p>RANGE Achievement Level Descriptor (Range ALD) Target B: Apply and extend previous knowledge of multiplication and division to divide fractions by fractions.</p> | <p>Level 1 Students should be able to apply and extend previous understandings of multiplication and division to multiply a fraction by a fraction, divide a fraction by a whole number, and be able to connect to a visual model. They should understand the effect that a fraction greater than or less than 1 has on a whole number when multiplied and use or create visual models when multiplying a whole number by a fraction between 0 and 1.</p> |
| | <p>Level 2 Students should be able to apply and extend previous understandings of multiplication and division to divide a whole number by a fraction between 0 and 1, divide a mixed number by a whole number, and be able to connect to a visual model.</p> |
| | <p>Level 3 Students should be able to apply and extend previous understandings of multiplication and division to divide a fraction by a fraction and be able to connect to a visual model.</p> |
| | <p>Level 4 Students should be able to use visual models in settings where smaller fractions are divided by larger fractions. They should also understand and apply the fact that a fraction multiplied or divided by 1 in the form of a/a is equivalent to the original fraction.</p> |
| Evidence Required: | <ol style="list-style-type: none"> The student interprets quotients of fractions using visual fraction models, equations, and the relationship between multiplication and division. The student solves real-world and mathematical one-step problems involving division of fractions by fractions. |
| Allowable Response Types: | Multiple Choice, single correct response; Drag and Drop; Equation/Numeric |
| Allowable Stimulus Materials: | visual fraction models |
| Construct-Relevant Vocabulary: | fraction, quotient, product |
| Allowable Tools: | none |
| Target-Specific Attributes: | The problems involving division of fractions by fractions should be able to be solved in one step. |
| Non-Targeted Constructs: | none |

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| <p>Accessibility Guidance:</p> | <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> |
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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

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| <p>Task Model 1</p> <p>Response Type: Equation/Numeric</p> <p>DOK Level 2</p> <p>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.</p> <p>Evidence Required: 1. The student interprets quotients of fractions using visual fraction models, equations, and the relationship between multiplication and division.</p> <p>Tools: None</p> <p>Version 3 Update: Retired TM1a, TM1b, and TM1c.</p> | <p>Prompt Features: The student is prompted to recognize and use the relationship between multiplication and division.</p> <p>Stimulus Guidelines:</p> <ul style="list-style-type: none"> • All fractions should be positive. • Item difficulty can be adjusted via these example methods: <ul style="list-style-type: none"> ○ Students find an unknown number in a division problem. ○ Students find an unknown dividend in a given equation involving division of two fractions. ○ Students find an unknown divisor in a given equation involving division of two fractions. <p>TM1d Stimulus: The student is presented with a quotient equation with an unknown fraction or number.</p> <p>Example Stem 1: The equation shown has an unknown number.</p> $\square \div \frac{2}{3} = \frac{3}{4}$ <p>Enter a number that makes the equation true.</p> <p>Example Stem 2: The equation shown has an unknown number.</p> $\frac{2}{3} \div \square = \frac{6}{8}$ <p>Enter a number that makes the equation true.</p> <p>Rubric: (1 point) Student enters the correct fraction (e.g., $\frac{1}{2}$; $\frac{8}{9}$ or equivalent value).</p> <p>Response Type: Equation/Numeric</p> |
