

## **Grade 4 Target G**

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

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### **Content Domain: Numbers and Operations—Fractions**

#### **Target G [m]: 4.NF.B Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.**

#### **Standards included in Target G: 4.NF.B.3, 4.NF.B.4**

**4.NF.B** Build fractions from unit fractions by applying and extending previous understandings of operations on whole numbers.

**4.NF.B.3** Understand a fraction  $a/b$  with  $a > 1$  as a sum of fractions  $1/b$ .

a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.

b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. Examples:  $3/8 = 1/8 + 1/8 + 1/8$  ;  
 $3/8 = 1/8 + 2/8$  ;  $2\ 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8$ .

c. Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction.

d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.

**4.NF.B.4** Apply and extend previous understandings of multiplication to multiply a fraction by a

whole number.

- a. Understand a fraction  $a/b$  as a multiple of  $1/b$ . For example, use a visual fraction model to represent  $5/4$  as the product  $5 \times (1/4)$ , recording the conclusion by the equation  $5/4 = 5 \times (1/4)$ .
- b. Understand a multiple of  $a/b$  as a multiple of  $1/b$ , and use this understanding to multiply a fraction by a whole number. For example, use a visual fraction model to express  $3 \times (2/5)$  as  $6 \times (1/5)$ , recognizing this product as  $6/5$ . (In general,  $n \times (a/b) = (n \times a)/b$ .)
- c. Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. For example, if each person at a party will eat  $3/8$  of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?

### **Vertical Alignment**

#### **Related Grade 3 standards**

3.NF.A Develop understanding of fractions as numbers.

3.NF.A.1 Understand a fraction  $1/b$  as the quantity formed by 1 part when a whole is partitioned into  $b$  equal parts; understand a fraction  $a/b$  as the quantity formed by  $a$  parts of size  $1/b$ .

3.NF.A.2 Understand a fraction as a number on the number line; represent fractions on a number line diagram.

- a. Represent a fraction  $1/b$  on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into  $b$  equal parts. Recognize that each part has size  $1/b$  and that the endpoint of the part based at 0 locates the number  $1/b$  on the number line.
- b. Represent a fraction  $a/b$  on a number line diagram by marking off a lengths  $1/b$  from 0. Recognize that the resulting interval has size  $a/b$  and that its endpoint locates the number  $a/b$  on the number line.

#### **Related Grade 5 Standards**

5.NF.A Use equivalent fractions as a strategy to add and subtract fractions.

5.NF.A.1 Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example,  $2/3 + 5/4 = 8/12 + 15/12 = 23/12$ . (In general,  $a/b + c/d = (ad + bc)/bd$ .)

5.NF.A.2 Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. For example, recognize an

incorrect result  $2/5 + 1/2 = 3/7$ , by observing that  $3/7 < 1/2$ .

5.NF.B Apply and extend previous understandings of multiplication and division to multiply and divide fractions.

5.NF.B.4 Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

- a. Interpret the product  $(a/b) \times q$  as a parts of a partition of  $q$  into  $b$  equal parts; equivalently, as the result of a sequence of operations  $a \times q \div b$ .
- b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

5.NF.B.6 Solve-real world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

### **Achievement Level Descriptors**

**Level 1** Students should be able to understand that a fraction  $a/b$  with  $a > 1$  is the sum of its unit fractional parts by extending previous understandings of addition on whole numbers. They should be able to identify fractions using visual models.

**Level 2** Students should be able to understand that a fraction  $a/b$  is a multiple of  $1/b$  by extending previous understanding of multiplication on whole numbers; solve one-step problems involving addition and subtraction of fractions referring to the same whole with like denominators; and use visual fraction models and/or equations to represent the problem.

**Level 3** Students should be able to identify and generate equivalent forms of a fraction including mixed numbers with like denominators and solve one-step problems involving multiplication of a fraction by a whole number.

**Level 4** No Descriptor

### **Evidence Required**

1. The student adds and subtracts fractions with like denominators by joining and separating parts referring to the same whole.
2. The student expresses an equivalent form of a fraction or mixed number by considering each as a sum of fractions with the same denominator.
3. The student solves contextual problems involving addition and subtraction of fractions referring to the same whole and having like denominators by using visual fraction models and equations to represent the problem.

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4. The student represents a fraction  $a/b$  as a multiple of  $1/b$ .
5. The student multiplies a fraction by a whole number.
6. The student solves contextual problems involving the multiplication of a fraction by a whole number by using visual fraction models and equations to represent the problem.

