

Part + Part = Whole ?

Teaching the Fundamentals of Adding and Subtracting Fractions

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Oklahoma Excel Math Instructional Specialist

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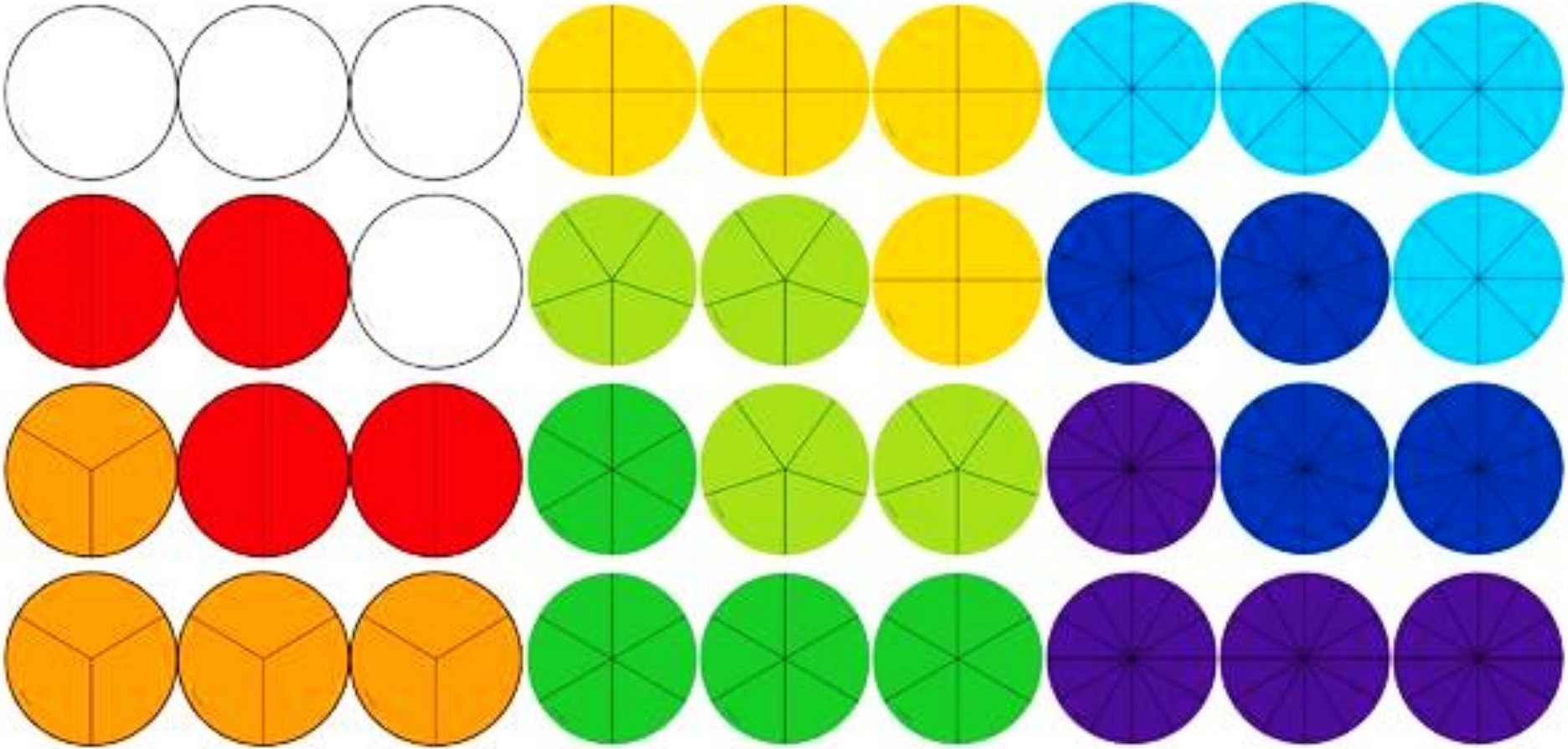
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Link to presentation: http://bit.ly/fundamentalfractions

Students need to build a **conceptual understanding of fraction concepts** in order to transition from addition and subtraction with whole numbers to addition and subtraction with rational numbers.



Beyond shading a region of a shape, how else are fractions represented?

Try to name three ideas.

Teaching the fundamentals of addition and subtraction of fractions must be a **problem-based number sense approach**.

