

NAEP Released Items Aligned to the Iowa Core

5.NF.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, $\frac{2}{3} + \frac{5}{4} = \frac{8}{12} + \frac{15}{12} = \frac{23}{12}$. (In general, $\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$.)

5.NF.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 $\frac{2}{5} + \frac{1}{2} = \frac{3}{7}$, by observing that $\frac{3}{7} < \frac{1}{2}$.

In which of the following are the three fractions arranged from least to greatest?

- A. $\frac{2}{7}, \frac{1}{2}, \frac{5}{9}$
- B. $\frac{1}{2}, \frac{2}{7}, \frac{5}{9}$
- C. $\frac{1}{2}, \frac{5}{9}, \frac{2}{7}$
- D. $\frac{5}{9}, \frac{1}{2}, \frac{2}{7}$
- E. $\frac{5}{9}, \frac{2}{7}, \frac{1}{2}$

2007-8-9-12

Source: National Assessment of Educational Progress, 2007, Grade 8 Mathematics Assessment.

5.NF.3 Interpret a fraction as division of the numerator by the denominator ($\frac{a}{b} = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. For example, interpret $\frac{3}{4}$ as the result of dividing 3 by 4, noting that $\frac{3}{4}$ multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size $\frac{3}{4}$. If 9 people want to share a 50-pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?

5.NF.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 $a \times q \div b$. For example, use a visual fraction model to show $(2/3) \times 4 = 8/3$, and create a story context for this equation. Do the same with $(2/3) \times (4/5) = 8/15$. (In general, $(a/b) \times (c/d) = ac/bd$.)
- 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.

What is $2/3$ of 15 marbles?

- A. 10 marbles
- B. 9 marbles
- C. 8 marbles
- D. 5 marbles

1990-12-9-1

Source: National Assessment of Educational Progress, 1990, Grade 12 Mathematics Assessment.

$$3 \times 2\frac{1}{3} =$$

2004-17-23-10

Source: National Assessment of Educational Progress, 2004, Age 17 Mathematics Assessment.

5.NF.5 Interpret multiplication as scaling (resizing), by:

- a. Comparing the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
- b. Explaining why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence $a/b = (n \times a)/(n \times b)$ to the effect of multiplying a/b by 1.

5.NF.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.

5.NF.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.

- a. Interpret division of a unit fraction by a non-zero whole number, and compute such quotients. 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 that $(1/3) \div 4 = 1/12$ because $(1/12) \times 4 = 1/3$.
- b. Interpret division of a whole number by a unit fraction, and compute such quotients. 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 $20 \times (1/5) = 4$.
- c. 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. 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?

3 pineapples

$$1 \text{ serving} = \frac{1}{2} \text{ pineapple}$$

Given the information above, write a mathematics word problem for which $3 \div \frac{1}{2}$ would be the method of solution.

2005-8-4-18

Source: National Assessment of Educational Progress, 2005, Grade 8 Mathematics Assessment.

Jim has $3/4$ of a yard of string which he wishes to divide into pieces, each $1/8$ of a yard long. How many pieces will he have?

- A. 3
- B. 4
- C. 6
- D. 8

2003-4-6-17
2003-8-6-17

Source: National Assessment of Educational Progress, 2003, Grade 4 and Grade 8 Mathematics Assessments.
