

Resource Packet for: PIE Learning Pathway Neighborhood 5.NF.B.4, 6

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Resource Packet for:

PIE Learning Pathway Neighborhood 5.NF.B.4, 6

Fraction Operation Result Estimation (Neighborhood 5.NF.B.4, 6)

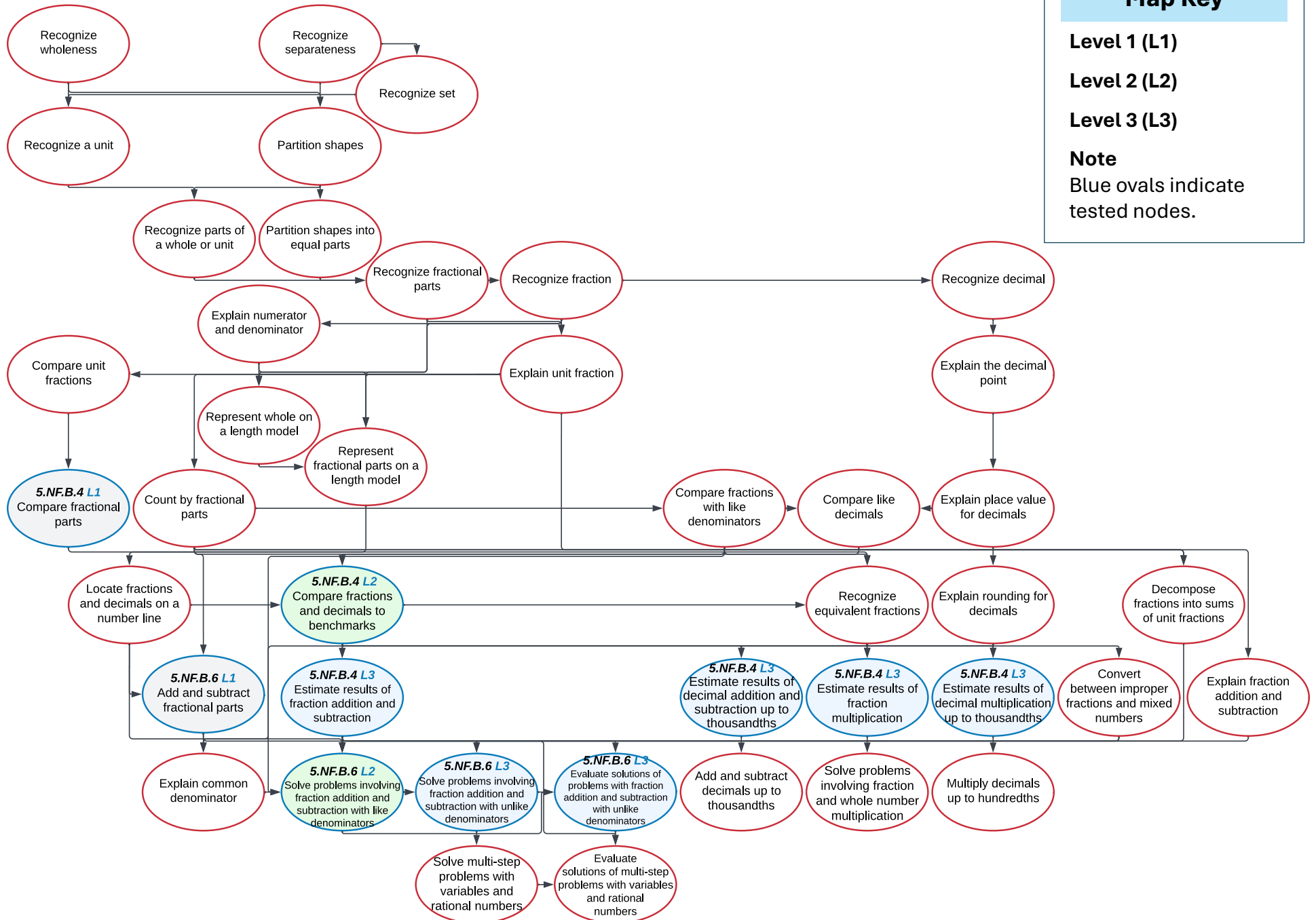
Perform operations and solve problems with fractions and decimals. (5.NF.B)

- The standards grouped for the learning pathway neighborhood share a common key idea, fraction operation result estimation, which covers two learning pathways:
 - » Estimate results of sums, differences, and products with fractions and decimals to the thousandths. (5.NF.B.4)
 - » Solve problems involving addition and subtraction of fractions and mixed numbers with unlike denominators, and justify the solution. (5.NF.B.6)

Insights From Research and Data From Missouri Students

This document is informed by research on student learning in mathematics and effective instructional strategies to promote student learning of concepts in this neighborhood. The [Helpful Hints](#) section uses findings from research on mathematics learning to provide instructional suggestions and strengths to build on. The Common Student Errors section is based on results from pilot studies with fifth-grade students in Missouri (in 2024 and 2025) who completed assessments for these standards. At least 25% of students made these errors when responding to multiple-choice items that assessed mastery of the corresponding knowledge or skill.

