TEKS Cluster: Fractions

5.3 **Number and operations.** The student applies mathematical process standards to develop and use strategies and methods for positive rational number computations in order to solve problems with efficiency and accuracy.

Connected Knowledge and Skills 5.4

Estimation of Fractions

Supporting Standards

5.3(A) estimate to determine solutions to mathematical and real-world problems involving addition, subtraction, multiplication, or division

Addition/Subtraction of Fractions

Readiness Standards

5.3(K) add and subtract positive rational numbers fluently

Supporting Standards

5.3(H) represent and solve addition and subtraction of fractions with unequal denominators referring to the same whole using objects and pictorial models and properties of operations

5.4(A) identify prime and composite numbers

Multiplication of Fractions

Supporting Standards

5.3(I) represent and solve multiplication of a whole number and a fraction that refers to the same whole using objects and pictorial models, including area models

Division of Fractions

Readiness Standards

5.3(L) divide whole numbers by unit fractions and unit fractions by whole numbers

Supporting Standards

5.3(J) represent division of a unit fraction by a whole number and the division of a whole number by a unit fraction such as 1/3 ÷ 7 and 7 ÷ 1/3 using objects and pictorial models, including area models

5.3 Number and operations. The student applies mathematical process standards to develop and use strategies and methods for positive rational number computations in order to solve problems with efficiency and accuracy. The student is expected to:

5.3(A) **(A) estimate to determine solutions to mathematical and real-world problems involving addition, subtraction, multiplication, or division**

Stimulus

Word Problem*	Verbal Description	Chart/Table	Graph
Equation/ Expression	Manipulatives	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

benchmark fraction
estimate*
estimation language (about, a little more/less than, close to, approximately)

Interesting Items

Data included in Whole Number Operations

Role in Concept Development

Supports

- 5.4(B) represent and solve multi-step problems involving the four operations with whole numbers using equations with a letter standing for the unknown quantity
- 5.3(K) add and subtract positive rational numbers fluently
- 5.3(E) solve for products of decimals to the hundredths, including situations involving money, using strategies based on place-value understandings, properties of operations, and the relationship to the multiplication of whole numbers
- 5.3(G) solve for quotients of decimals to hundredths, up to four-digit dividends and two-digit whole number divisors, using strategies and algorithms, including the standard algorithm

Connection/ Relevance

As students are asked to solve problems using all four operations involving whole numbers, fractions, and decimals, it is important for them to estimate solutions prior to solving. The use of rounding and/or compatible numbers also allows students to evaluate the reasonableness of solutions.

When to Teach

- Before/Prerequisite to 5.3(K)
- With 5.4(B), 5.3(E), 5.3(G)

Instructional Implications

Instruction should model the use of estimations to all operational problems prior to solving for the exact answer. Estimations become even more critical in determining the reasonableness of various solutions as students begin working with decimal and fraction problems.

Estimating strategies should include:

- Rounding (e.g., 4.5 x 1.25 ≈ 5 x 1 = 5)
- Compatible numbers (e.g., 4.5 x 1.25 ≈ 4 x 1.25 = 6.00)
- Front-end estimation (e.g., 4.6 x 1.2 ≈ 4 x 1 = 4.00)
- Compensation (e.g., 4.2 x 5 = 2.1 x 10 = 21)

Employing a specific rounding rule is not necessary. It is important for students to determine if their estimates will yield an over-estimated amount or under-estimated amount (e.g., 3.75 x 6.7 could yield 4 x 7 = 28; this would be an over-estimated product as both factors were rounded up to the next whole number).

Learning from Mistakes

Students may make the following mistakes:

- Solving a problem first and then estimating the results

5.3(K) Readiness

Subcluster: Addition/Subtraction of Fractions

TEKS Scaffold

TEKS	Student Expectation
7.3(A)	add, subtract, multiply, and divide rational numbers fluently (S)
5.3(K)	**5.3 Number and operations.** The student applies mathematical process standards to develop and use strategies and methods for positive rational number computations in order to solve problems with efficiency and accuracy. The student is expected to: **(K) add and subtract positive rational numbers fluently**
5.3(H)	represent and solve addition and subtraction of fractions with unequal denominators referring to the same whole using objects and pictorial models and properties of operations (S)
4.3(C)	determine if two given fractions are equivalent using a variety of methods (S)
4.3(E)	represent and solve addition and subtraction of fractions with equal denominators using objects and pictorial models that build to the number line and properties of operations (R)
4.3(F)	evaluate the reasonableness of sums and differences of fractions using benchmark fractions 0, 1/4, 1/2, 3/4, and 1, referring to the same whole (S)