Effective Fraction Computation Instruction

1. Use contextual tasks - context should fit both the meaning of the operation and fractions involved

2. Explore each operation with a variety of models - have students defend their solutions using models

Effective Fraction Computation Instruction

3. Let estimation and invented methods play a big role in the development of strategies - keeps the focus on the meanings of numbers and operations, encourage reflective thinking, and help build number sense with fractions.

4. Address common misconceptions regarding computational procedures- discuss why some approaches lead right to answers and some do not.

Use Contextual Tasks

- Given the context of the task, students should be able to know which operation to use and easily determine the fractions involved
- Real world relevance
- Don’t let the fraction get in the way of the problem - chose numbers that are compatible

Jacob ordered 3 pizzas. But before his guests arrived he got hungry and ate $\frac{3}{8}$ of one pizza. How much was left for the party?

On Friday, Lydia ran $1\frac{1}{2}$ miles, on Saturday she ran $2\frac{1}{8}$ miles and on Sunday she ran $2\frac{3}{4}$ miles. How many miles did she run over the weekend?

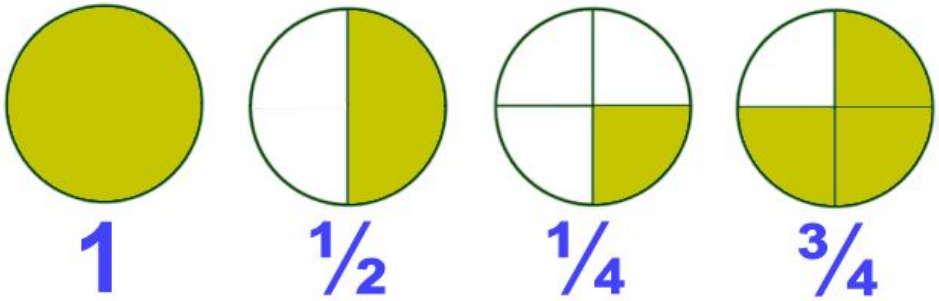
Sammy gathered $\frac{3}{4}$ pounds of walnuts and Chala gathered $\frac{7}{8}$ pounds. Who gathered the most? How much more?

In measuring the wood needed for a picture frame, Elizabeth figured that she needed two pieces that were $5\frac{1}{4}$ inches and two pieces that were $7\frac{3}{4}$ inches. What length of wood does she need to buy to build her picture frame?

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Variety of Models for Each Operation

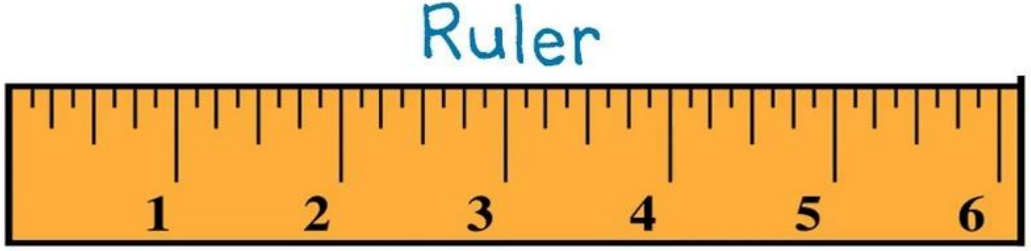
Addition of fractions should initially focus on area and linear models.

