

Lesson Introduction: Reading and Writing Fractions

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Identify parts of a fraction. • Read and write fractions in standard form. • Read and write fractions in word form.
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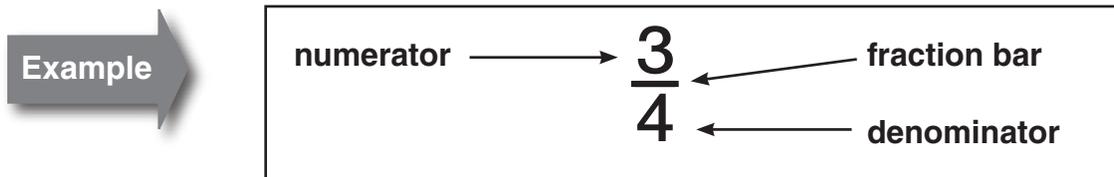
Vocabulary

denominator, fraction, fraction bar, numerator, standard form, word form

Overview

A **fraction** expresses a whole divided into any number of equal parts. It is a number usually expressed in the form a/b . The bottom number of a fraction is the **denominator**. It tells you how many equal parts the whole is divided into. The top number of the fraction is the **numerator**. It tells how many equal parts of the whole you have. A **fraction bar** is a line separating the numerator and denominator of a fraction. The fraction bar stands for division.

Parts of a Fraction



Writing Fractions

A fraction can be written in **standard form** or **word form**. A fraction written in standard form is written as a number. A fraction written in word form is written as words.

Example →

Standard Form	Word Form
$\frac{1}{2}$	one-half

Problems to Try

- a. Write the standard form of four-sixths. b. Write the word form of $\frac{5}{9}$.

Answer: $\frac{4}{6}$

Answer: five-ninths

Real-World Connection

You use fractions every time you use money. Half a dollar ($\frac{1}{2}$) is a fraction.



Lesson Introduction: Finding Equivalent Fractions

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Finding missing numerators or denominators in equal fractions. • Cross-multiplying to find if two fractions are equal.
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Vocabulary

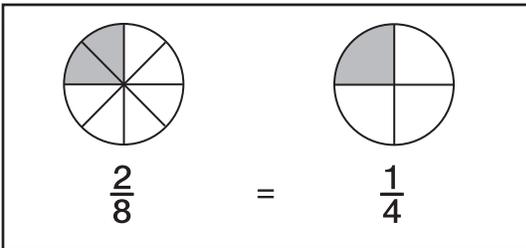
equivalent fractions

Overview

Equivalent fractions have the same value, even though they may look different. When fractions are equivalent, it means they are equal.

Finding Equivalent Fractions

Example →



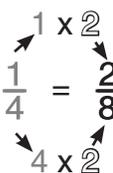
$\frac{2}{8} = \frac{1}{4}$

In each figure, the shaded portion represents one-fourth of the whole circle.

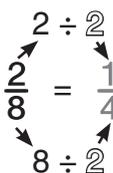
$\frac{2}{8}$ is the same as $\frac{1}{4}$. We can express this by writing $\frac{2}{8} = \frac{1}{4}$.

Example →

Multiply to find equal fractions.



Divide to find equal fractions.



Cross-multiply to find if two fractions are equal.

$$\frac{3}{6} \neq \frac{1}{2} = \frac{6}{6}$$

The two fractions above are equivalent because their cross products are the same.

Problems to Try

a. Multiply to find equal fractions.

$$\frac{1}{3} = \frac{3}{\square} \quad \text{Answer: 9}$$

b. Divide to find equal fractions.

$$\frac{3}{12} = \frac{\square}{4} \quad \text{Answer: 1}$$

c. Are the fractions equal?

$$\frac{2}{5} \quad \frac{4}{10} \quad \text{Answer: yes}$$

Real-World Connection

When pouring milk, you are using a portion or a fraction of the milk available in the container.

Lesson Introduction: Simplifying Fractions

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Write fractions in lowest terms. • Find the factors of numbers. • Find the greatest common factor of two numbers.
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Vocabulary

common factor, equivalent, factors, greatest common factor, simplest form, simplify

Overview

Every number has factors. The **factors** of a number divide that number evenly. The factors of 12 are 1, 2, 3, 4, 6, and 12.

A number that is a factor of two or more numbers is a **common factor** of those numbers. The largest common factor of two or more numbers is called the **greatest common factor (GCF)**.

A fraction is in its **simplest form** if 1 is the only number that will divide both the numerator and the denominator. If a fraction is not in simplest form, you can reduce it. **Simplify** means to reduce a fraction to the lowest **equivalent**, or equal fraction. To simplify a fraction, divide both the numerator and the denominator by the greatest common factor. Then, rewrite the fraction.