Stimulus

Word Problem*	Verbal Description	Chart/Table	Graph
Equation/ Expression	Manipulatives	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Content Builder (see Appendix for Tree Diagram)

- Add positive rational numbers fluently
- Subtract positive rational numbers fluently

Instructional Implications

Students should add and subtract fractional values with a variety of representations (e.g., improper, mixed numbers, like denominators, unlike denominators). Instruction should vary the context (e.g., joining, separating, comparing) and number of steps needed to solve the problem. As students have related decimals to fractions [4.2(G)], instruction may include the mixture of rational number representations (e.g., $4.75 + 2\frac{1}{2} = x$).

Learning from Mistakes

Students may make the following mistakes:

- Applying the use of "key words" to select addition or subtraction instead of understanding the context of the problem
- Having difficulty finding (or forgetting to use) a common denominator when adding or subtracting fractions or mixed numbers
- Adding either the numerator, denominator, or both rather than finding a common denominator*

Academic Vocabulary

common denominator
difference
equivalent fraction
improper fraction
mixed number
simplified form
sum

Interesting Items

English	*Spanish*
5.3(K) 2022 #8	5.3(K) 2024 #12
5.3(K) 2021 #10	5.3(K) 2017 #21
5.3(K) 2017 #21	

5.3(H)

5.3 Number and operations. The student applies mathematical process standards to develop and use strategies and methods for positive rational number computations in order to solve problems with efficiency and accuracy. The student is expected to:

(H) represent and solve addition and subtraction of fractions with unequal denominators referring to the same whole using objects and pictorial models and properties of operations

Stimulus

Word Problem*	Verbal Description	Chart/Table	Graph
Equation/ Expression	Manipulatives	Diagram/Image*	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop* (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

common denominator
equal parts/equal shares
equivalent fraction
improper fraction
mixed number
numerator
simplified form

Interesting Items

English
5.3(H) 2024 #16
5.3(H) 2023 #9
5.3(H) 2022 #14
5.3(H) 2017 #4
5.3(H) 2015 #8

Spanish
5.3(H) 2023 #9
5.3(H) 2017 #4
5.3(H) 2016 #6

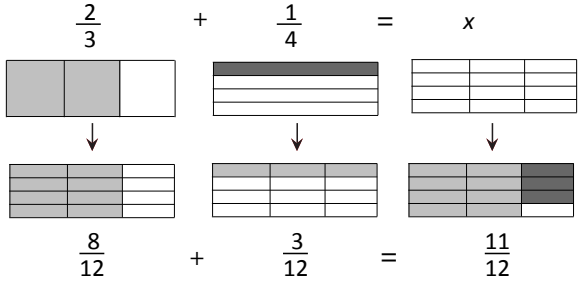
Role in Concept Development

Supports
5.3(K) add and subtract positive rational numbers fluently

Connection/ Relevance
Using concrete objects and pictorial models to represent the addition and subtraction of fractions with unlike denominators supports students in developing the concrete understanding of the concept before moving to the abstract of developing a strategy and/or algorithm.

When to Teach
Before/Prerequisite to 5.3(K)

Instructional Implications
In conjunction with 4.3(E), students extend their understanding of how to add and subtract fractions with like denominators (e.g., $\frac{2}{3} + \frac{5}{3} = \frac{7}{3}$) to adding and subtracting fractions with unlike denominators (e.g., $\frac{2}{3} + \frac{1}{4} = x$). An area model is one example of how to represent the addition/subtraction of fractions with unlike denominators (e.g., $\frac{2}{3} + \frac{1}{4} = x$).



The use of strip diagrams and number lines are other methods for representing addition/subtraction of fractions.

Instruction should include examples of mixed numbers and extend to the use of properties of operations (e.g., $4\frac{3}{5} - 2\frac{11}{15} = 4\frac{9}{15} - 2\frac{11}{15} = (3 + 1 + \frac{9}{15}) - 2\frac{11}{15} = (3 + \frac{15}{15} + \frac{9}{15}) - 2\frac{11}{15} = 3\frac{24}{15} - 2\frac{11}{15} = 1\frac{13}{15}$).

