

## Grade 3 Mathematics Item Specification C1 TB

### **Claim 1:** Concepts and Procedures

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

Content Domain: **Operations and Algebraic Thinking**

**Target B [m]:** Understand properties of multiplication and the relationship between multiplication and division. (DOK 1)

Whereas Target A focuses more on the practical uses of multiplication and division, Target B focuses more on the mathematical properties of these operations, including the mathematical relationship between multiplication and division.

Tasks associated with this target are not intended to be vocabulary exercises along the lines of “Which of these illustrates the Distributive Property?” As indicated by the CCSSM, students need not know the formal names for the properties of operations. Instead, tasks are to probe whether students are able to *use* the properties to multiply and divide. Note: Tasks that code directly to Target B will be limited to products and dividends within 100.

<p>Standards: 3.OA.B, 3.OA.B.5, 3.OA.B.6</p>	<p><b>3.OA.B Understand properties of multiplication and the relationship between multiplication and division.</b></p> <p><b>3.OA.B.5</b> Apply properties of operations as strategies to multiply and divide. <i>Examples: If <math>6 \times 4 = 24</math> is known, then <math>4 \times 6 = 24</math> is also known. (Commutative Property of Multiplication.) <math>3 \times 5 \times 2</math> can be found by <math>3 \times 5 = 15</math>, then <math>15 \times 2 = 30</math>, or by <math>5 \times 2 = 10</math>, then <math>3 \times 10 = 30</math>. (Associative Property of Multiplication.) Knowing that <math>8 \times 5 = 40</math> and <math>8 \times 2 = 16</math>, one can find <math>8 \times 7</math> as <math>8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56</math>. (Distributive Property.)</i></p> <p><b>3.OA.6</b> Understand division as an unknown-factor problem. <i>For example, find <math>32 \div 8</math> by finding the number that makes 32 when multiplied by 8.</i></p>
<p>Related Below-Grade and Above-Grade Standards for Purposes of Planning for Vertical Scaling:</p> <p>2.NBT.B, 2.NBT.B.5, 2.NBT.B.6, 2.NBT.B.7, 2.NBT.B.9, 2.G.A, 2.G.A.2</p> <p>4.NBT.B, 4.NBT.5, 4.NBT.6</p>	<p><b>Related Grade 2 Standards</b></p> <p><b>2.NBT.B Use place value understanding and properties of operations to add and subtract.</b></p> <p><b>2.NBT.5</b> Fluently add and subtract within 100, using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.</p> <p><b>2.NBT.6</b> Add up to four two-digit numbers, using strategies based on place value and properties of operations.</p> <p><b>2.NTB.7</b> Add and subtract within 1000, using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.</p> <p><b>2.NBT.9</b> Explain why addition and subtraction strategies work, using place value and the properties of operations.</p>

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	<p><b>2.G.A Reason with shapes and their attributes.</b></p> <p><b>2.G.A.2</b> Partition a rectangle into rows and columns of same-sized squares, and count to find the total number of them.</p> <p><b>Related Grade 4 Standards</b></p> <p><b>4.NBT.B Use place value understanding and properties of operations to perform multi-digit arithmetic.</b></p> <p><b>4.NBT.B.5</b> Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.</p> <p><b>4.NBT.B.6</b> Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.</p>
DOK Level:	1
<b>Achievement Level Descriptors:</b>	
<p><b>RANGE Achievement Level Descriptor (Range ALD)</b></p> <p>Target B: Understand properties of multiplication and the relationship between multiplication and division.</p>	<p><b>Level 1</b> No Descriptor</p> <p><b>Level 2</b> Students should be able to apply the Commutative Property of Multiplication to mathematical problems with one-digit factors.</p> <p><b>Level 3</b> Students should be able to apply the Commutative and Associative Properties of Multiplication and the Distributive Property within 100. They should be able to understand the relationship between multiplication and division when solving an unknown factor problem.</p> <p><b>Level 4</b> Students should be able to communicate a deep understanding of the Commutative and Associative Properties of Multiplication, and the relationship between multiplication and division.</p>
Evidence Required:	<p>1. The student uses the properties of operations (Commutative Property of Multiplication, Associative Property of Multiplication, and Distributive Property) as strategies to multiply and divide.</p> <p>2. The student will represent division as an unknown-factor problem.</p>
Allowable Response Types:	Multiple Choice, single correct response; Matching Tables; Equation/Numeric
Allowable Stimulus Materials:	Area models will be used and should reflect the appropriate property and have a product or dividend within 100 using single-digit factors.