Learning Pathway: Neighborhood View

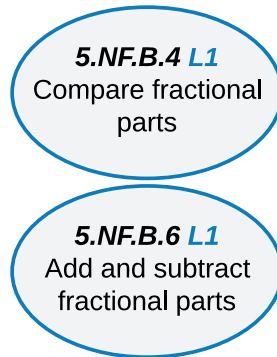


Learning Pathway: Level Clusters View

The neighborhood (on page 3) contains three level clusters. Level 1 Cluster integrates the Level 1 concepts and skills, Level 2 Cluster integrates the Level 2 concepts and skills, and Level 3 Cluster integrates the Level 3 concepts and skills from each of the learning pathways. Each level cluster is summarized below.

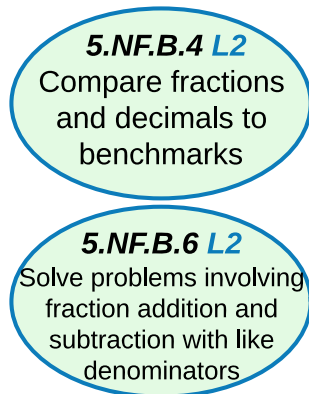
Level 1 Cluster

([more information on pg. 7](#))



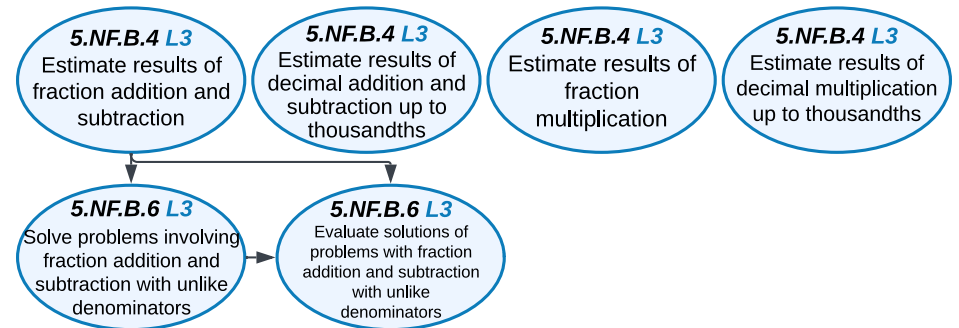
Level 2 Cluster

([more information on pg. 8](#))



Level 3 Cluster

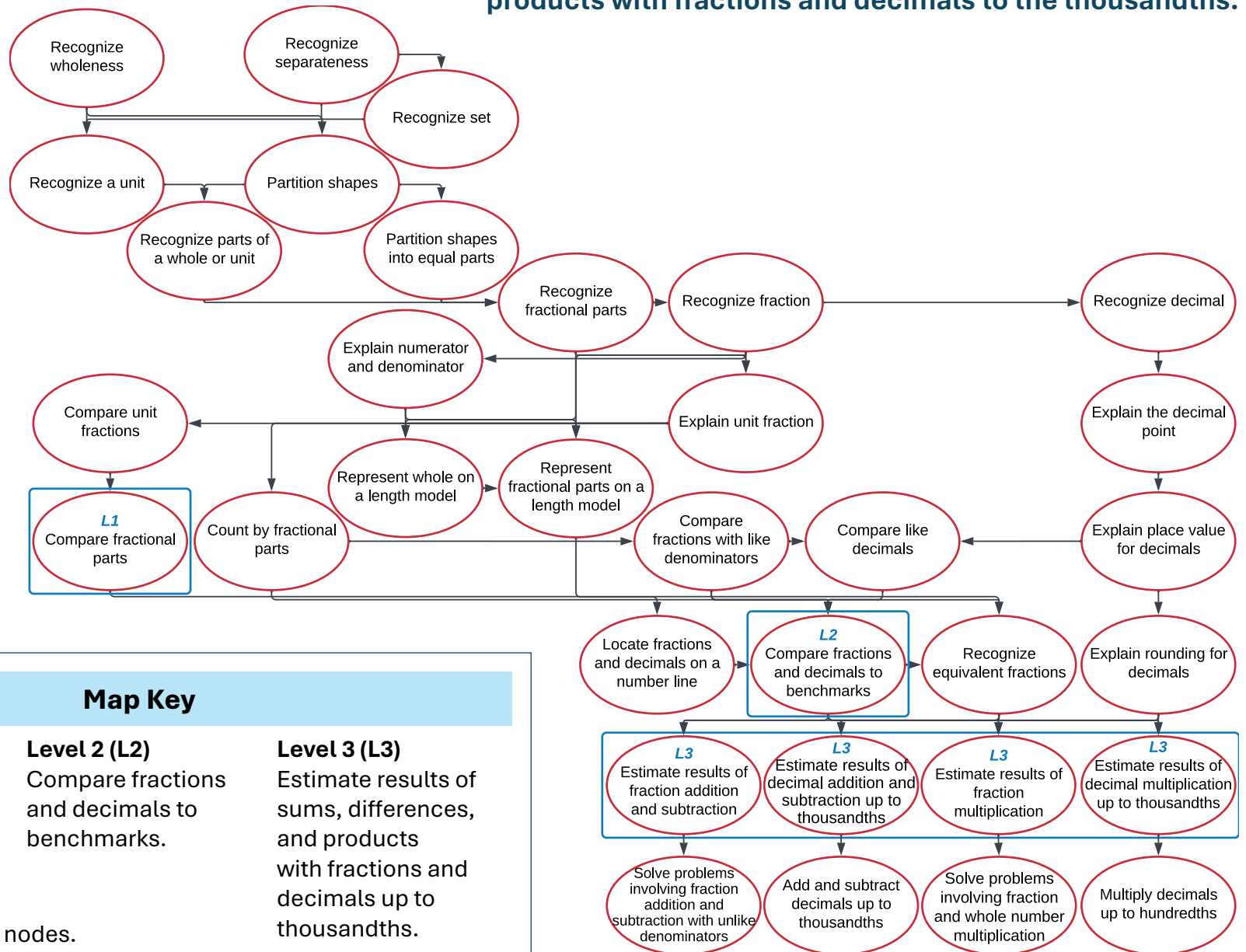
([more information on pg. 10](#))