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| <p>Task Model 2</p> <p>Response Type: Equation/Numeric</p> <p>DOK Level 1</p> <p>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.</p> <p>Evidence Required: 2. The student solves real-world and mathematical one-step problems involving division of fractions by fractions.</p> <p>Tools: None</p> <p>Version 3 Update: Added more example stems to TM2b and added new TM2c.</p> | <p>Prompt Features: The student is prompted to solve a one-step mathematical or real-world problem involving division of fractions by fractions.</p> <p>Stimulus Guidelines:</p> <ul style="list-style-type: none"> Context should be familiar to students 11 to 13 years old. Numbers used could be positive fractions and/or mixed numbers. Answers should be appropriate for the context. Item difficulty can be adjusted via these example methods: <ul style="list-style-type: none"> Students solve a problem involving division of two fractions (no mixed numbers). Students solve a problem involving division of two fractions (at least one mixed number). divide two fractions (at least one mixed number). Do not allow operation symbols in the response keypad. <p>TM2a Stimulus: The student is is asked to compute the quotient of two fractions.</p> <p>Example Stem 1: What is the value of $\frac{2}{3} \div \frac{3}{4}$?</p> <p>Example Stem 2: What is the value of $2\frac{2}{3} \div \frac{3}{4}$?</p> <p>Rubric: (1 point) Student enters a whole number, mixed number, or fraction equivalent to the correct quotient (e.g., $\frac{8}{9}$; $3\frac{5}{9}$).</p> <p>Response Type: Equation/Numeric</p> <p>TM2b Stimulus: The student is presented with a real-world one-step problem involving division of fractions by fractions.</p> <p>Example Stem 1: A recipe requires $\frac{3}{4}$ cup of nuts for 1 batch of muffins.</p> <p>Enter the number of batches of muffins that can be made using $7\frac{1}{2}$ cups of nuts.</p> <p>Example Stem 2: Nina used $3\frac{3}{4}$ liters of water to completely fill 3 water bottles.</p> <p>If the water bottles are all the same size, how many liters of water does each bottle hold? Enter your answer in the response box.</p> |
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| | <p>Example Stem 3: Joey made $\frac{1}{2}$ of a recipe and used $\frac{3}{4}$ cups of peas. How many cups of peas are required for a whole recipe? Enter your answer in the response box.</p> <p>Rubric: (1 point) Student enters the correct quotient (e.g., 10; $1\frac{1}{4}$ or $\frac{5}{4}$; $1\frac{1}{2}$ or $\frac{6}{4}$ or equivalents).</p> <p>Response Type: Equation/Numeric</p> |
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| <p>Task Model 2</p> <p>Response Type: Multiple choice, multiple select response</p> <p>DOK Level 2</p> <p>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.</p> <p>Evidence Required: 1. The student interprets quotients of fractions using visual fraction models, equations, and the relationship between multiplication and division.</p> <p>Tools: None</p> <p>Version 3 Update: Added new TM2c</p> | <p>Prompt Features: The student is prompted to interpret fraction division in a context.</p> <p>Stimulus Guidelines:</p> <ul style="list-style-type: none"> • Context should be familiar to students 11 to 13 years old. • Numbers used could be positive fractions and/or mixed numbers. • Item difficulty can be adjusted via these example methods: <ul style="list-style-type: none"> ○ by including different combinations of whole numbers, ○ fractions less than 1, ○ fractions greater than 1, ○ mixed numbers as dividend, divisor, and quotient. <p>TM2c Stimulus: The student is asked to interpret fraction division in a context.</p> <p>Example Stem 1: Select all the questions that can be answered by determining the value of $1\frac{3}{4} \div \frac{1}{2}$?</p> <ul style="list-style-type: none"> A. Chloe has $1\frac{3}{4}$ kilograms of rice she is using to fill $\frac{1}{2}$ kilogram packets. How many packets can she fill? B. Terry ran $1\frac{3}{4}$ miles. This is $\frac{1}{2}$ the distance that Kim ran. What is the distance, in miles, that Kim ran? C. Danielle has a cat who is $1\frac{3}{4}$ years old. Her dog is $\frac{1}{2}$ that age. How old is her dog? D. Jeri had $1\frac{3}{4}$ pounds of gummi worms, which she shared equally with her best friend. How many pounds of gummi worms did they each get? <p>Rubric: (1 point) The student selects all of the contexts that can be represented by the given quotient (e.g., A, B).</p> <p>Response Type: Multiple choice, multiple select response</p> |
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