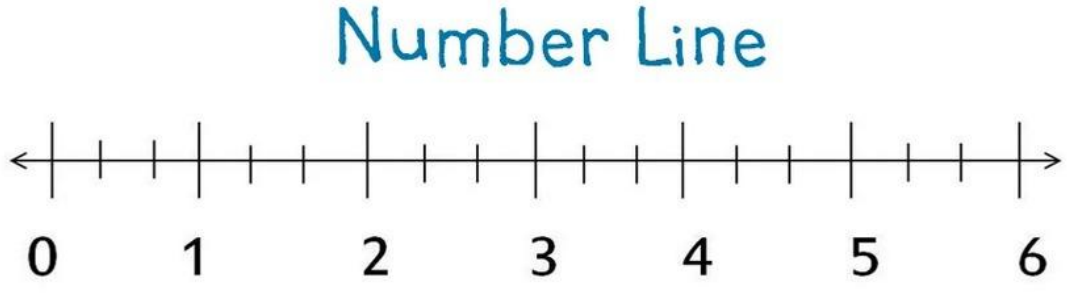




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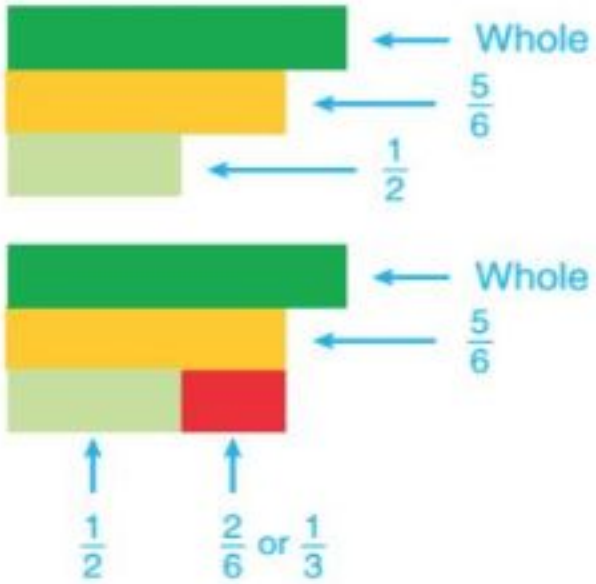
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Comparison

(b) $\frac{5}{6} - \frac{1}{2}$



Compare the lengths of the two fractions.

$\frac{5}{6}$ is $\frac{2}{6}$ longer than $\frac{1}{2}$, so the difference is $\frac{2}{6}$ or $\frac{1}{3}$.

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Estimation

1. Benchmarks - Decide whether fractions are closest to 0, ½, or 1 then mentally add or subtract.

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Think $^{7}/_{8}$ is close to **1** and $^{1}/_{10}$ is close to **0**, so

the sum is about 1 + 0 or **close to 1**.

Estimation

2. Relative size of unit fractions- decide how big the fraction is based on its unit (denominator) and apply this information to adding or subtracting

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⅞ is just ⅛ away from a whole and ⅛ is close to (but bigger than) 1/10 so the sum will be close to 1

Over or Under 1

Using an estimation strategy, determine if the sum or difference will be over or under 1.

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$$\frac{1}{8} + \frac{4}{5}$$

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UNDER

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$$\frac{3}{4} - \frac{1}{3}$$

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UNDER

Develop Algorithms - Like Denominators

- Like Denominators- fraction addition and subtraction begins with situation using like denominators
  - Students need to focus on the key idea that the units are the same so they can be combined.

Develop Algorithms - Like Denominators

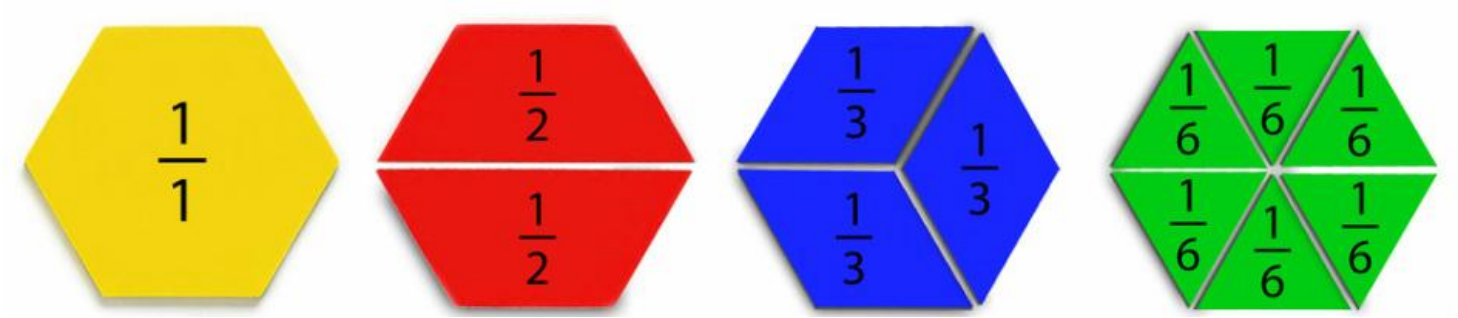
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$$^{3}/_{4} + ^{2}/_{4}$$

How many fourths all together?