Dive Into the Content of the Standards

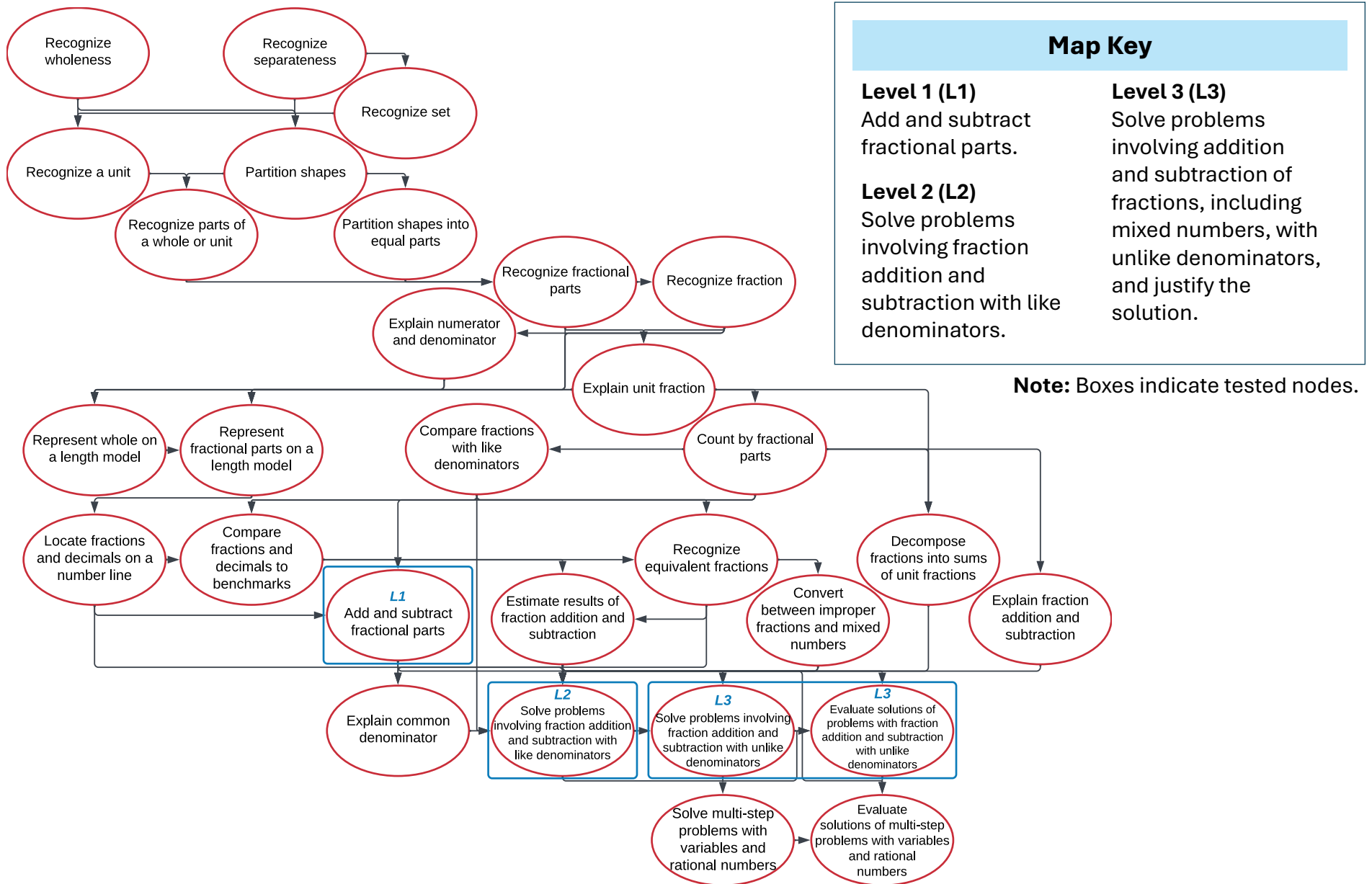
Learning Pathway for 5.NF.B.4

Estimate results of sums, differences, and products with fractions and decimals to the thousandths.



Learning Pathway for 5.NF.B.6

Solve problems involving addition and subtraction of fractions and mixed numbers with unlike denominators, and justify the solution.

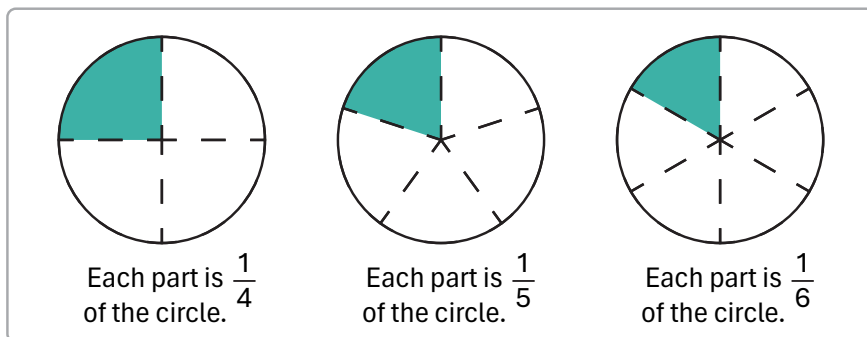


Fraction Operation Result Estimation: Helpful Hints

Level 1 Cluster

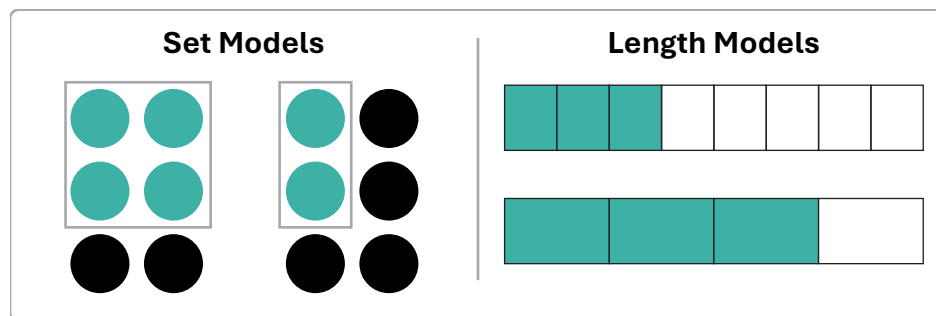
Relative Size of Fractional Parts

- Area models, such as fraction circles or length models, can help students understand how the size of the parts changes as the number of parts increases or decreases.
- Students should recognize the size of the fractional parts get smaller as the whole is partitioned into a larger number of fractional parts.
- Students should understand that a unit fraction is one equal-sized part of a whole that has been partitioned into a specified number of equal-sized parts.



Compare Fractional Parts

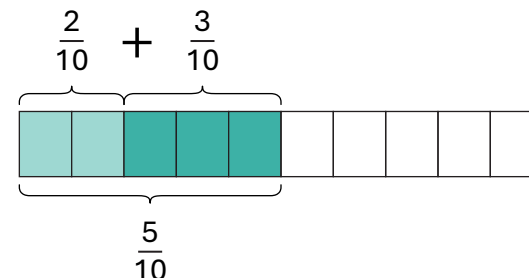
- Students should be able to compare fractional parts and recognize the fraction model that represents the greater number.
- Students should understand that the whole must be the same size when comparing fractional parts.



Add and Subtract Fractional Parts

- Students should understand that the whole must be the same size when adding and subtracting fractional parts.
- To help students connect addition and subtraction to the relationship between the parts and the whole, it may help to emphasize the denominator or the unit. For example, two *tenths* plus three *tenths* is how many *tenths*?