Finding Greatest Common Factor (GCF)

Example →

What is the greatest common factor of 6 and 12?
 factors of 6: 1, 2, 3, and **6**
 factors of 12: 1, 2, 3, 4, **6**, and 12
 The greatest common factor of 6 and 12 is 6.

Simplifying Fractions

Example →

Divide both the numerator and the denominator by the greatest common factor.

$$\frac{8}{12} = \frac{2}{3}$$

Greatest common factor of 8 and 12 is 4.

Problems to Try

- What is the greatest common factor of 24 and 36? **Answer:** 12
- Simplify $\frac{4}{16}$. **Answer:** $\frac{1}{4}$



Real-World Connection

You use fractions every time you look at a clock. A quarter ($\frac{1}{4}$) past the hour is a fraction.

Lesson Introduction: Reading and Writing Mixed Numbers

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Write mixed numbers for pictured items. • Write the standard form for mixed numbers. • Write the word form for mixed numbers.
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Vocabulary

fraction, mixed number, standard form, whole number, word form

Overview

A **mixed number** is a whole number and a fraction. A **whole number** is a counting number. A **fraction** expresses a whole divided into any number of equal parts. It is a number usually expressed in the form a/b .

A mixed number can be written in **standard form** or **word form**. A mixed number written in standard form is written as a number. A mixed number written in word form is written as words.

Reading and Writing Mixed Numbers



Whole Number \longrightarrow $3\frac{1}{6}$ \longleftarrow Fraction



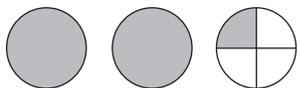
$$3\frac{1}{6} = 3 + \frac{1}{6}$$



	Standard Form	Word Form
	$3\frac{1}{6}$	three and one-sixth

Problems to Try

a. Write a mixed number for the picture.



Answer: $2\frac{1}{2}$

b. Write the standard form of nine and one-half.

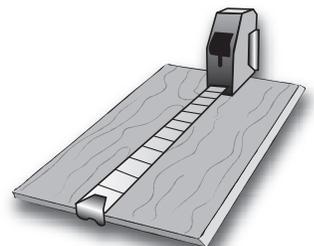
Answer: $9\frac{1}{2}$

c. Write the word form of $4\frac{2}{7}$.

Answer: four and two-sevenths

Real-World Connection

A carpenter uses measurements involving mixed numbers, such as $6\frac{1}{2}$ feet.



Lesson Introduction: Points on a Number Line and Reading a Ruler

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Identifying points on a number line. • Write fractions or mixed numbers to give the lengths of objects to the nearest half, fourth, eighth, and sixteenth inch.
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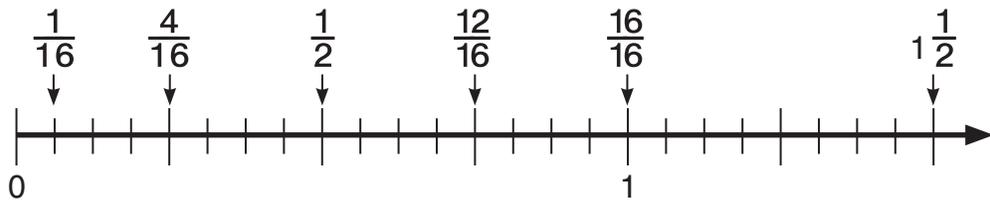
Vocabulary

number line, points, ruler, whole number

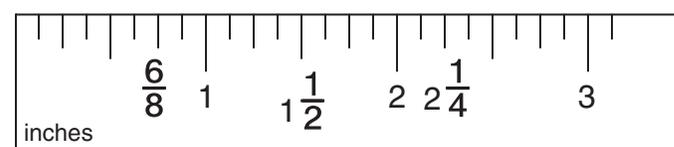
Overview

A **number line** is a line in which real numbers can be placed, according to their value. Fractions can name **points** or places on a number line that are between points named by whole numbers. A **whole number** is a counting number. A **ruler** is a measuring tool that uses a number line.

Points on a Number Line

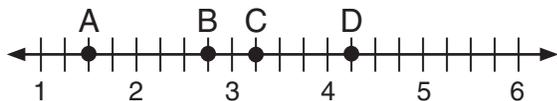


Reading a Ruler



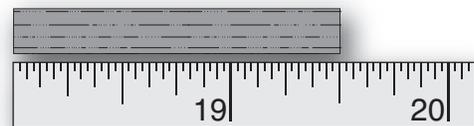
Problems to Try

a. Name the points on the number line.