Learning from Mistakes
Students may make the following mistakes:
- Adding and/or subtracting the numerators and unequal denominators*
- Being unable to identify the model representation of an addition/subtraction problem*
- Not recognizing solutions in their simplified form (e.g., not recognizing a solution of $\frac{3}{6}$ is equivalent to $\frac{1}{2}$)

5.4(A) **5.4 Algebraic reasoning.** The student applies mathematical process standards to develop concepts of expressions and equations. The student is expected to:

(A) identify prime and composite numbers

Stimulus

Word Problem	Verbal Description*	Chart/Table	Graph
Equation/ Expression	Manipulatives	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect* (2 pts)	Match Table Grid (2 pts)	Drag and Drop (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

composite number*
factor pairs*
prime number*

Interesting Items

English	*Spanish*
5.4(A) 2024 #13	5.4(A) 2024 #13
5.4(A) 2021 #23	5.4(A) 2018 #15
5.4(A) 2018 #15	5.4(A) 2017 #13
5.4(A) 2017 #13	5.4(A) 2016 #20

Role in Concept Development

Supports

- 5.3(K) add and subtract positive rational numbers fluently
- 6.7(A) generate equivalent numerical expressions using order of operations, including whole number exponents, and prime factorization

Connection/ Relevance

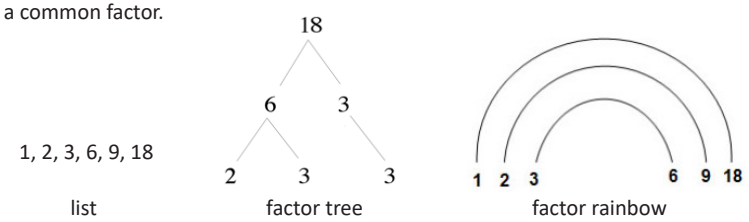
Identifying prime and composite numbers supports students as they determine a common denominator in order to add and subtract fractions with unlike denominators and identify a common factor in order to represent sums/differences in simplified form. In conjunction with 6.7(A), identifying prime numbers is key for determining the prime factorization of numbers.

When to Teach

Before/Prerequisite to 5.3(K)

Instructional Implications

Students need to identify prime numbers as those that only have two factors; one and itself (e.g., 13 is prime because the only factors for 13 are 1 and 13, 1 x 13 = 13). A composite number has more than two factors (e.g., 18 is composite because 1 x 18 = 18; 2 x 9 = 18; 3 x 6 = 18). The number one is neither prime nor composite. Instruction should model multiple representations of composite numbers as this supports future needs of finding a common denominator and/or a common factor.



Learning from Mistakes

Students may make the following mistakes:

- Misinterpreting 1 as prime because its factors are 1 and itself
- Misinterpreting 2 as a composite number because it is even*
- Misinterpreting all odd numbers as prime

5.3 Number and operations. The student applies mathematical process standards to develop and use strategies and methods for positive rational number computations in order to solve problems with efficiency and accuracy. The student is expected to:

5.3(I) **(I) represent and solve multiplication of a whole number and a fraction that refers to the same whole using objects and pictorial models, including area models**

Stimulus

Word Problem*	Verbal Description	Chart/Table*	Graph
Equation/ Expression	Manipulatives	Diagram/Image*	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop* (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

(area) model*
factor
product

Interesting Items

English
5.3(I) 2022 #36
5.3(I) 2016 #50
5.3(I) 2015 #9

Spanish
5.3(I) 2016 #50
5.3(I) 2015 #9

Role in Concept Development

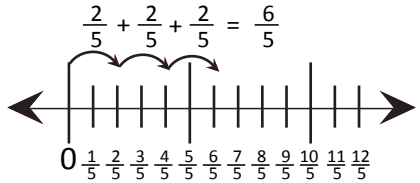
Supports
- 5.3(K) add and subtract positive rational numbers fluently
- 5.3(L) divide whole numbers by unit fractions and unit fractions by whole numbers

Connection/ Relevance
Using concrete objects and pictorial models to represent and solve the multiplication of fractions and whole numbers supports students in developing the concrete understanding of the concept before moving to the abstract of developing a strategy and/or algorithm. Understanding the use of the area model for multiplication of fractions supports its use in the division of fractions as well.

