

Math Background

Basic Fraction Concepts

Fraction Chains

$$\frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{3}{3} = 1 \quad \frac{1}{5} + \frac{1}{5} + \frac{1}{5} = \frac{3}{5} \quad \frac{5}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$$

The unit fraction chains help students overcome typical errors in adding and subtracting fractions (adding and subtracting the tops and the bottoms, not just the tops.)

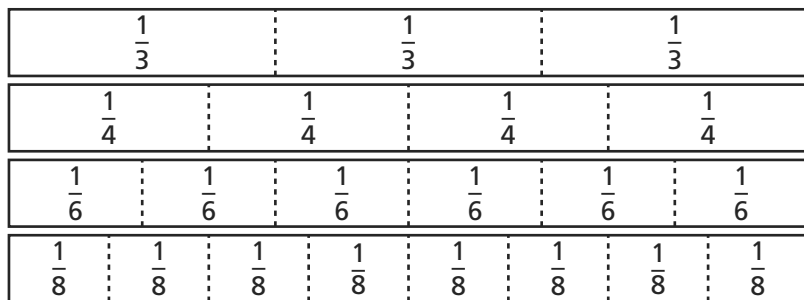
Fraction Partners of 1 Whole Students find “fraction partners” of 1 whole—two fractions with the same denominator that together form 1 whole. The model below shows 1 whole as the sum of a $\frac{1}{4}$ and $\frac{3}{4}$. So, $\frac{1}{4}$ and $\frac{3}{4}$ are partners of 1 whole.



$$\frac{1}{4} + \frac{3}{4} = \frac{4}{4} = 1$$

Seeing 1 whole as $\frac{d}{d}$ ($\frac{4}{4}$, $\frac{7}{7}$, and so on) is crucial in understanding mixed numbers and ungrouping in subtracting mixed numbers.

Visualizing Unit Fractions as Equal Parts of 1 Whole Students fold fraction strips to see each unit fraction $\frac{1}{d}$ as one of d equal parts of the whole. They see fraction bars on student pages throughout the unit. Fraction bars show the crucial inverse relationship between the number and the size of unit fractions: a larger d in $\frac{1}{d}$ means more but smaller equal parts. Fraction bars also show equivalent fractions ($\frac{2}{4} = \frac{3}{6} = \frac{4}{8}$).

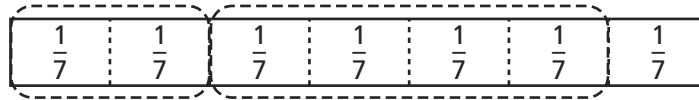


Numerical Unit Fractions Along with the fraction bars, students write fractions and wholes as sums of unit fractions to show this as their central meaning.

Modeling Fractions and Fraction Operations

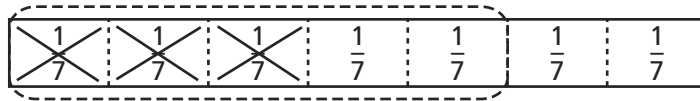
Fraction Strips and Bars We focus on using fraction strips and fraction bars along with unit fractions to model fraction addition and subtraction.

Addition Model for Fractions with Like Denominators:



$$\frac{2}{7} + \frac{4}{7} = \frac{2+4}{7} = \frac{6}{7}$$

Subtraction Model for Fractions with Like Denominators:

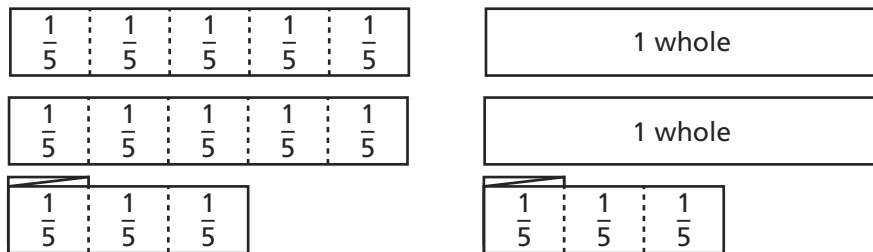


$$\frac{5}{7} - \frac{3}{7} = \frac{5-3}{7} = \frac{2}{7}$$

For both addition and subtraction, the critical step of adding or subtracting only the numerators is circled as a transition for understanding. That step can be omitted later.