Answer: A. $1 \frac{1}{2}$, B. $2 \frac{3}{4}$, C. $3 \frac{1}{4}$, D. $4 \frac{1}{4}$

b. Give the length to the nearest half inch.



Answer: $19 \frac{1}{2}$ inches

Real-World Connection

Shoe sizes are measured in fractions. A store clerk often uses a Brannock Device foot-measurer to determine a customer's shoe size.

Lesson Introduction: Finding Least Common Denominators

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Find the least common denominator (LCD) for two and three fractions.
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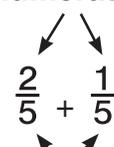
Vocabulary

common denominator, equivalent fractions, least common denominator, least common multiple, unlike fractions

Overview

Unlike fractions are fractions with different denominators. To add or subtract fractions with unlike denominators, the fractions must be rewritten as equivalent fractions with a common denominator. **Equivalent fractions** are equal. Fractions with **common denominators** are fractions that have the same denominator. The common denominator is found by identifying the least common multiple (LCM) of the denominators of the fractions. The **least common multiple** is the smallest number that is a multiple of two or more numbers.

Finding Least Common Denominators

<p>Example </p>	<p>Common Denominator</p> <p>numerators</p>  <p>$\frac{2}{5} + \frac{1}{5}$</p> <p>denominators</p> <p>These denominators are common (the same).</p>	<p>Finding the Least Common Denominator</p> <p>To find the least common denominator, list multiples of the denominators.</p> <p>Multiples of 5 are 10, 15, 20, 25, 30, ...</p> <p>Multiples of 6 are 12, 18, 24, 30, 36, ...</p> <p>30 is the least common denominator.</p>
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<p>Rewrite the fractions $\frac{1}{5}$ and $\frac{2}{6}$ as equivalent fractions with the least common denominator of 30.</p> $\frac{1}{5} = \frac{1 \times 6}{5 \times 6} = \frac{6}{30} \qquad \frac{2}{6} = \frac{2 \times 5}{6 \times 5} = \frac{10}{30}$

Problems to Try

Write the fractions as equivalent fractions with the least common denominator.

a. $\frac{2}{3}$ $\frac{1}{6}$ Answer: $\frac{4}{6}$ $\frac{1}{6}$

b. $\frac{1}{2}$ $\frac{2}{3}$ $\frac{3}{4}$ Answer: $\frac{6}{12}$ $\frac{8}{12}$ $\frac{9}{12}$

Real-World Connection

When you buy a pizza, it is cut into equal parts.

Lesson Introduction: Comparing and Ordering Fractions

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Compare fractions and mixed numbers with like denominators. • Compare fractions and mixed numbers with different denominators.
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Vocabulary

common denominators, denominator, <, >, =

Overview

A **denominator** is the bottom number of a fraction. Fractions with **common denominators** have the same bottom number. The first step in comparing fractions is to make sure they have the same denominators. If they do not, rewrite the fractions with common denominators. When comparing fractions, use the symbols <, >, and =. The symbol < means greater than, > means less than, and = means equal to.

Comparing and Ordering Fractions

Examples	Like Denominators	Unlike Denominators	Mixed Numbers
	<p>Since the fractions both have a denominator of 9, compare the numerators.</p> $\frac{5}{9} \quad \frac{2}{9}$ <p style="text-align: center;">↓ ↓</p> $\frac{5}{9} \quad \frac{2}{9}$ <p>The numerator 5 is greater than the numerator 2.</p> $\frac{5}{9} > \frac{2}{9}$ <p>$\frac{5}{9}$ is greater than $\frac{2}{9}$.</p>	<p>The denominators are not the same.</p> $\frac{3}{4} \quad \frac{5}{6}$ <p style="text-align: center;">↓ ↘</p> $\frac{9}{12} \quad \frac{10}{12}$ <p>Write the fractions with a common denominator.</p> $\frac{9}{12} < \frac{10}{12}$ <p>Compare the numerators. 9 is less than 10.</p> $\frac{3}{4} < \frac{5}{6}$ <p>$\frac{9}{12}$ is less than $\frac{10}{12}$.</p>	<p>The whole numbers are the same. Compare the fractions.</p> $4\frac{1}{5} \quad 4\frac{2}{3}$ <p style="text-align: center;">↓ ↓</p> $4\frac{3}{15} \quad 4\frac{10}{15}$ <p>Write the fractions with a common denominator.</p> $4\frac{3}{15} \quad 4\frac{10}{15}$ <p>$\frac{3}{15}$ is less than $\frac{10}{15}$.</p> $4\frac{1}{5} < 4\frac{2}{3}$

Problems to Try

a. Compare the fractions. Use <, >, or =.