 Students should recognize the unit is **tenths**, and each part is $\frac{1}{10}$ of the whole.



[Return to the Cluster View on pg. 4](#)

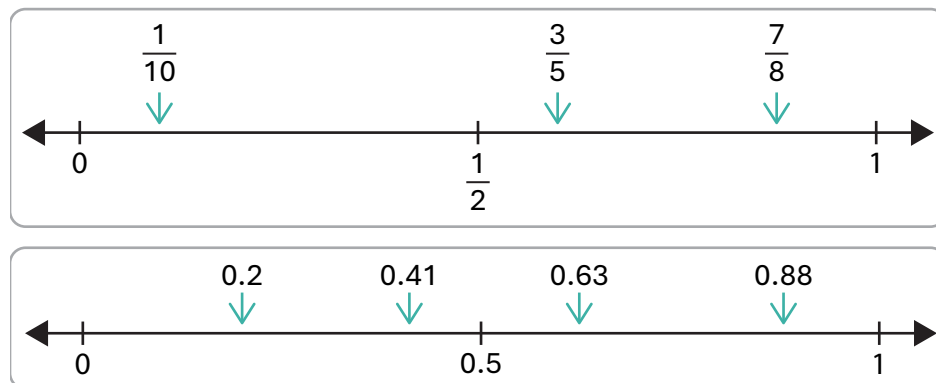
Fraction Operation Result Estimation: Helpful Hints

Level 2 Cluster

Compare Fractions and Decimals to Benchmark Numbers

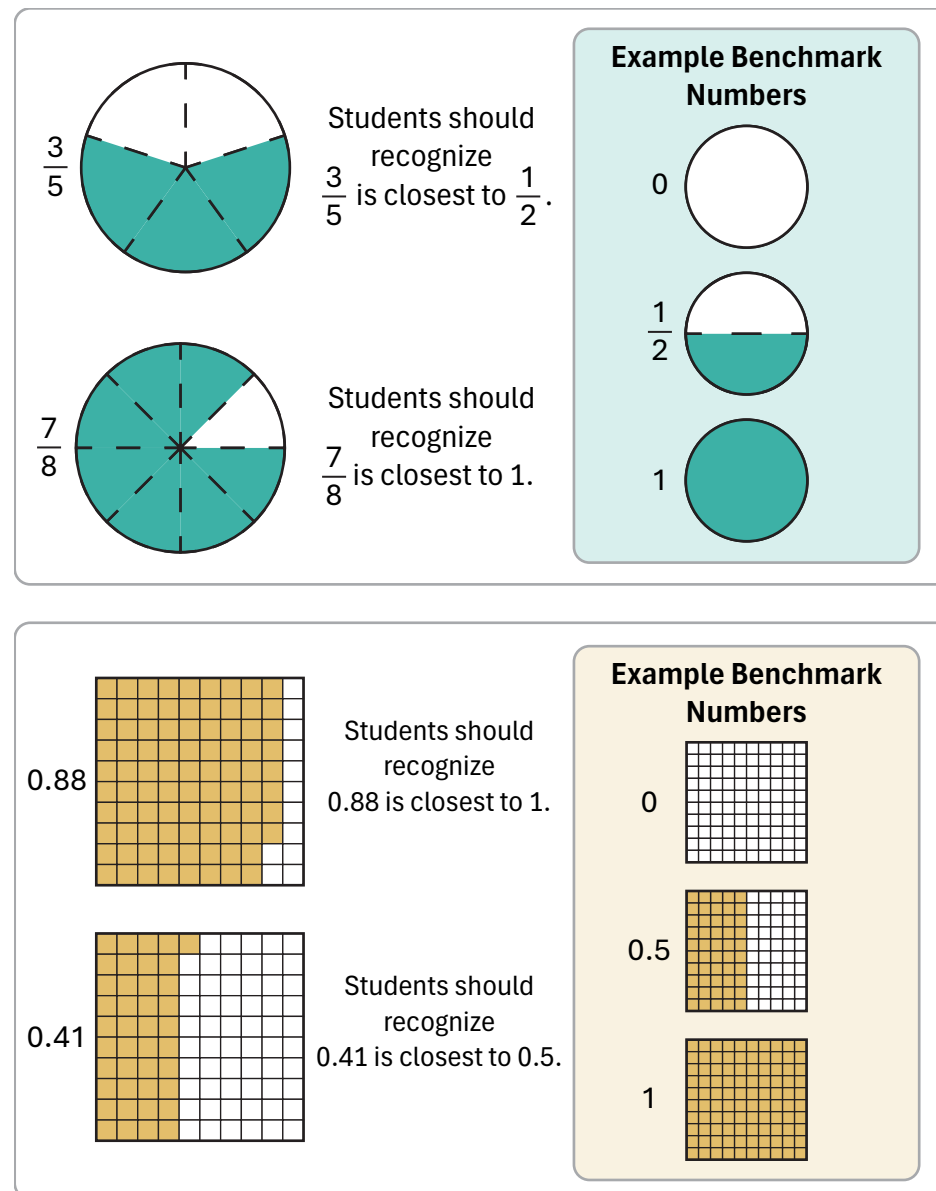
- Number lines and area models are useful tools to visually represent fractions and estimate the values of fractions.
- To estimate the value of a fraction, students can use benchmark numbers, such as 0 , $\frac{1}{2}$, 1 , $1\frac{1}{2}$, and 2 .
- To estimate the value of a decimal, students can use benchmark numbers, such as 0 , 0.5 , 1 , 1.5 , and 2 .