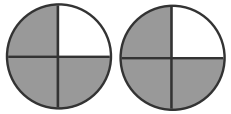
When to Teach
Before/Prerequisite to 5.3(J) and 5.3(L)

Instructional Implications
Limit instruction to multiplication of a whole number and fraction (e.g., $\frac{2}{5} \times 3 = x$) not a fraction multiplied by a fraction (e.g., $\frac{2}{5} \times \frac{1}{3} = x$).

Instruction should associate how multiplication is repeated addition. The use of fraction circles, rectangles, number lines, etc., supports the concrete understanding of repeated addition (e.g., $3 \times \frac{2}{5} = \frac{2}{5} + \frac{2}{5} + \frac{2}{5} = \frac{6}{5}$).



Instruction should also model the use of the term "of" when multiplying fractions (e.g., $\frac{3}{4} \times 2 = x$; what is three-fourths "of" two wholes?).



$\frac{3}{4} \times 2 = \frac{3}{4} + \frac{3}{4} = \frac{6}{4}$

Learning from Mistakes
Students may make the following mistakes:
- Confusing multiplication of fractions (repeated addition of different wholes) with addition/subtraction of fractions (joining/separating of the same whole)*
- Having difficulty identifying fractional amounts for a given set of objects*

5.3(L) Readiness

TEKS Scaffold

TEKS	Student Expectation
6.3(A)	recognize that dividing by a rational number and multiplying by its reciprocal result in equivalent values (S)
5.3(L)	**5.3 Number and operations.** The student applies mathematical process standards to develop and use strategies and methods for positive rational number computations in order to solve problems with efficiency and accuracy. The student is expected to: **(L) divide whole numbers by unit fractions and unit fractions by whole numbers**
5.3(J)	represent division of a unit fraction by a whole number and the division of a whole number by a unit fraction such as 1/3 ÷ 7 and 7 ÷ 1/3 using objects and pictorial models, including area models (S)
5.3(I)	represent and solve multiplication of a whole number and a fraction that refers to the same whole using objects and pictorial models, including area models (S)
5.3(F)	represent quotients of decimals to the hundredths, up to four-digit dividends and two-digit whole number divisors, using objects and pictorial models, including area models (S)

Stimulus

Word Problem*	Verbal Description	Chart/Table	Graph
Equation/ Expression*	Manipulatives	Diagram/Image	Number Line
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop* (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Content Builder (see Appendix for Tree Diagram)

- Divide whole numbers by unit fractions
- Divide unit fractions by whole numbers

Instructional Implications

In conjunction with 5.3(J), this standard builds the concrete foundational understanding of division of fractions. Limit instruction to whole numbers divided by a unit fraction (e.g., $4 \div \frac{1}{4} = x$) or a unit fraction divided by a whole number (e.g., $\frac{1}{4} \div 4 = x$). A unit fraction is one part of a whole that is divided into equal parts; the numerator is 1. Students are not expected to divide a non-unit fraction by a whole number (e.g., $\frac{3}{4} \div 5 = x$). A non-unit fraction has a numerator other than 1. The standard also excludes the division of two fractions (e.g., $\frac{4}{5} \div \frac{3}{4} = x$).

This foundation prepares students to better understand how dividing by a fraction and multiplying by its reciprocal yield equivalent answers (e.g., $3 \div \frac{1}{4} = 12$ and $3 \times 4 = 12$). Instruction should model how division of fractions is like division of whole numbers (e.g., $18 \div 3 = x$; how many equal groups of three divide into 18? Or $18 \div \frac{1}{3} = x$; how many times can one-third go into 18? Or $\frac{1}{3} \div 8 = x$; given one-third of a whole, divide it into eight equal parts). See 5.3(J) for examples. Provide a variety of real-world examples to help students make sense of the division of fractions.