$\frac{3}{8} \bigcirc \frac{1}{2}$ **Answer:** $\frac{3}{8} < \frac{1}{2}$

b. Compare the fractions. Use <, >, or =.

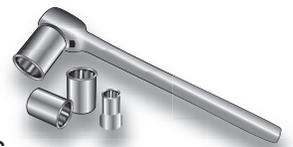
$8\frac{6}{7} \bigcirc 8\frac{5}{6}$ **Answer:** $8\frac{6}{7} > 8\frac{5}{6}$

c. Write the group of fractions in order from least to greatest. $\frac{1}{2}$ $\frac{2}{3}$ $\frac{2}{6}$

Answer: $\frac{2}{6}$ $\frac{1}{2}$ $\frac{2}{3}$

Real-World Connection

A car mechanic's tools are measured in fractions of inches and meters.



Lesson Introduction: Converting Improper Fractions to Mixed Numbers

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Convert improper fractions to mixed numbers.
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Vocabulary

convert, denominator, divisor, improper fraction, mixed numbers, numerator, quotient, remainder, whole number

Overview

The **numerator** of a fraction is the top number, and the **denominator** is the bottom number. An **improper fraction** is a fraction in which the numerator is greater than the denominator. Improper fractions can be written as mixed numbers. A **mixed number** is a whole number and a fraction. A **whole number** is a counting number. To **convert** means to change. To convert an improper fraction to a mixed number, divide the numerator by the denominator.

In division, the number used to divide another number is the **divisor**. The answer is the **quotient**. The amount left over when one number is divided by another number is the **remainder**.

Convert Improper Fractions to Mixed Numbers

Example →

The quotient becomes the whole number.

The remainder becomes the numerator.

The divisor becomes the denominator.

$$\frac{3}{2} = 2 \overline{)3} \quad \begin{array}{r} 1 \\ 2 \overline{)3} \\ \underline{2} \\ 1 \end{array} = 1 \frac{1}{2}$$

Problems to Try

- a. Write a whole number for the improper fraction $\frac{35}{7}$. **Answer: 5**
- b. Write a mixed number for the improper fraction $\frac{9}{2}$. **Answer: $4 \frac{1}{2}$**

Real-World Connection

Nurses often calculate drug dosages for patients using fractions.



Lesson Introduction: Converting Mixed Numbers to Improper Fractions

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Convert mixed numbers to improper fractions.
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Vocabulary

convert, denominator, improper fraction, mixed numbers, numerator, whole number

Overview

A **mixed number** is a whole number and a fraction. A **whole number** is a counting number. It is easy to **convert** or change a mixed number to an improper fraction. An **improper fraction** is a fraction in which the numerator is greater than the denominator. The **numerator** of a fraction is the top number, and the **denominator** is the bottom number.

Convert Mixed Numbers to Improper Fractions

Example →

Multiply the whole number by the denominator.

$$2 \times \frac{1}{4} = \frac{9}{4}$$

= 8 + 1

Add the numerator to the product.

The sum is the new numerator in your improper fraction.

Keep the denominator the same.

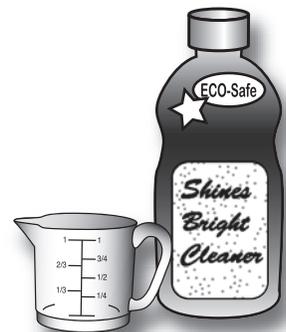
Problems to Try

Write an improper fraction for each mixed number.

a. $3 \frac{1}{3}$ Answer: $\frac{10}{3}$ b. $5 \frac{1}{2}$ Answer: $\frac{11}{2}$

Real-World Connection

School custodians occasionally use fractions in the workplace. An example would be calculating the correct amount of disinfecting concentrate to be added to water to make a cleaning solution.



Lesson Introduction: Adding Fractions With Like Denominators

Common Core State Standard	Objective
<ul style="list-style-type: none"> Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 Sixth Grade: 6.NS.1, 6.NS.4 Seventh Grade: 7.NS.1 Eighth Grade: 8.NS.1 	<ul style="list-style-type: none"> Add two fractions with the same denominator.

Vocabulary

common denominator, convert, like fraction, improper fraction, mixed number, numerator, simplify, whole number

Overview

Like fractions are fractions with **common denominators**, or the same bottom number. You can add like fractions by simply adding the **numerators**, which are the top numbers, and writing the sum over the common denominator. If possible, simplify the answer. **Simplify** means to rewrite the answer in its lowest term.