### **Vocabulary**

equation, expression, equal, fraction, model, product, numerator

### **Response Types**

Multiple Choice, single correct response; Equation/Numeric; Matching Tables; Drag and Drop; Hot Spot

### **Materials**

number lines, parts of whole visual models, parts of set visual models, equations, expressions

### **Attributes**

- Unless otherwise specified, no distinction is made between proper and improper fractions.
- Unless otherwise specified, improper fractions and mixed numbers do not get special treatment.
- The majority of items in this target should follow the CCSS limitations on denominators allowed at 4th grade (2, 3, 4, 5, 6, 8, 10, 12, and 100). For the purposes of adaptive testing, however, some items will use denominators

### **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 4.NF.B.3 DOK Level 1**

Understand a fraction  $a/b$  with  $a > 1$  as a sum of fraction  $1/b$ .

#### **Evidence Required**

The student adds and subtracts fractions with like denominators by joining and separating parts referring to the same whole.

**Question Type 1:** The student is presented with a fraction addition or subtraction equation with a box to represent an unknown result.

1. Enter the unknown number that makes the equation true.

$$\frac{1}{8} + \frac{4}{8} = \square$$

2. Enter the unknown number that makes the equation true.

$$\square = \frac{4}{8} - \frac{1}{8}$$

Rubric: (1 point) The student shows understanding of addition and subtraction of fractions by entering the correct sum or difference of two fractions with like denominators (e.g., 58; 38).

Response Type: Equation/Numeric

**Question Type 2:** The student is presented with a fraction addition or subtraction equation with a box for an unknown number.

1. Enter the unknown number that makes the equation true.

$$\frac{7}{5} - \square = \frac{4}{5}$$

2. Enter the unknown number that makes the equation true.

$$\frac{4}{5} = \square + \frac{2}{5}$$

Rubric: (1 point) The student shows understanding of addition and subtraction of fractions by entering the correct sum or difference of two fractions with like denominators (e.g.,  $\frac{3}{5}$ ;  $\frac{2}{5}$ ).

Response Type: Equation/Numeric

### **Claim 1 4.NF.B.3 DOK Level 2**

Understand a fraction  $a/b$  with  $a > 1$  as a sum of fraction  $1/b$ .

#### **Evidence Required**

The student expresses an equivalent form of a fraction or mixed number by considering each as a sum of fractions with the same denominator.

**Question Type 1:** The student is presented with a fraction and three fraction addition expressions. The number 1 may be used in place of a fraction with like denominator.

Decide whether each expression is equal to  $1 \frac{5}{8}$ . Click in the table to respond.

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	Equal to $1\frac{5}{8}$	Not Equal to $1\frac{5}{8}$
$1 + \frac{5}{8}$		
$\frac{8}{8} + \frac{3}{8} + \frac{2}{8}$		
$1 + \frac{3}{8} + \frac{1}{8} + \frac{2}{8}$		

Rubric: (1 point) The student correctly identifies all three expressions as either equal or not equal to the given fraction (e.g., Equal, Equal, Not Equal).

Response Type: Matching Tables

**Question Type 2:** The student is presented with two equations representing the decomposition of a fraction or mixed number.

1. Drag numbers to the numerators of the fractions to show **two** different correct equations.

$$\frac{7}{8} = \frac{\square}{8} + \frac{\square}{8} + \frac{\square}{8} \qquad \frac{7}{8} = \frac{\square}{8} + \frac{\square}{8} + \frac{\square}{8}$$

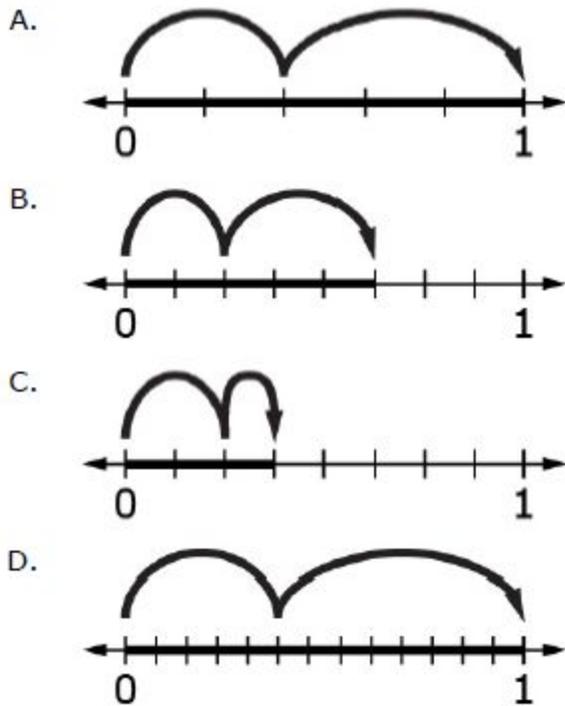
Rubric: (1 point) The student correctly completes the equations provided (e.g., 2, 1, 4 and 4, 3, 0).