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	Unknown quantities within equations should be represented by a box ( $\square$ ), "n", or "?" in place of the missing factor, product, divisor, dividend, or quotient.
Construct-Relevant Vocabulary:	divide, equation, multiply, factor, equal, operation, product, quotient, expression
Allowable Tools:	None
Target-Specific Attributes:	Use multiplication and division <b>within</b> 100 using single-digit factors.
Non-Targeted Constructs:	None
Accessibility Guidance:	<p>Item writers should consider the following Language and Visual Element/Design guidelines<sup>1</sup> when developing items.</p> <p>Language Key Considerations:</p> <ul style="list-style-type: none"> <li>• Use simple, clear, and easy-to-understand language needed to assess the construct or aid in the understanding of the context</li> <li>• Avoid sentences with multiple clauses</li> <li>• Use vocabulary that is at or below grade level</li> <li>• Avoid ambiguous or obscure words, idioms, jargon, unusual names and references</li> </ul> <p>Visual Elements/Design Key Considerations:</p> <ul style="list-style-type: none"> <li>• Include visual elements only if the graphic is needed to assess the construct or it aids in the understanding of the context</li> <li>• Use the simplest graphic possible with the greatest degree of contrast, and include clear, concise labels where necessary</li> <li>• Avoid crowding of details and graphics</li> </ul> <p>Items are selected for a student's test according to the blueprint, which selects items based on Claims and targets, not task models.</p> <p>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.<sup>2</sup></p>
Development Notes:	None

<sup>1</sup> 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>

<sup>2</sup> For more information about student accessibility resources and policies, refer to

[http://www.smarterbalanced.org/wordpress/wp-content/uploads/2014/08/SmarterBalanced\\_Guidelines.pdf](http://www.smarterbalanced.org/wordpress/wp-content/uploads/2014/08/SmarterBalanced_Guidelines.pdf)

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<p><b>Task Model 1</b></p> <p><b>Response Type:</b> <b>Multiple Choice,</b> <b>single correct</b> <b>response</b></p> <p><b>DOK Level 1</b></p> <p><b>3.OA.B.5</b> Apply properties of operations as strategies to multiply and divide. <i>Examples: If <math>6 \times 4 = 24</math> is known, then <math>4 \times 6 = 24</math> is also known. (Commutative Property of Multiplication.) <math>3 \times 5 \times 2</math> can be found by <math>3 \times 5 = 15</math>, then <math>15 \times 2 = 30</math>, or by <math>5 \times 2 = 10</math>, then <math>3 \times 10 = 30</math>. (Associative Property of Multiplication.) Knowing that <math>8 \times 5 = 40</math> and <math>8 \times 2 = 16</math>, one can find <math>8 \times 7</math> as <math>8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56</math>. (Distributive Property.)</i></p> <p><b>Evidence Required:</b> 1. The student uses the properties of operations (Commutative Property of Multiplication, Associative Property of Multiplication, and Distributive Property of Multiplication) as strategies to multiply and divide.</p> <p><b>Tools:</b> None</p> <p><b>Version 3 Update:</b> Revised TM1a, including the prompt features and stimulus guidelines, and replaced all example stems.</p>	<p><b>Prompt Features:</b> The student uses Properties of Multiplication to determine an unknown value in an equation.</p> <p><b>Stimulus Guidelines:</b></p> <ul style="list-style-type: none"> <li>Emphasis of task models should be on using the strategies to develop fluency, specifically on harder to remember products and quotients within the limits established for grade 3</li> <li>Items do not include parentheses</li> <li>Unknown number can be in any position</li> </ul> <p><b>TM1a</b> <b>Stimulus:</b> The student is presented with an equation that encourages use of one or more properties to find an unknown value.</p> <p><b>Example Stem 1:</b> What unknown number makes the equation true?</p> $8 \times 6 = 6 \times \square$ <p><b>Example Stem 2:</b> What unknown number makes the equation true?</p> $8 \times 6 = 8 \times \square \times 2$ <p><b>Example Stem 3:</b> What unknown number makes the equation true?</p> $5 \times 9 = 5 \times 10 - \square$ <p><b>Example Stem 4:</b> What unknown number makes the equation true?</p> $5 \times 8 = 10 \times 8 \div \square$ <p><b>Example Stem 5:</b> What unknown number makes the equation true?</p> $6 \times 6 = 6 \times 5 + \square$ <p><b>Example Stem 6:</b> What unknown number makes the equation true?</p> $8 \times 7 = 5 \times 7 + \square \times 7$ <p><b>Rubric:</b> (1 point) The student identifies the correct unknown number for each equation (e.g., 8; 3; 5; 2; 6; 3).</p> <p><b>Response Type:</b> Equation/Numeric</p>
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**Task Model 1****Response Type:**  
**Matching Tables****DOK Level 1****3.OA.B.5**

Apply properties of operations as strategies to multiply and divide.