Sometimes the answer to an addition problem is an improper fraction. An **improper fraction** is a fraction in which the numerator is greater than the denominator. Improper fractions can be written as mixed numbers. A **mixed number** is a whole number and a fraction. A **whole number** is a counting number. To **convert** or change an improper fraction to a mixed number, divide the numerator by the denominator. If possible, simplify the answer.

Adding Fractions With Like Denominators

Examples

$$\begin{array}{r} \frac{2}{6} \\ + \frac{3}{6} \\ \hline \frac{5}{6} \end{array}$$

$$\begin{array}{r} \frac{1}{9} \\ + \frac{2}{9} \\ \hline \frac{3}{9} = \frac{1}{3} \end{array}$$

$$\begin{array}{r} \frac{4}{5} \\ + \frac{3}{5} \\ \hline \frac{7}{5} = 1\frac{2}{5} \end{array}$$

Problems to Try

a. Add $\frac{1}{8} + \frac{2}{8}$

Answer: $\frac{3}{8}$

b. Add $\frac{1}{4} + \frac{1}{4}$

Answer: $\frac{1}{2}$

c. Add $\frac{5}{10} + \frac{9}{10}$

Answer: $1\frac{2}{5}$

Real-World Connection

Cabinetmakers use fractions to measure the dimensions of a space where kitchen cabinets will fit.

Lesson Introduction: Adding Mixed Numbers With Like Denominators

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Add two fractions with like denominators.
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Vocabulary

like fractions, common denominator, mixed number, numerator, whole number, simplify

Overview

A **mixed number** is a whole number and a fraction. A **whole number** is a counting number. **Like fractions** are fractions with **common denominators**, or the same bottom number. You add mixed numbers by first adding the **numerators**, which are the top number of the fractions. Write the sum over the like denominator. Next, add the whole numbers. If possible, simplify the answer. **Simplify** means to rewrite the answer in its lowest term.

Adding Mixed Numbers With Like Denominators

Examples

$2\frac{2}{5}$	5	$12\frac{4}{9}$
$+ 1\frac{1}{5}$	$+ 3\frac{1}{2}$	$+ 6\frac{3}{9}$
<hr style="width: 50%; margin: 0 auto;"/>	<hr style="width: 50%; margin: 0 auto;"/>	<hr style="width: 50%; margin: 0 auto;"/>
$3\frac{3}{5}$	$8\frac{1}{2}$	$18\frac{7}{9}$

Problems to Try

a. Add $2\frac{1}{8} + \frac{2}{8}$

Answer: $2\frac{3}{8}$

b. Add $1\frac{3}{10} + 3\frac{1}{10}$

Answer: $4\frac{4}{10} = 4\frac{2}{5}$

c. Add $1\frac{4}{9} + 3\frac{2}{9}$

Answer: $4\frac{6}{9} = 4\frac{2}{3}$

Real-World Connection

A plumber must choose the correct wrench size to install a kitchen sink. Sizes are marked in fractions on the handles of the wrenches.



Lesson Introduction: Adding Mixed Numbers and Renaming Sums

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Add two mixed numbers with like denominators and rename the sum.
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Vocabulary

convert, denominator, like denominators, improper fraction, mixed number, numerator, simplify, whole number

Overview

An **improper fraction** is a fraction in which the **numerator**, the top number, is greater than the **denominator**, the bottom number. Improper fractions can be written as mixed numbers. A **mixed number** is a whole number and a fraction. A **whole number** is a counting number. To **convert** or change an improper fraction to a mixed number, divide the numerator by the denominator. If possible, simplify the answer. **Simplify** means to rewrite the answer in its lowest term.

To add mixed numbers where the fractions have **like denominators**, or the same denominator, first add the whole numbers together and then add the fractions. If the answer is an improper fraction, convert it to a mixed number. Next, add the whole number and the mixed number. If possible, simplify the answer.

Adding Mixed Numbers and Renaming the Sum



First add the whole numbers together.

$$\begin{array}{r} 3\frac{7}{8} \\ + 5\frac{4}{8} \\ \hline 8\frac{11}{8} \end{array}$$

Add the numerators of the fractions and write the sum over the like denominator.

$$8\frac{11}{8} = 8 + 1\frac{3}{8} = 9\frac{3}{8}$$

If the answer is an improper fraction, rename it as a mixed number. Next, add the whole number and the mixed number.

Problems to Try

- a. Add $4\frac{5}{7} + 3\frac{6}{7}$ **Answer:** $8\frac{4}{7}$ b. Add $10\frac{2}{5} + 3\frac{3}{5}$ **Answer:** 14

Real-World Connection

Baseball is more than a game. It is a game of mathematical numbers used to try and determine how players respond in certain situations. For example, a batter might get a hit 2 out of 3 times ($\frac{2}{3}$) or a pitcher may pitch a total of $48\frac{1}{3}$ innings for the season.