Response Type: Drag and Drop

**Question Type 3:** The student is presented with an addition equation representing the decomposition of a fraction.

Select the model that matches this equation.

$$\frac{5}{8} = \frac{2}{8} + \frac{3}{8}$$



Rubric: (1 point) The student selects the correct visual representation of the decomposition of a fraction (e.g., B).

Response Type: Multiple Choice, single correct response

**Question Type 4:** The student is presented with an expression representing the decomposition of a fraction into unit fractions.

Enter the fraction that is equivalent to the expression:  $\frac{1}{8} + \frac{1}{8} + \frac{1}{8}$ .

Rubric: (1 point) The student enters the correct fraction (e.g.,  $\frac{3}{8}$ ).

Response Type: Equation/Numeric

**Claim 1 4.NF.B.3 DOK Level 1**

Understand a fraction  $a/b$  with  $a > 1$  as a sum of fraction  $1/b$ .

**Evidence Required**

The student solves contextual problems involving addition and subtraction of fractions referring to the same whole and having like denominators by using visual fraction models and equations to represent the problem.

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**Question Type 1:** The student is presented with a contextual problem involving the addition or subtraction of fractions referring to the same whole and having like denominators.

1. John has  $\frac{5}{6}$  of a liter of juice. Jill has  $\frac{3}{6}$  of a liter of juice. How many liters of juice do John and Jill have together?

Enter the number.

2. Eric has  $\frac{7}{8}$  of a pound of nuts. Jill has  $\frac{2}{8}$  of a pound of nuts. How many more pounds of nuts does Eric have than Jill?

Enter the number.

Rubric: (1 point) The student enters the correct fraction (e.g,  $\frac{8}{6}$  or  $\frac{4}{3}$  or  $\frac{12}{6}$  or  $\frac{11}{3}$  ;  $\frac{5}{8}$  ).

Response Type: Equation/Numeric

**Question Type 2:** The student is presented with a contextual problem involving the addition or subtraction of fractions referring to the same whole and having like denominators.

1. Jack has  $2\frac{3}{4}$  feet of rope. Together, Jack and Diane have  $4\frac{1}{4}$  feet of rope. How many feet of rope does Diane have? Enter your answer in the response box.

2 A baker has  $3\frac{8}{6}$  cups of sugar. She has  $2\frac{1}{4}$  more cups of sugar than cups of flour. How many cups of flour does she have? Enter your answer in the response box.

Rubric: (1 point) The student enters the correct fraction (e.g,  $1\frac{2}{4}$  ,  $1\frac{2}{4}$  ).

Response Type: Equation/Numeric

**Question Type 3:** The student is presented with a contextual problem involving the addition or subtraction of fractions.

1. Michael eats  $\frac{4}{6}$  of a bar of chocolate. Erin eats  $\frac{5}{6}$  of a bar of chocolate.

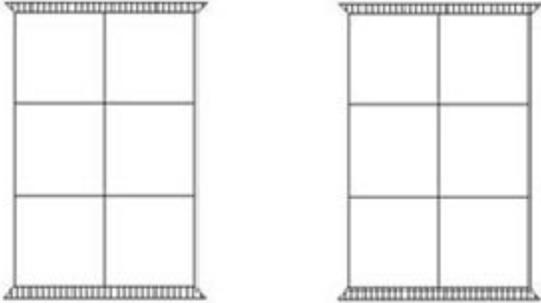


represents one bar of chocolate

**Part A:** Shade the model to show how many bars of chocolate Michael and Erin eat together.

**Part B:** Click on the total number of bars of chocolate Michael and Erin eat together.

**Part A:**



**Part B:**  $\frac{9}{12}$     $1\frac{3}{6}$     $\frac{1}{6}$     $1\frac{3}{12}$

Rubric:

**Part A:** (1 point) The student builds a model that correctly represents a fraction addition or subtraction problem (e.g.,  $1\frac{3}{6}$ ).