Number Lines



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Area Models



Fraction Operation Result Estimation: Helpful Hints

Level 2 Cluster

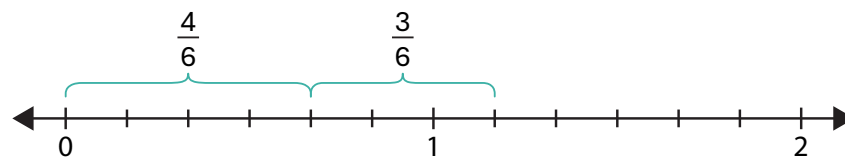
Addition and Subtraction of Fractions With Like Denominators

- Students should be able to solve problems involving addition and subtraction of fractions, including mixed numbers.
- Students should understand that when adding or subtracting fractions with like denominators, the units are the same.

$$\frac{4}{6} + \frac{3}{6}$$

How many
sixths
altogether?

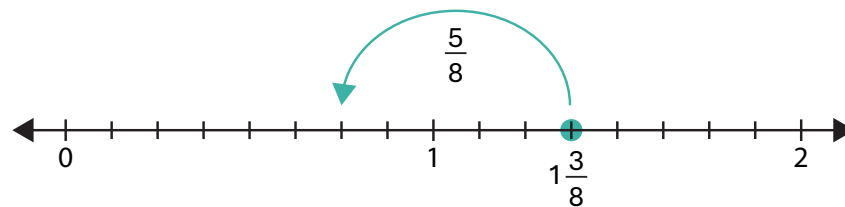
$$\frac{7}{6} \text{ or } 1\frac{1}{6}$$



$$1\frac{3}{8} - \frac{5}{8}$$

How many
eighths
are left?

$$\frac{6}{8}$$



Strengths to Build On

- Students can demonstrate that the denominator indicates the size of the equal parts.
- Students can represent fractions, including mixed numbers, using fraction models and can demonstrate their understanding of those models to represent addition and subtraction involving fractions.
- Students can use their understanding of benchmark numbers to evaluate the reasonableness of their answer.

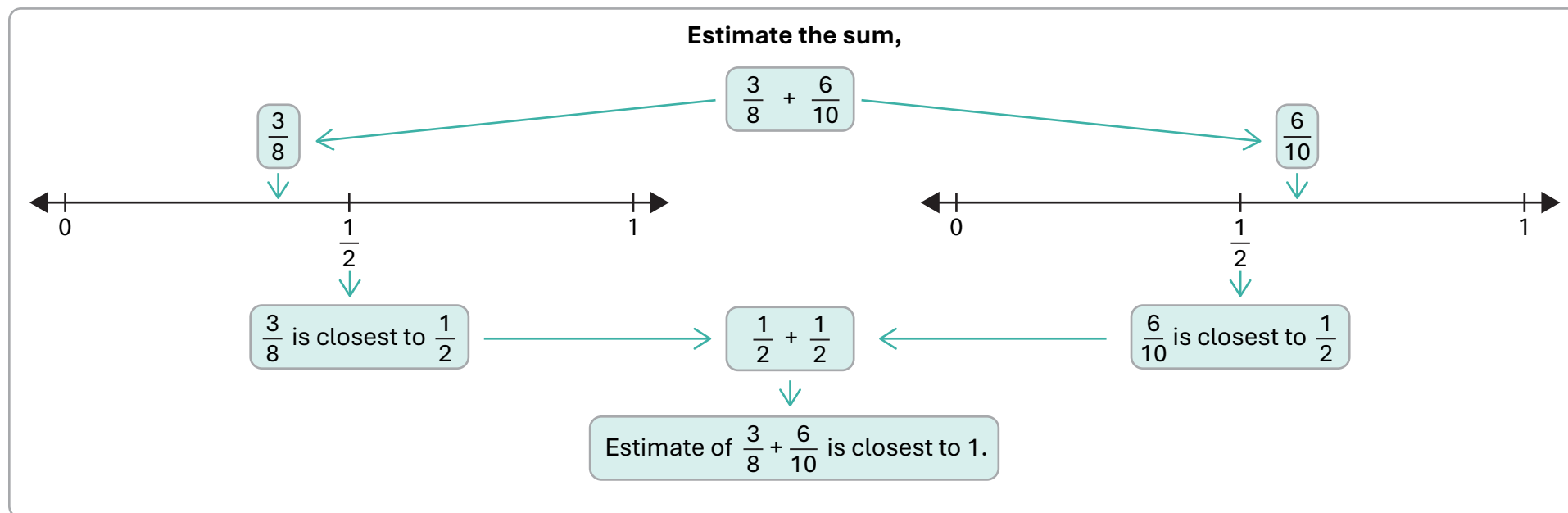
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Common Student Errors