Lesson Introduction: Adding Fractions With Unlike Denominators

Common Core State Standard	Objective
<ul style="list-style-type: none"> Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 Sixth Grade: 6.NS.1, 6.NS.4 Seventh Grade: 7.NS.1 Eighth Grade: 8.NS.1 	<ul style="list-style-type: none"> Add two fractions with unlike denominators.

Vocabulary

common denominator, convert, denominator, improper fractions, mixed number, simplify, unlike fractions, whole number

Overview

Unlike fractions are fractions with different **denominators**, or bottom numbers. To add fractions with unlike denominators, first rewrite the fractions with a **common denominator**, or the same denominator. Add the new fractions. If possible, simplify the answer. **Simplify** means to rewrite the answer in its lowest term.

Sometimes the answer to an addition problem is an improper fraction. An **improper fraction** is a fraction in which the numerator or top number is greater than the denominator. Improper fractions can be written as mixed numbers. A **mixed number** is a whole number and a fraction. A **whole number** is a counting number. To **convert** or change an improper fraction to a mixed number, divide the numerator by the denominator. If possible, simplify the answer.

Adding Fractions With Unlike Denominators

Example

$\frac{2}{5} = \frac{4}{10}$	Write the fractions with a common denominator.
$ \begin{array}{r} \frac{2}{5} = \frac{4}{10} \\ + \frac{9}{10} = \frac{9}{10} \\ \hline \frac{13}{10} = 1 \frac{3}{10} \end{array} $	
$\frac{9}{10} = \frac{9}{10}$	Convert the improper fraction to a mixed number.

Add the numerators and write the sum over the like denominator.

Problems to Try

a. Add $\frac{1}{3} + \frac{2}{5}$

Answer: $\frac{11}{15}$

b. Add $\frac{2}{3} + \frac{5}{6}$

Answer: $1 \frac{1}{2}$

Real-World Connection

Teachers can use fractions to keep track of how many students handed in their math homework on a specific day. An example might be 18 of the 20 ($\frac{18}{20}$) students handed in their homework.

Lesson Introduction: Adding Mixed Numbers With Unlike Denominators

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Add two mixed numbers with unlike denominators.
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Vocabulary

common denominator, convert, denominator, improper fraction, mixed number, numerator, simplify, unlike fractions, whole number

Overview

A **mixed number** is a whole number and a fraction. A **whole number** is a counting number. **Unlike fractions** are fractions with different **denominators**, or bottom numbers. The first step in adding mixed numbers is to add the fractions. If the fractions have unlike denominators, **convert** or change the fractions to fractions with a common denominator. Fractions with **common denominators** have the same denominator. Next, add the new fractions. Then, add the whole numbers. If possible, simplify the answer. **Simplify** means to rewrite the answer in its lowest term.

Sometimes the answer to an addition problem involving mixed numbers is an improper fraction. An **improper fraction** is a fraction in which the **numerator**, top number, is greater than the denominator. Improper fractions can be written as mixed numbers. To convert an improper fraction to a mixed number, divide the numerator by the denominator. If possible, simplify the answer.

Adding Mixed Numbers With Unlike Denominators

Example

$\begin{array}{r} 6\frac{2}{3} = 6\frac{8}{12} \\ + 7\frac{3}{4} = 7\frac{9}{12} \\ \hline 13\frac{17}{12} \end{array}$	<p>Convert the fractions to fractions with a common denominator and add.</p>
$13 + 1\frac{5}{12} = 14\frac{5}{12}$	<p>If the sum is an improper fraction, convert it to a mixed number.</p>
<p>Add the whole numbers.</p>	<p>Add the whole number and the mixed number.</p>

Problems to Try

- a. Add $3\frac{1}{2} + 4\frac{3}{4}$ **Answer:** $8\frac{1}{4}$ b. Add $3\frac{3}{5} + 5\frac{9}{10}$ **Answer:** $9\frac{1}{2}$

Real-World Connection

A mile is a unit of length. We measure distance traveled in miles. Fractions are used to show parts of miles traveled, such as $\frac{1}{2}$ mile to the gas station, $\frac{3}{4}$ mile to school, and $5\frac{1}{4}$ miles to the mall.

Lesson Introduction: Adding Fractions and Mixed Numbers With Three Addends

Common Core State Standard	Objective
<ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<ul style="list-style-type: none"> • Add three fractions. • Add three mixed numbers.