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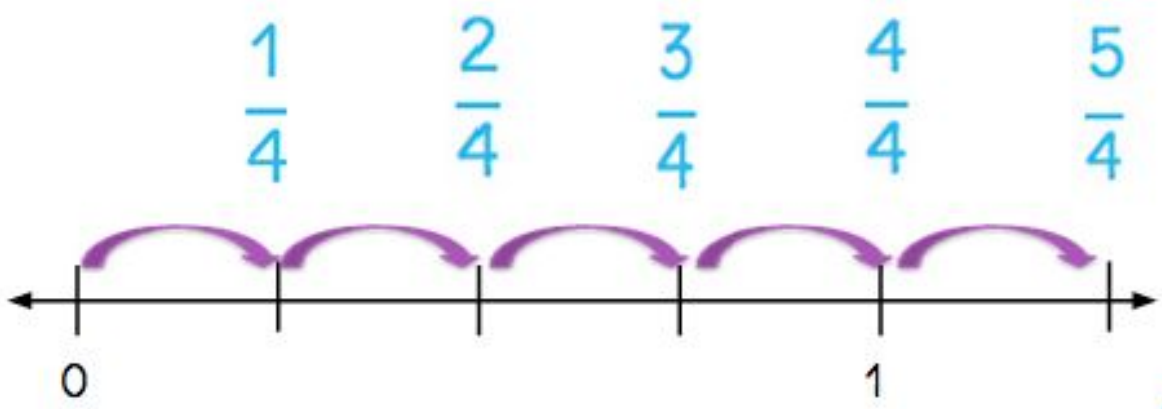


Develop Algorithms - Like Denominators

- Iteration connects fraction operations to whole number operations and explains why the denominator stays the same.

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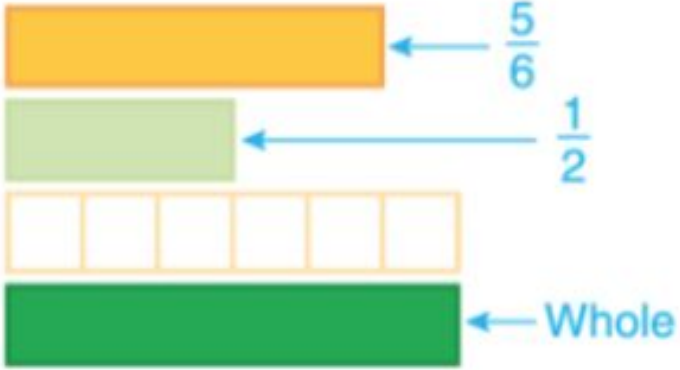
Develop Algorithms - Unlike Denominators

- Begin adding and subtracting fractions with unlike denominators with tasks where only one fraction needs to be changed then continue with examples where both fractions need to be changed by using contexts, visuals and explanations.

Develop Algorithms - Unlike Denominators

$\frac{5}{6} - \frac{1}{2}$

Use the dark green as a whole. It is 6 whites long.



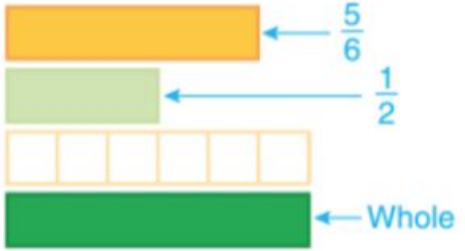
In terms of the white strips, the problem $\frac{5}{6} - \frac{1}{2}$ is the same as $\frac{5}{6} - \frac{3}{6}$

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Focus attention on the idea of rewriting an equivalent problem to make it possible to add or subtract equal sized parts

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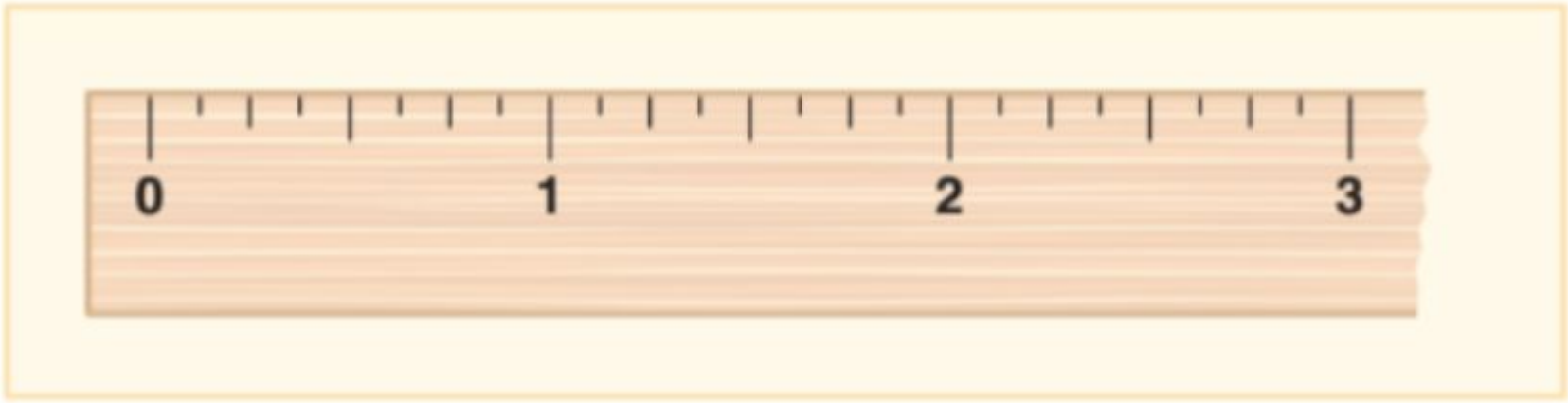
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Are Common Denominators Required?