*Examples: If  $6 \times 4 = 24$  is known, then  $4 \times 6 = 24$  is also known.*

*(Commutative Property of Multiplication.)  $3 \times 5 \times 2$  can be found by  $3 \times 5 = 15$ , then  $15 \times 2 = 30$ , or by  $5 \times 2 = 10$ , then  $3 \times 10 = 30$ .*

*(Associative Property of Multiplication.) Knowing that  $8 \times 5 = 40$  and  $8 \times 2 = 16$ , one can find  $8 \times 7$  as  $8 \times (5 + 2) = (8 \times 5) + (8 \times 2) = 40 + 16 = 56$ . (Distributive Property.)*

**Evidence Required:**

1. The student uses the properties of operations (Commutative Property of Multiplication, Associative Property of Multiplication, and Distributive Property of Multiplication) as strategies to multiply and divide.

**Tools:** None

**Prompt Features:** The student uses the Properties of Multiplication to select equivalent expressions.

**Stimulus Guidelines:**

- Product must be within 100.
- Parentheses may be used with the Associative and Distributive Properties.
- Three to four expressions can be provided in the table.
- Applying the properties of operations as strategies to multiply and divide should be equally distributed among the following types:
  - Use the Commutative Property of Multiplication.
  - Use the Associative Property of Multiplication.
  - Use the Distributive Property.
- Equations or expressions in the stem may be presented in the following formats:
  - $a \times b$
  - $a \times b \times c$
  - $(a \times b) \times c$
  - $a \times (b \times c)$
  - $a \times (b + c)$

**TM1b**

**Stimulus:** The student is presented with a multiplication expression with two to four factors.

**Example Stem 1:** Decide whether each expression is equal to  $5 \times 9$ . Select Yes or No for each expression.

	Yes	No
$5 \times (5 + 4)$		
$(5 \times 5) + 4$		
$(5 \times 5) + (5 \times 4)$		

**Rubric:** (1 point) The student correctly responds to each choice (e.g., YNY).

**Response Type:** Matching Tables

<p><b>Task Model 2a</b></p> <p><b>Response Type:</b> <b>Multiple Choice,</b> <b>single correct</b> <b>response</b></p> <p><b>DOK Level 1</b></p> <p><b>3.OA.B.6</b> Understand division as an unknown-factor problem. <i>For example, find <math>32 \div 8</math> by finding the number that makes 32 when multiplied by 8.</i></p> <p><b>Evidence Required:</b> 2. The student will represent division as an unknown-factor problem.</p> <p><b>Tools:</b> None</p> <p><b>Version 3 Update:</b> Retired TM2b</p>	<p><b>Prompt Features:</b> The student represents division as an unknown-factor problem.</p> <p><b>Stimulus Guidelines:</b></p> <ul style="list-style-type: none"> <li>• The unknown value is represented by “?” or a box (<math>\square</math>).</li> <li>• Dividends are within 100.</li> <li>• Item difficulty can be adjusted via these example methods:             <ul style="list-style-type: none"> <li>○ The unknown factor in the equivalent multiplication equation is the first or second factor.</li> <li>○ The product is presented first with the unknown factor in the equivalent multiplication equation as either the first or second factor.</li> <li>○ The format of the correct answer: <math>2 \times \square = 8</math>; <math>\square \times 3 = 27</math>; <math>48 = \square \times 6</math>; or <math>48 = 6 \times \square</math>.</li> </ul> </li> </ul> <p><b>TM2a</b> <b>Stimulus:</b> The student is presented with a division equation with an unknown quotient.</p> <p><b>Example Stem 1:</b> Which equation has the same unknown value as <math>8 \div 2 = \square</math>?</p> <p>A. <math>8 \times \square = 2</math>          B. <math>2 \times \square = 8</math>          C. <math>\square \div 2 = 8</math>          D. <math>\square \div 8 = 2</math></p> <p><b>Example Stem 2:</b> Which equation has the same unknown value as <math>27 \div 3 = \square</math>?</p> <p>A. <math>27 \times \square = 3</math>          B. <math>\square = 3 \times 27</math>          C. <math>\square \times 3 = 27</math>          D. <math>3 \times 27 = \square</math></p> <p><b>Example Stem 3:</b> Which equation has the same unknown value as <math>48 \div 6 = \square</math>?</p> <p>A. <math>48 \times \square = 6</math>          B. <math>6 \times \square = 48</math>          C. <math>\square \div 6 = 48</math>          D. <math>\square \div 48 = 6</math></p> <p><b>Rubric:</b> (1 point) The student identifies the correct equation (e.g., B; C; B).</p> <p><b>Response Type:</b> Multiple Choice, single correct response</p>
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