Vocabulary

addends, common denominator, convert, denominator, mixed number, unlike fractions, whole number, simplify

Overview

A **mixed number** is a whole number and a fraction. A **whole number** is a counting number. **Unlike fractions** are fractions with different **denominators**, or bottom numbers. Fractions with **common denominators** are fractions that have like denominators. **Addends** are any of the numbers that are added together.

The first step in adding fractions and mixed numbers with three addends is to add the fractions. If the fractions have unlike denominators, **convert** or change the fractions to fractions with a common denominator. Next, add the new fractions. Then, add the whole numbers. If possible, simplify the answer. **Simplify** means to rewrite the answer in its lowest term.

Adding Fractions and Mixed Numbers With Three Addends

Example

	$6 \frac{3}{4} = 6 \frac{9}{12}$	Convert the fractions to fractions with a common denominator and add.
	$1 \frac{2}{6} = 1 \frac{4}{12}$	
Add the whole numbers.	$+ 2 \frac{2}{3} = 2 \frac{8}{12}$	
	$\hline 9 \frac{21}{12} = 9 + 1 \frac{9}{12} = 10 \frac{9}{12} = 10 \frac{3}{4}$	If the sum is an improper fraction, convert it to a mixed number.
	$\xrightarrow{\hspace{10em}}$	Simplify the answer.
	Add the whole number and the mixed number.	

Problems to Try

a. Add $\frac{1}{2} + \frac{3}{4} + \frac{2}{8}$ **Answer:** $1 \frac{1}{2}$

b. Add $7 \frac{1}{5} + 4 \frac{2}{3} + 2 \frac{3}{5}$ **Answer:** $14 \frac{7}{15}$

Real-World Connection

If you are musically inclined, you know the connection between math and music. The values of musical notes are expressed as fractions. The half note, quarter note, and eighth note are a few examples.

Lesson Introduction: Subtracting Fractions and Mixed Numbers With Like Denominators

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Subtract two fractions with like denominators. • Subtract two mixed numbers with like denominators.
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Vocabulary

common denominator, difference, like fractions, mixed number, numerator, simplify, whole number

Overview

Like fractions are fractions with **common denominators**, or the same bottom number. You can subtract like fractions by simply subtracting the **numerators**, which are the top numbers of the fractions, and writing the difference over the common denominator. The **difference** is the answer in a subtraction problem. If possible, simplify the answer. **Simplify** means to rewrite the answer in its lowest term.

A **mixed number** is a whole number and a fraction. A **whole number** is a counting number. You subtract mixed numbers by first subtracting the numerators of the two fractions. Write the answer over the like denominator. Next, subtract the whole numbers. If possible, simplify the answer.

Subtracting Fractions and Mixed Numbers With Like Denominators



$$\begin{array}{r} \frac{4}{5} \\ - \frac{2}{5} \\ \hline \frac{2}{5} \end{array}$$

Subtract the numerators.

Write the difference over the denominator.

$$\begin{array}{r} 12\frac{5}{8} \\ - 6\frac{3}{8} \\ \hline 6\frac{2}{8} = 6\frac{1}{4} \end{array}$$

After subtracting the numerators, subtract the whole numbers.

Simplify.

Problems to Try

a. Subtract: $\frac{6}{9} - \frac{3}{9}$ **Answer:** $\frac{1}{3}$

b. Subtract: $4\frac{7}{12} - 3\frac{1}{12}$ **Answer:** $1\frac{1}{2}$

Real-World Connection

Schools districts have budgets. The budget lets everyone know how much each department has to spend. Many times parents want to know what fraction of the budget will be spent on sports or fine arts.



Lesson Introduction: Subtracting From a Whole Number

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Subtract fractions from a whole number. • Subtract a mixed number from a whole number.
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Vocabulary

mixed number, simplify, whole number

Overview

A **whole number** is a counting number. A **mixed number** is a whole number and a fraction. When subtracting a fraction from a whole number, rename the whole number by borrowing one from the whole number. Rewrite the whole number as a mixed number. The borrowed one becomes a fraction with the same numerator and denominator. Next, subtract the fractions. Then, subtract the whole numbers. If possible, simplify the answer. **Simplify** means to rewrite the answer in its lowest term.

Subtracting From a Whole Number

Examples

$$\begin{array}{r} \cancel{4} = 4 + 1 = 4 + \frac{2}{2} = 4\frac{2}{2} \\ - \frac{1}{2} \\ \hline 4\frac{1}{2} \end{array}$$

Use the same number as the denominator of the problem fraction to make the new fraction.

$$\begin{array}{r} \cancel{19} = 19 + 1 = 19\frac{4}{4} \\ - 15\frac{3}{4} \\ \hline 4\frac{1}{4} \end{array}$$

Use the same number as the denominator of the problem fraction to make the new fraction.