**Part B:** (1 point) The student selects the correct number (e.g.,  $1\frac{3}{6}$ ).

Response Type: Hot Spot

2. Michael and Erin have 2 bars of chocolate. Together they eat  $1\frac{1}{6}$  bars of chocolate.

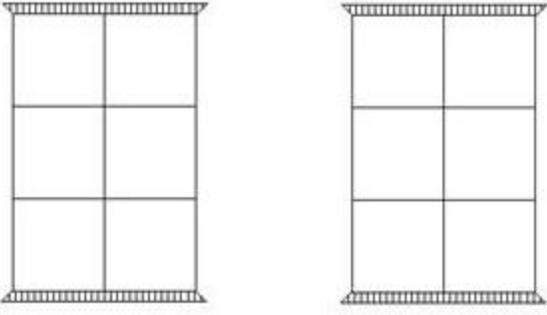
**Part A:** Shade the model to show the amount of chocolate they did not eat.

**Part B:** Click on the fraction that shows the amount of chocolate they did not eat.



represents one bar of chocolate

**Part A:**



**Part B:**      $\frac{5}{6}$      $\frac{7}{6}$      $\frac{5}{12}$      $\frac{7}{12}$

Rubric:

**Part A:** (1 point) The student builds a model that correctly represents a fraction addition or subtraction problem (e.g.,  $\frac{5}{6}$ ).

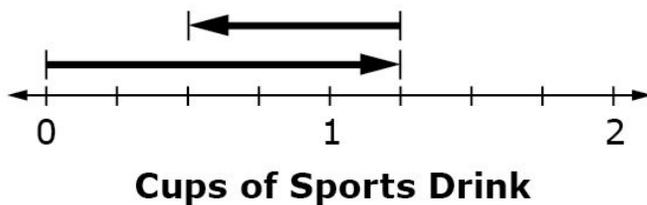
**Part B:** (1 point) The student selects the correct number (e.g.,  $\frac{5}{6}$ ).

Response Type: Hot Spot

**Question Type 4:** The student is presented with a model of a contextual problem involving the addition or subtraction of fractions.

José has  $1\frac{1}{4}$  cups of a sports drink. He gives  $\frac{3}{4}$  cup of his drink to his sister.

How much sports drink, in cups, does José has left?



Rubric:

(1 point) The student enters the correct amount (e.g.,  $\frac{2}{4}$  or  $\frac{1}{2}$  or equivalent).

Response Type: Equation/Numeric

**Claim 1 4.NF.B.4 DOK Level 1**

Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.

**Evidence Required**

The student understands that a fraction  $a/b$  is a multiple of  $1/b$ .

**Question Type 1:** The student is presented with a multiplication equation of the form  $\square = a \times \frac{1}{b}$ .

Enter the unknown number that makes the equation true.

$$\square = 4 \times \frac{1}{12}$$

Rubric: (1 point) The student identifies the equivalent fraction or whole number which will make the equation true (e.g.,  $\frac{4}{12}$ ).

Response Type: Equation/Numeric

**Question Type 2:** The student is presented with a multiplication equation of the form  $\frac{a}{b} = a \times \frac{1}{b}$  with an unknown value.

Enter the unknown number that makes the equation true.

$$\frac{4}{12} = \square \times \frac{1}{12}$$

Rubric: (1 point) The student identifies the equivalent fraction or whole number which will make the equation true (e.g., 4).

Response Type: Equation/Numeric

**Question Type 3:** The student is presented with a fraction multiplication expression of the form  $c \times \frac{a}{b}$ .

1. Decide whether each expression is equal to  $5 \times \frac{2}{4}$ . Click in the table to respond.

	Equal to $5 \times \frac{2}{4}$	Not Equal to $5 \times \frac{2}{4}$
$2 \times \frac{1}{20}$		
$4 \times \frac{2}{5}$		
$10 \times \frac{1}{4}$		

2. Decide whether each expression is equal to  $5 \times \frac{2}{4}$ . Click in the table to respond.

	Equal to $5 \times \frac{2}{4}$	Not Equal to $5 \times \frac{2}{4}$
$2 \times \frac{1}{20}$		
$2 \times \frac{5}{4}$		
$\frac{5 \times 2}{10}$		

Rubric: (1 point) The student correctly identifies the expressions as Equal or Not Equal (e.g., Not Equal, Not Equal, Equal; Not Equal, Equal, Not Equal).