The model below shows how fractions strips help students visualize the relationship between mixed numbers and improper fractions. Students can turn over each $\frac{5}{5}$ piece to reveal 1 whole.

Mixed Numbers and Improper Fractions Model:



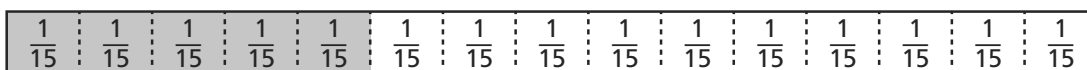
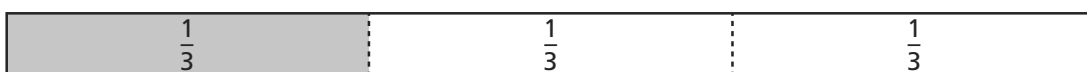
$$\frac{13}{5} = \frac{5}{5} + \frac{5}{5} + \frac{3}{5} = 1 + 1 + \frac{3}{5} = 2\frac{3}{5}$$

Students continually discuss how the numerical computations relate to the visual models so that the computations become meaningful.

Teaching Unit 5 (Continued)

Equivalent Fractions

Fraction Bars and the Multiplication Table These tools help students understand and find equivalent fractions. Fraction bars show how to group smaller unit fractions with larger denominators to simplify them (for example: $\frac{5}{15} = \frac{1}{3}$). Numerically, this same process is done by dividing the numerator and denominator by the same number (in this example, 5), the number you used to group. To unsimplify to find equivalent fractions to add, subtract, and compare fractions with unlike denominators, you equal-split the larger unit fractions with smaller denominators (for example, $\frac{1}{3} = \frac{5}{15}$). Numerically, this process is done by multiplying the numerator and denominator by that number you used to split (in this example, 5). Two rows from the multiplication table make whole chains of equivalent fractions so that students see that these processes are general and can work for any numbers.



Simplify

$$\frac{5}{15} = \frac{5 \div 5}{15 \div 5} = \frac{1}{3}$$

Unsimplify to Find
An Equivalent Fraction

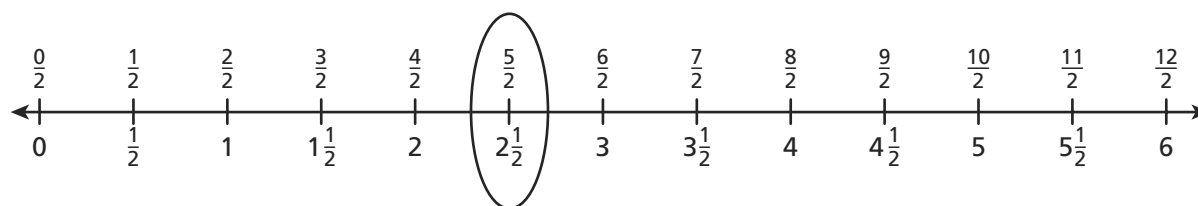
$$\frac{1}{3} = \frac{1 \times 5}{3 \times 5} = \frac{5}{15}$$

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
3	3	6	9	12	15	18	21	24	27	30

×	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
3	3	6	9	12	15	18	21	24	27	30

Adding and Subtracting with Unlike Denominators With the use of fraction bars, students see that they must find the same denominators before they can add, subtract, or compare fractions. They find equivalent fractions and then use their knowledge of adding, subtracting, and comparing fractions with the same denominators.

The Number Line A number line can be used to help students find relationships between mixed numbers and improper fractions. By looking at the number line below, it is clear that $\frac{5}{2}$ is the same as $2\frac{1}{2}$. Students also place many different fractions on number lines.



Problem Solving

Real-World Problem Solving Throughout the unit, students see and discuss real-world situations as the context for all of the fraction operations they carry out. Real-world scenarios are used to develop meanings and computational methods for whole numbers times fractions and fractions times whole numbers. Multiplicative comparison situations are revisited now so that students have fuller understandings of unit fractions. Probability is discussed and related to fraction notation. The Solve and Discuss structure is used throughout the unit to ensure that students can describe and explain their problem-solving strategies in the various problem situations they encounter in the unit.