Problems to Try

a. Subtract: $3 - \frac{3}{4}$ **Answer:** $2\frac{1}{4}$

b. Subtract: $4 - 2\frac{1}{2}$ **Answer:** $1\frac{1}{2}$

Real-World Connection

A doctor or nurse will usually check a patient's pulse during a physical examination. The pulse is the rate at which your heart beats. The pulse is measured by the number of times a heart beats each minute. It can be expressed as a fraction, beats/minute.



Lesson Introduction: Subtracting Fractions With Unlike Denominators

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Subtract fractions with unlike denominators.
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Vocabulary

common denominator, denominator, numerator, simplify, unlike fractions

Overview

The top number of a fraction is the **numerator**, and the bottom number is the **denominator**. **Unlike fractions** are fractions with different denominators. To subtract fractions with unlike denominators, first rewrite the fractions with a **common denominator**, or the same denominator. Next, subtract the numerators and keep the same denominator. If possible, simplify the answer. **Simplify** means to rewrite the answer in its lowest term.

Subtracting Fractions With Unlike Denominators

Example

$$\frac{2}{3} - \frac{1}{2}$$

$$\downarrow \quad \downarrow$$

$$\frac{4}{6} - \frac{3}{6} = \frac{1}{6}$$

Convert the unlike fractions to like fractions.

← Subtract the numerators and keep the same denominator.

Simplify, if possible.

Problems to Try

a. Subtract $\frac{2}{3} - \frac{1}{6}$ **Answer:** $\frac{1}{2}$

b. Subtract $\frac{7}{10} - \frac{2}{5}$ **Answer:** $\frac{3}{10}$

Real-World Connection

Everyone likes to save money. It is helpful to understand fractions when purchasing items placed on sale at $\frac{1}{3}$ or $\frac{1}{2}$ off the original price.



Lesson Introduction: Subtracting Mixed Numbers With Unlike Denominators

<p>Common Core State Standard</p> <ul style="list-style-type: none"> • Fifth Grade: 5.NF.1, 5.NF.2, 5.MD.2 • Sixth Grade: 6.NS.1, 6.NS.4 • Seventh Grade: 7.NS.1 • Eighth Grade: 8.NS.1 	<p>Objective</p> <ul style="list-style-type: none"> • Subtract mixed numbers with unlike denominators.
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Vocabulary

common denominator, convert, denominator, numerator, mixed number, rename, simplify, unlike fractions, whole number

Overview

The top number of a fraction is the **numerator**, and the bottom number is the **denominator**. **Unlike fractions** are fractions with different denominators. A **mixed number** is a whole number and a fraction. A **whole number** is a counting number. **Simplify** means to rewrite the answer in its lowest term. **Convert** and **rename** both mean to change.

Two Methods for Subtracting Mixed Numbers With Unlike Denominators

Method #1

$$\begin{array}{r}
 6\frac{2}{5} \\
 - 2\frac{1}{2} \\
 \hline
 \end{array}$$

Borrow one from the whole number.

$$\begin{array}{r}
 6\cancel{2} \frac{2}{5} = 5 + 1 + \frac{2}{5} = 5 + \frac{10}{10} + \frac{4}{10} = 5\frac{14}{10} \\
 - 2\frac{1}{2} = 2\frac{5}{10} \\
 \hline
 3\frac{9}{10}
 \end{array}$$

Rename the fractions using a **common denominator**.

Subtract the fractions.
Subtract the whole numbers.

Method #2

Convert the mixed numbers to improper fractions.

$$\begin{array}{r}
 6\frac{2}{5} = \frac{32}{5} = \frac{64}{10} \\
 - 2\frac{1}{2} = \frac{5}{2} = -\frac{25}{10} \\
 \hline
 \frac{39}{10} = 3\frac{9}{10}
 \end{array}$$

Rename the fractions with a common denominator and subtract.

Convert the answer to a mixed number.

Problems to Try

- a. Subtract: $9\frac{7}{10} - 5\frac{1}{5}$ **Answer:** $4\frac{1}{2}$ b. Subtract: $11\frac{1}{4} - 4\frac{7}{8}$ **Answer:** $6\frac{3}{8}$

Real-World Connection

Understanding fractions is critical when baking. When cooks mix ingredients in a recipe, they need to measure accurately to make the food taste right. Most recipes use portions of a cup for some ingredients, such as $\frac{1}{4}$, $\frac{1}{3}$, or $\frac{1}{2}$ cup. In some recipes, mixed numbers are used, such as $1\frac{1}{2}$ cups.