- When subtracting a fraction less than 1 from a mixed number, students subtracted the smaller fractional part from the larger fractional part.
 - » For example, when subtracting $\frac{5}{8}$ from $1\frac{3}{8}$, students selected either $1\frac{2}{8}$ or just $\frac{2}{8}$.
 - » Students did not consider the mixed number as a single quantity, and they did not attend to the order of the numbers being subtracted.
 - » Students did not consider the whole (1) as an equivalent fraction ($\frac{8}{8}$).

Estimate Sums, Differences, and Products

- It can be helpful to use numbers that are not easy to compute, so students use benchmark numbers and estimation strategies.
- Using benchmark numbers to estimate can support students in assessing the reasonableness of an answer.



Strengths to Build On

- Students can compare fractions and decimals to benchmark numbers.
- Students can use their understanding of number lines and fraction models to relate fractions to the nearest benchmark number.
- Students can use their understanding of whole-number operations to estimate using benchmark numbers.

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Common Student Errors

- When estimating the sum or product of two fractions less than 1, students did not identify the benchmark numbers and then perform the operation.
 - » For example, when estimating the sum of $\frac{6}{10}$ and $\frac{3}{8}$, students identified the sum would be closest to $1\frac{1}{2}$.
 - » For example, when estimating the product of $\frac{1}{10}$ and $\frac{1}{6}$, students identified the product would be closest to $\frac{1}{4}$.

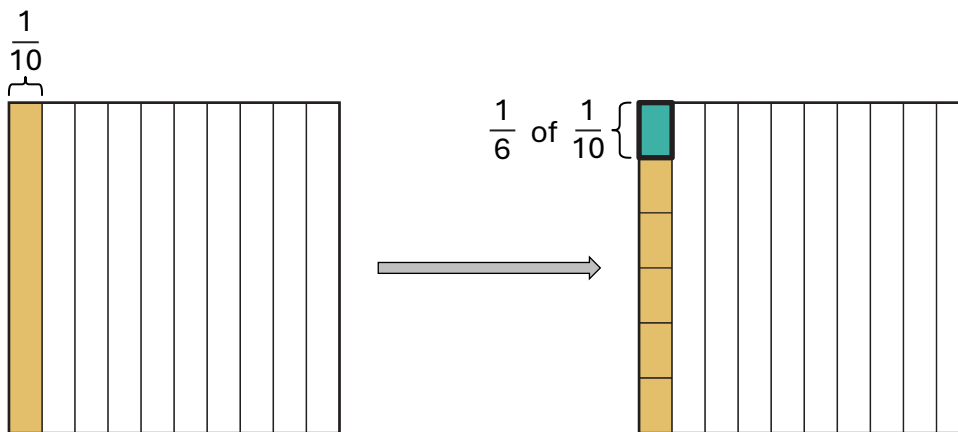
Fraction Operation Result Estimation: Helpful Hints

Level 3 Cluster

Estimate Sums, Differences, and Products (cont.)

Estimate
the product.

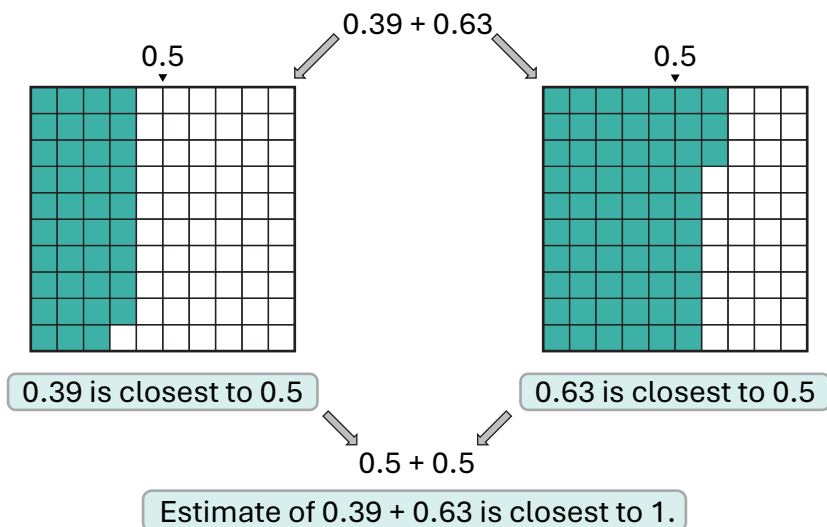
$$\frac{1}{6} \times \frac{1}{10}$$



Estimate of $\frac{1}{6} \times \frac{1}{10}$ is closest to 0.