- The use of invented strategies will show students that there are methods to find correct solutions without finding a common denominator.
- Look for ways different fractional parts are related (i.e. halves , fourths, and eighths)

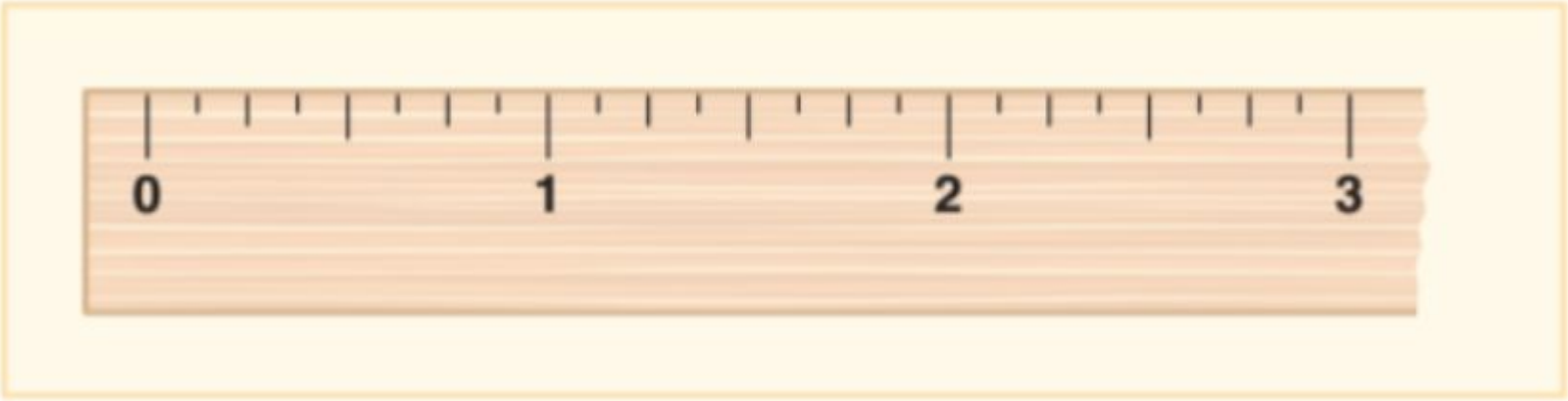
Are Common Denominators Required?

$$\frac{3}{4} + \frac{1}{2}$$



Are Common Denominators Required?

$$\frac{1}{8} + 1\frac{1}{2}$$



Addressing Misconceptions

- Adding both numerators AND denominators

$$\frac{3}{8} + \frac{2}{8} = \frac{5}{16}$$

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Can you support this answer

with a rectangle partitioned into eighths?

When procedures are connected with the underlying concepts, students have better retention of the procedures and are more able to apply them in new situations.

Mathematics

	Grade-Level Mathematics Actions and Processes	Descriptions of the Mathematics Actions and Processes provide a sense of what students are doing as they develop into mathematically literate students.
	Progression (v2)	experience that engages in meaningful, connected mathematics.
	Objective Analysis	Analysis for each grade-level objective is provided in a manner to support deep understanding for the teacher.

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Build Procedural Fluency from Conceptual Understanding

Teacher Actions:

- Provide students with opportunities to use their own reasoning strategies and methods for solving problems.
- Ask students to discuss and explain why the procedures that they are using work to solve particular problems.
- Connect student-generated strategies and methods to more efficient procedures as appropriate.
- Use visual models to support students' understanding of general methods.

Build Procedural Fluency from Conceptual Understanding

Student Actions

- Make sure that they understand and can explain the mathematical basis for the procedures that they are using.
- Demonstrate flexible use of strategies and methods while reflecting on which procedures seem to work best for specific types of problems.
- Determine whether specific approaches generalize to a broad class of procedures.

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Variety of Models for Each Operation

Subtraction of fractions can be thought of as:

- Separate
- Comparison
- How many more are needed?