Response Type: Matching Tables

#### Claim 1 4.NF.B.4 DOK Level 1

Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.

#### Evidence Required

The student multiplies a fraction by a whole number.

**Question Type 1:** The student is presented with a fraction multiplication equation with an unknown product.

Enter the unknown number that makes the equation true.

$$6 \times \frac{5}{8} = \square$$

Rubric: (1 point) The student multiplies a fraction and a whole number and enters the correct product (e.g.,  $\frac{30}{8}$  or  $3\frac{6}{8}$  or  $3\frac{3}{4}$  or equivalent).

Response Type: Equation/Numeric

### **Claim 1 4.NF.B.4 DOK Level 2**

Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.

#### **Evidence Required**

The student solves contextual problems involving the multiplication of a fraction by a whole number by using visual fraction models and equations to represent the problem.

**Question Type 1:** The student is presented with a contextual problem involving the multiplication of a fraction by a whole number.

A bottle holds  $\frac{3}{5}$  liter of water. Sam needs 8 bottles of water to fill his fish tank. How many liters of water does Sam need to fill the fish tank? Enter the number of liters.

Rubric: (1 point) The student enters the correct product (e.g.,  $\frac{24}{5}$  or  $4\frac{4}{5}$ ).

Response Type: Equation/Numeric

**Question Type 2:** The student is presented with a contextual problem involving the multiplication of a fraction by a whole number.

1. There are 7 people at a picnic. Each person drinks  $\frac{2}{3}$  of a liter of lemonade.

**Part A:** Each pitcher holds 1 liter. Click on the pitchers to shade the amount of lemonade needed for the picnic. Use the fewest number of pitchers possible.

**Part B:** Click the total amount of lemonade that is needed.

**Part A:**

**Part B:**

$\frac{14}{3}$  L       $\frac{9}{3}$  L       $\frac{8}{3}$  L       $\frac{10}{3}$  L

Rubric:

Part A: (1 point) The student correctly shades the model to represent the product (e.g.,  $4 \frac{2}{3}$ ).

Part B: (1 point) The student selects the correct product (e.g.,  $1 \frac{4}{3}$ ).

Response Type: Hot Spot

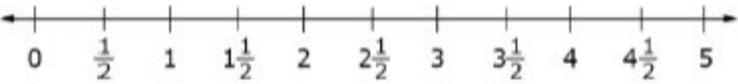
**Claim 2 Problem Solving Questions Banks**

[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

Plot the value of  $5 \times \frac{1}{2}$  on the number line shown.



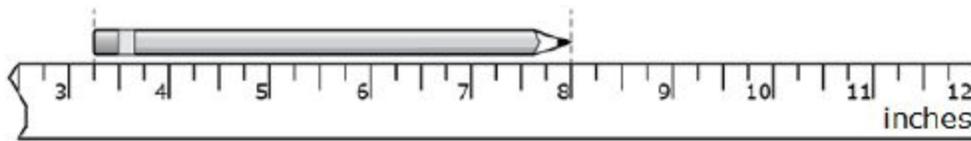
Rubric: (1 point) The student correctly plots a point at  $2 \frac{1}{2}$  (with a graphing tolerance of  $\pm \frac{1}{16}$  or points snap to tick marks).

Response Type: Graphing (Interaction: The student is able to plot a single point somewhere on the line.)

Commentary: A variation on this item would show points on a number line and ask which one represents the product, or shows one point and asks which of four products it could be (MC). Asking for the approximate location on the number line for the results of computations would also be appropriate.

Example 2

What is the length, in inches, of the pencil shown?



Enter your answer in the response box.

Rubric: (1 point) The student enters the correct length in inches (4 1/2).

Response Type: Equation/Numeric

Example 3

**43328**

Jared is testing how much weight a bag can hold. He plans to put juice bottles into three bags. He wants each bag to have a total weight within the given range.

- Drag juice bottles into each bag so that the weight is within the given range.
- Leave the bag empty if the given range is not possible using juice bottles.

  $3\frac{5}{8}$  lb

Delete

**Between 6 lb and 7 lb**      **Between 10 lb and 11 lb**      **Between 14 lb and 15 lb**

Three empty bags are shown in a row, each with two handles at the top. They are intended for placing juice bottles to test their weight capacity.