Estimate
the sum.

$$0.39 + 0.63$$



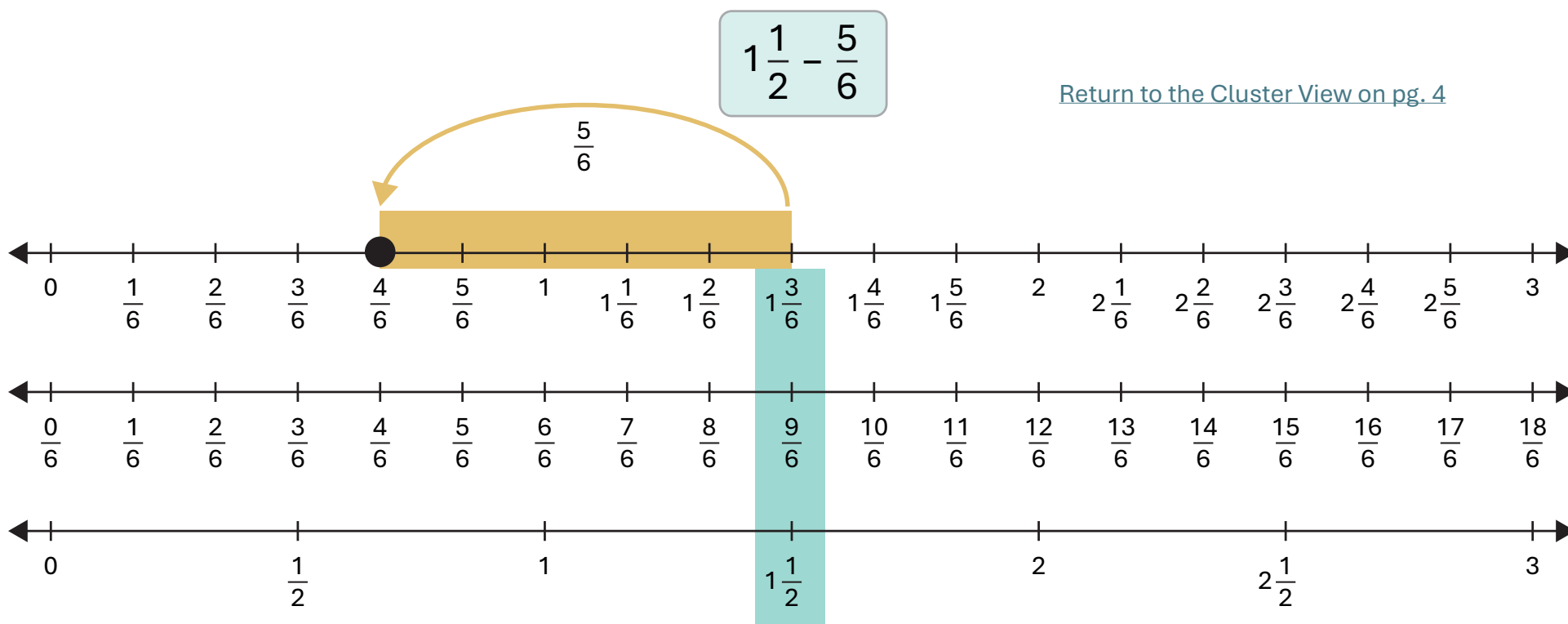
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Fraction Operation Result Estimation: Helpful Hints

Level 3 Cluster

Solve Fraction Problems With Unlike Denominators

- Students should consider the denominators as the size of the parts in the whole before solving.
- Students justify the solution using estimation or an appropriate strategy to evaluate whether their answers are reasonable.



Strengths to Build On

- Students can use models and other strategies when computing with fractions.
 - » For example, using a number line can help students recognize the fractional parts are different sizes when the whole is partitioned into a different number of equal-sized parts.

Common Student Errors

- When adding and subtracting two mixed numbers with different denominators, students did not attend to the wholes having different-sized parts. For addition, students added the fractional parts by finding the sum of the numerators and denominators. For subtraction, students subtracted the numerators and used the largest denominator.