Learning from Mistakes

Students may make the following mistakes:

- Confusing the dividend from the divisor (e.g., $4 \div \frac{1}{4} = x$; "how many fours divide into $\frac{1}{4}$" instead of "how many fourths divide into four wholes?")*
- Confusing whether to multiply and/or divide fractions when given a contextual situation*
- Misrepresenting whole numbers as having the same denominator as the given fraction (e.g., $4 \div \frac{1}{3}$ is the same as $\frac{4}{3} \div \frac{1}{3}$)

Academic Vocabulary

dividend
divisor
quotient
unit fraction

Interesting Items

English	*Spanish*
5.3(L) 2024 #17	5.3(L) 2017 #8
5.3(L) 2024 #25	5.3(L) 2016 #13
5.3(L) 2023 #27	5.3(L) 2016 #37
5.3(L) 2022 #13	5.3(L) 2015 #11
5.3(L) 2017 #8	
5.3(L) 2016 #13	
5.3(L) 2016 #37	

5.3(J)

5.3 Number and operations. The student applies mathematical process standards to develop and use strategies and methods for positive rational number computations in order to solve problems with efficiency and accuracy. The student is expected to:

(J) represent division of a unit fraction by a whole number and the division of a whole number by a unit fraction such as 1/3 ÷ 7 and 7 ÷ 1/3 using objects and pictorial models, including area models

Stimulus

Word Problem	Verbal Description	Chart/Table	Graph
Equation/ Expression*	Manipulatives	Diagram/Image	Number Line*
Base Ten Blocks	Measurement Tool	Formula	Geometric Figures

Item Types

Multiselect (2 pts)	Match Table Grid (2 pts)	Drag and Drop* (1-2 pts)	Fraction Model (1-2 pts)
Hot Spot (1-2 pts)	Inline Choice (1-2 pts)	Number Line (1-2 pts)	Graphing (1-2 pts)
Text Entry (1-2 pts)	Equation Editor (1-2 pts)	Multiple Choice* (1 pt)	

Academic Vocabulary

(area) model*
dividend
division
divisor
equal parts*/equal shares
quotient
unit fraction

Interesting Items

English
5.3(J) 2024 #8
5.3(J) 2023 #12
5.3(J) 2016 #21

Spanish
5.3(J) 2023 #12
5.3(J) 2016 #21

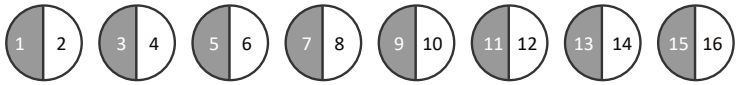
Role in Concept Development

Supports
5.3(L) divide whole numbers by unit fractions and unit fractions by whole numbers

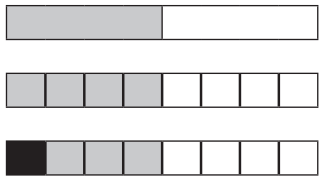
Connection/ Relevance
Using concrete objects and pictorial models to represent the division of fractions by whole numbers and whole numbers by fractions supports students in developing the concrete understanding of the concept before moving to the abstract of developing a strategy and/or algorithm.

When to Teach
Before/Prerequisite to 5.3(L)

Instructional Implications
Instruction surrounding the division of fractions is limited to unit fractions and whole numbers (e.g., $\frac{1}{4} \div 5 = x$ or $5 \div \frac{1}{4} = x$). Instruction will not include a non-unit fraction and whole number (e.g., $\frac{3}{4} \div 5 = x$) or the division of two fractions (e.g., $\frac{4}{5} \div \frac{3}{4} = x$). Instruction should model how division of fractions is like division of whole numbers (e.g., 8 ÷ 2 = x; how many equal groups of two divide into 8? Or $8 \div \frac{1}{2} = x$; how many equal groups of halves divide into 8? If a circle represents one whole, then $8 \div \frac{1}{2} = 16$ because 16 halves will divide into 8 whole circles).



(e.g., $\frac{1}{2}$ divided by 4 = x; divide half of whole into four equal parts, how many would be in each group? If a rectangle represents one whole and the shaded portion represents half of a whole, then $\frac{1}{2} \div 4 = \frac{1}{8}$ because a half divided into four parts would yield eighths and each group would have one-eighth).



Learning from Mistakes
Students may make the following mistakes:

- Thinking that division always yields a smaller quotient
- Thinking that a common denominator is needed to divide fractions
- Misrepresenting whole numbers as having the same denominator as the given fraction (e.g., $4 \div \frac{1}{3}$ is the same as $\frac{4}{3} \div \frac{1}{3}$)
- Thinking that dividing a whole by half (e.g., $5 \div \frac{1}{2} = x$) is the same thing as dividing a whole in halves or two equal parts (e.g., 5 ÷ 2 = x)
- Not relating one division representation with another (e.g., strip diagram to number line for $2 \div \frac{1}{4}$)*